



**ENGAGING TOUCH & MOVEMENT IN SOMATIC
EXPERIENCING[®] TRAUMA RESOLUTION APPROACH.**

Sônia Maria Gomes Silva

New York - USA
2014



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Dr. Carlos Alberto Franco, PhD – Mentor

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Acknowledgements

In memory of Freddy (Rubén Alfredo Garcia), my first master in sense-perception therapy.

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ABSTRACT

1. The problem:

The personal experience of Sonia Gomes with body psychotherapies as a Clinical Psychologist, using structural & movement rolfing, yoga, spirituality and Somatic Experiencing, led to the observation that even with highly efficient SE intervention processes in severe trauma, the client goes through a recovery. For that, one needs to redefine and restructure negative experience, with a reasonable understanding of what happened and relieve and / or transform the emotional and physiological symptoms. A problem found is the lack of integration between the spatial organization and time needed for the body to restructure more appropriate recovery embodiment, in order to increase the resilience to establish the trauma healing. The quality of this restructuring is variable.

2. Objective:

Understand how and why this occurs, and organize a new form of intervention that allows the elimination and / or symptom relief, ensuring maximum embodiment and integration in a minimum recovery time of resilience: what are the necessary and sufficient conditions for this to occur?

3. The dissertation:

This thesis, thus, has a theoretical construct that talks about the problem of trauma (Chapter I and Chapter II) and the mind-physiology question.

This paper brings the basis of the updated neurosciences, seen in Chapter II. It is also addressing a historical overview of the problem and how it is done today (Chapter IV).

What is needed to solve the problem (Chapters V and VI).

How to solve the problem is discussed in Chapter VI.

The chapters of this dissertation are for: to situate the problem, understand its construction and under the guidelines of neuroscience justifiably propose a new form of intervention.

Chapter VII shows that it is possible to measure, and includes a proposal for how to do this.

4. What occurs and how?

The brain rearranges to deal with the trauma and neuronal circuitry is altered physiologically.

Various muscle tensions generated by escape, fight or freeze responses are circuited in a new way, interfering with the original circuits of the subject.

Main problems: procedural memory, physiological defense structure for permanent threat (anxiety, hormonal changes, muscle mobilization) and modification of perceptual processes.

When intervened, it can bring up awareness for procedural memory and allows the body, contracted at different levels, to relax: the intervention allows for the decreased activation of neuronal circuits of trauma.

Where they are organized: procedural memory (which withdraws the alarm level), internal organization of the muscle systems and physiology (fascia) communication.

How to achieve maximum recovery:

- dis-abling the circuitry of trauma awareness, partly amending the procedural memory:

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- re-organizing the system of procedural memory for learning awareness of new organization: moving the muscle structures from the fascia: touch and movement sought to recover the natural way to give and receive information through the senses of both the client and the therapist. Rolfing and Godard's Movement Education applied in the Somatic Experiencing Therapy.

Keywords: Somatic Experiencing™ Trauma Therapy & Movement Education; Soma Embodiment for Trauma Therapy; Body Oriented Trauma Therapy.

SUMMARY

<i>Chapter I</i>	INTRODUCTION	1
<i>Chapter II</i>	PHENOMENON OF TRAUMA	21
II.A	WHAT IS TRAUMA?	21
II.A.1	Ethologists call this innate response <i>tonic immobility</i> (TI):	23
II.B	TYPES OF TRAUMA:	25
II.B.1	Trans-generational trauma:	26
II.B.2	Existential trauma:	28
II.B.3	Threat trauma:	29
II.B.4	Loss Trauma:	30
II.B.6	Birth Trauma:	31
II.B.7	War trauma:	31
II.B.8	Attachment disorders:	32
II.B.9	Emotional or psychological trauma:	33
II.B.10	Illness Trauma:	34
II.B.10.1	<i>Considerations on the section B.10:</i>	36
II.C.	TRAUMA RESIDES IN THE PHYSIOLOGY OF DEFENSE SURVIVAL RESPONSE (LEVINE, 1976):.....	37
II.C.1	Fight:	39
II.C.2	Flight:	39
II.C.3	Freeze or Tonic Immobility:	39
II.C.4	Cycle of Activation to danger & Hyperactivation:	40
II.C.5	Hyperactivation of the Nervous System:	40
II.C.6	Dissociation:	41
II.C.7	Neurophysiology of Trauma:	42
II.C.8	Biological Alteration an ongoing stress:	43
II.C.9	Motor Activity in trauma & Stress response:	44
II.C.10	Phenomenon of paralysis or tonic immobility: shock state:	45
II.C.11	Critical Importance of the Freeze Discharge or the motor act of completion Defense Response:	48
II.C.11.1	<i>By Levine, 1976:</i>	48
II.C.12	Nature and Intensity of Trauma (Trauma symptoms):	56
II.C.12.1	<i>PTSD - Post-Traumatic Stress Disorders:</i>	60
II.D	MEMORY OF TRAUMA AND STRESS:.....	65
II.E	HOW TRAUMA AFFECTS THE BODY:.....	69
II.E.1	Severe dysregulation from developmental trauma:	69
II.E.2	Trauma affects cognition, feelings and learning:	72

Chapter III	A NEUROSCIENCE UPDATE ON TRAUMA RESOLUTION	77
III.A	EVOLUTIONARY PSYCHOLOGY’S PERSPECTIVE:	77
III-B	HOW THE BODY IN ACTION SHAPES THE SELF:	82
III.B.1	Neurobiology & Evolution:	85
III.C	NEURONAL PLASTICITY:	86
III.C.1	Types of Brain Plasticity:	88
III.D	THE BRAIN – A COMPLEX AND DYNAMIC STRUCTURE & ABILITY OF NEURONS TO CHANGE:	90
III.D.1	The Nervous System:	90
<i>III.D.1.1</i>	<i>The ANS involved in the physiology of stress:</i>	<i>94</i>
<i>III.D.1.2</i>	<i>ANS and Cardiac vagal tone activity and Stress:</i>	<i>96</i>
<i>III.D.1.3</i>	<i>The Heart Rate Variability (HRV):</i>	<i>97</i>
III.D.2 –	Triune Brain’s model of Paul MacLean:	98
<i>III.D.2.1</i>	<i>Reptilian Brain:</i>	<i>99</i>
<i>III.D.2.2</i>	<i>Limbic Brain:</i>	<i>100</i>
<i>III.D.2.3</i>	<i>Primate Brain or Neocortex Brain:</i>	<i>101</i>
<i>III.D.2.4</i>	<i>Considerations:</i>	<i>102</i>
III.D.3	The brain and its complexity in function and anatomy:	104
III.D.4	The Brain: a dynamic and integration structure:	105
III.D.5	The basic neural structures related to trauma therapeutic approaches and its functions:	106
III.D.6	Brain Structures of Motor /Emotions (Sub-cortical & Limbic systems): ..	108
<i>III.D.6.1</i>	<i>The Thalamus:</i>	<i>108</i>
<i>III.D.6.2</i>	<i>The Basal ganglia:</i>	<i>109</i>
III.D.7	The Limbic System:	110
<i>III.D.7.1</i>	<i>The hypothalamus:</i>	<i>110</i>
<i>III.D.7.2</i>	<i>The Amygdala:</i>	<i>111</i>
<i>III.D.7.3</i>	<i>The Hippocampus:</i>	<i>113</i>
<i>III.D.7.3.1</i>	<i>Sensivity to stress:</i>	<i>114</i>
III.D.8	The Cortical Systems:	114
<i>III.D.8.1</i>	<i>The parietal lobes:</i>	<i>116</i>
III.D.9	Insula:	117
III.D.10	The prefrontal cortex:	118
Figure 9	The insula in the parietal lobes	118
III.D.11	The Orbitofrontal Cortex:	120
III.E	THE POLYVAGAL THEORY:	122
III.E.1	New perspectives for adaptation to Autonomic Nervous System:	122
<i>III.E.1.1</i>	<i>The Polyvagal Theory:</i>	<i>122</i>
<i>III.E.1.2</i>	<i>The cranial nerves:</i>	<i>123</i>

III.E.1.3	<i>Mammalian Modifications of our Evolutionary Heritage: - A Polyvagal Theory:</i>	124
III.E.1.4	<i>The ANS adaptative responses:</i>	126
III.E.1.5	<i>A Neuroception:</i>	127
III.E.1.6	<i>Social engagement and Defensive behavior: Adaptive or maladaptive strategies:</i>	128
III.E.1.7	<i>Immobilization with fear and without fear:</i>	130
III.E.1.8	<i>Social Engagement:</i>	131
III.E.1.9	<i>Social Engagement System – face/heart</i>	133
III.E.2	Vagal Tone:	135
Chapter IV	<i>HISTORY OF SOMATIC PSYCHOLOGY</i>	137
IV.A	BODY DEFINITION:	137
IV.B	DEFINITION OF PSYCHOLOGY:	138
IV.B.1	Regarding regulation’s mechanism of Psychology & Body:	138
IV.B.2	Classical psychotherapy:	139
IV.B.3	The body as a vehicle for communication and healing:	140
IV.B.4	Different approaches of Body psychotherapies:	141
IV.B.5	History of Somatic Psychology:	141
IV.C	NEURO-AFFECTIVE DEVELOPMENT PSYCHOLOGY:	143
IV.C.1	The human biological capacity for social engagement:	146
IV.C.2	Emotional System Regulation:	147
IV.C.3	Affect, Caregivers and Tolerance:	148
IV.C.4	Trauma and neuroaffective developing relationship:	149
IV.C.5	Neural Emotional Dysregulation:	150
IV.D	THE SOMATOMOTOR COMPONENTS INCLUDE NEURAL STRUCTURES IN SOCIAL AND EMOTIONAL BEHAVIOR:.....	152
IV.E	SELF-REGULATION:	154
IV.E.1	Physiological Homeostasis:	156
IV.F	SOMATIC EXPERIENCING™ - A MAP IN THE TRAUMA RESOLUTION.....	161
IV.F.1	SE – Contemporary innovation for trauma therapy:	162
IV.F.2	Somatic Experiencing™ and its clinical practice:	175
IV.G	SOMATIC EXPERIENCING™ & THE POLYVAGAL THEORY:	176
Chapter V	<i>LANGUAGE OF BODY & TRAUMA RESOLUTION</i>	181
V.A	PHENOMENOLOGY OF PERCEPTION:	181
V.A.1	Change the sensations:	183
V.B	EXTEROCEPTION – INTEROCEPTION AND PROPRIOCEPTION:	183
V.B.1	A Neurobiology of sensorial language:	183
V.B.2	There are three types of neurons of sensorial language –	185
V.B.2.1	Exteroception sensations:	185

V.B.2.1.1	Hearing or Sense of Sound:	187
V.B.2.1.2	Sense of Taste:	189
V.B.2.1.3	Types of touch:	190
V.B.2.2	<i>Interoception Sensations:</i>	191
V.B.2.3	<i>Proprioceptors sensations:</i>	194
V.B.2.4	<i>Considerations sensorial language:</i>	196
V.C	EMBRYOLOGICAL DEVELOPMENT AND SPATIAL ORGANIZATION:	198
V.D	TOUCH - A LANGUAGE OF ENGAGEMENT:	202
V.E	GESTURE & MOVEMENT	205
V.E.1	Neurobiology of movement:	208
Chapter VI	<i>HOW TOUCH & MOVEMENT ACTS WITH SE TO RESTORE THE ONE SELF</i>	213
VI.A	EMBODIMENT – A PATH TO SELF-REGULATION:	213
VI.A.1	Tonic Function by Godard’s perspective for embodiment:	217
VI.A.2	How to create a dynamic balance between inner and outer space:	225
VI.A.3	The core stabilization and an organization space process:	227
VI.A.4	Touch & Movement from Godard’s Analysis Movement Education:	228
VI.A.4.1	<i>There are two levels of body organization:</i>	230
VI.B	FASCIAL ORIENTED & GRAVITY FIELD RELATED TO TRAUMA:....	230
VI.B.1	The importance of Fascia in trauma: The work of Dr. Ida P. Rolf	232
VI.B.2	Trauma vortex and memory of traumatized fascia:	235
VI.C	TOUCH & MOVEMENT ACTING IN ORDER TO HEAL BODY – LEVINE & GODARD’S APPROACHES:	237
VI.C.1	How to evoke the intelligence of the body toward self-regulation:	244
VI.D	TRANSFORMING FIXATIONSTONENW POSSIBILITIES:	247
Chapter VII	<i>METHODOLOGY</i>	265
VII.A	QUALITATIVE STUDY ASSESSMENT:	265
VII.A.1	Selected Processing Mechanism	266
VII.A.2	Sample Population	267
VII.A.2.1	<i>Volunteer patients</i>	267
VII.A.2.2	<i>Team</i>	268
VII.A.3	Procedure	268
VII.A.3.1	<i>Setting and testing conditions</i>	268
VII.A.3.2	<i>Data Collection</i>	269
VII.A.3.3	<i>Data Analysis</i>	273
VII.A.3.4	<i>Conclusion</i>	274
Chapter VIII	<i>CONCLUSION</i>	275
	<i>BIBLIOGRAPHY</i>	281

Chapter I

INTRODUCTION

Trauma is an experience of extreme stress or shock that is or was, at some point, part of life. It is an experience that threatens body/mind's entire organism¹ by causing a rupture in its capacity to assimilate and accommodate into inner regulatory, taking it to functioning in a new level of organization. The organism is forced beyond its physiological adaptation's capacity, in order to regulate the activation state of the Nervous System, and fails in its reciprocal relationship among the other body systems (LEVINE, 2010). A reciprocal relationship suggests a positive cooperation within and between systems; a system works, therefore, in coherence,² harmony and continuity, taking and bringing back internal environmental information related to the external environment, and vice versa, promoting well-being, comprehensive health, which means self-regulation. When there is trauma, the continuity of internal experience breaks, and one dissociates³ from the present moment. This manifests itself in a global setting between sensorimotor stimuli, and cognitive and emotional states, which arise from the experience of shock and or chronic stress. Thus, a loss in rhythmic capacity for

¹ The term *organism* is equivalent to the term *body*. It is used by most biologists who designated "a living being endowed with organs whose totality constitutes a *living being*," described by (LAMARCK, 1802, HELLER, 2012:3).

²Coherence can be defined as: connected, open, harmonious, engaged, receptive, noetic, compassionate, empathic. The movement toward well-being is a movement toward integration. When connected to the deep self, feel "wholeness". Organization within body systems and cooperative, organized function between various physiological systems contributes to the sense presence. Coherence reflects a homeostatic state in which the organism is self-regulating in an optimal way. Coherence can be measured between physiologic subsystems. In a coherent system, with each breath, there is modulation of the heart rate, as well as of vasomotor and muscle tone; the exception to this natural state is where there's been severe trauma. (SE-MANUAL, 2007).

³ Dissociation is a distortion of objective reality that includes the distortion of time and perception, by breaking the continuity of experience (Levine, 1996). Dissociation (according to the criteria of the APA (2000 apud GUPTA, 2006), is defined as a disruption in the "experience of perceiving the world" by splitting the integrated functions of consciousness, memory, identity and perception. According to Gupta (2006) there a close relationship between somatization and dissociation: the dissociative process, occupies a central role in the development of symptoms that are found in somatic (Farhi; Franco, 2012:96).

self-regulation occurs, which is the natural organismic state that guides the person to the presents state and to fluidity during life (LEVINE, 2010).

Trauma may begin as acute stress from a perceived life-threat or as the end product of accumulative stress; threat is the *felt sense* of fear that a person experiences under attack and in danger of physical or psychological harm (LEVINE, 1997). Stress could be defined as any physiological event, external or internal, that demands that the body adapt to it (SCAER, 2012:94). Trauma, life threats in the face of helplessness, ultimately has a very different neurophysiology than stress (SCAER, 2012:94); trauma has its roots in an unresolved fight, flight/freeze defense response, involves the arousal centers of the brain, and affects autonomic homeostasis⁴ (SCAER, 2012:95).

Trauma is also a syndrome of the corruption of memory with regard to its relationship to time (SCAER, 2012:109) and develops into many of the symptoms that define dissociation (SCAER, 2012:106). If you are exposed to something in your environment that provides an intense enough cue to an old trauma, for the moment, you will be back in that old state of helplessness, with all of its associated numbing, visceral feelings, body sensations and altered thoughts. The tendency for recurrent freezing in the face of danger is the hallmark of late, or complex trauma, which is clearly a syndrome of dissociation (SCAER, 2012:106). When the nervous system does not reset after an overwhelming experience, sleep, cardiac, digestion, respiration, and immune system function can be seriously disturbed. Unresolved physiological distress can also lead to an array of other physical, cognitive, emotional and behavioral symptoms (LEVINE, 2010).

Symptoms of trauma are characterized by chronic arousal, sleep disturbance, obsessive persistence, distraction, etc. Sometimes there are even somatic sensations: myofascial

⁴ Homeostasis: interactive & communication system that maintain inner regulatory equilibrium.

pain, headache, bruxing, bowel symptoms, back pain, and other symptoms that keep interrupting one's present moment (SCAER; 2012:106). Systematic studies have found links between symptoms of PTSD and traumatic stress, according to Bessel van der Kolk (VAN DER KOLK, 1996). The majority of victims of trauma develop a variety of psychological disorders and personality changes, in addition to PTSD; these disorders include major depression, generalized anxiety disorder, panic disorder and others.

The purpose of Body Oriented Therapies to work through traumatic events is to help patients amplify their feelings, perceptions, and thoughts about an event, ultimately to change their experience of that event. Common experiential approaches include such interventions as: dance and movement therapy, guided imagery, art and music therapies, and sometimes written exercises. Patients who have been sexually abused typically describe feelings of shame, lack of control over the event and their bodies, and insecurity regarding interpersonal relationships. Experiential therapies offer opportunities to address the shame, repair their sense of control, and a chance to "rewrite" a different ending to the abuse story (FALLON & WONDERLICH, 1997:122).

Movement, dance, self-defense techniques, and relaxation therapies can be excellent interventions for survivors having a difficult time feeling safe within their bodies. These interventions provide opportunities to experience the body differently; for example, from weak and vulnerable, to strong and powerful. Patients can shift their body experience from one of passivity to activity; from one of allowing their body to control how they feel, to using the body to convey assertive messages to other people; and from one mere form (how the body looks), to function (the power of the body that can be used for the purpose of healing). Learning to recognize and identify various tension and relaxation states felt by the survivor can introduce new feelings of competence, and help her/his identity of different states within the body that can be used as "radar" to guide

future interactions with others. For example, when a patient learns to detect and respect anxious feelings within her/his body, he/she can then choose to seek safety by talking with a trusted individual, or to avoid the situation that is creating the uncomfortable and overwhelming feelings of anxiousness (FALLON & WONDERLICH, 1997:122).

Somatic Psychology has been influenced, either directly or indirectly, by occupational and physical therapy, as well as dance therapy and Sensory Integration. Because of this influence it possesses a finely developed understanding of developmental movement sequencing, and by trauma or neglect (RAND & CALDEWELL, 2004:53).

In body-oriented therapies, touch and movement have multiple meanings; one aspect is the psychophysiology of the organs of movement and touch: the muscles and the skin. Movement and touching, in relation to others, helps one to form a unique pattern of embodied and conceptual self-awareness; if the ability to coordinate movement and touch increases, this leads to a sense of linkages and boundaries, of being different from other and also a sense of being connected to the other (FOGEL, 2009:208).

Touch and movement can also converge in a single meaning: to stir the emotions; to say one is moved emotionally by something is the same as saying that one is touched by something. As one has seen, the sense of threat⁵ limits the ability to act and to feel. Threat creates muscle tension that limits spontaneous movement, makes one less flexible and more rigid, both physically and mentally. When one feels safe, movements and such emotions can be more spontaneous, and one can be free to realize their fullest potential, as those terrestrial beings with the most articulate hands, the most agile

⁵Threat: Under conditions of threat, biobehavioral response modes become activated automatically, sending a cascade of stress hormones, immunosuppressants, and sympathetic neurotransmitters into the body to activate the skeletal muscles and inhibit the activation of the gut muscles during states of **vigilance, mobilization, and immobilization**. Long-term threat and stress is associated with muscle tension and muscle pain, resulting from the chronic activation of the threat response neural networks. (FOGEL, 2009:187).

minds, and the most subtle range of emotional feelings (FELDENKRAIS, 1985; JOHNSON, 1992; ROSEN, 2004, FOGEL, 2009:188). Touching and movement can activate embodied self-awareness and lead to positive change, following the basic principles of treatment (STEIN, NARENDRA, et al., 2007).

Movement increases flexibility, opens the posture for co-regulate engagement with others, emphasizes awareness and the joy of movement, and teaches about finding comfort and enjoyment in touching and moving with other people (Rosen & Brenner, 1992, FOGEL, 2009:215).

Touch stimulates receptors in the skin for pressure, pain, temperature, and movement and receptors in the muscles and tendons for stretch, fatigue and pain. These receptors are linked directly into the neural networks for interoception⁶ and body schema⁷ self-awareness (FOGEL, 2009: 216). Some touch is unwanted and intrusive, activating the threat response system; touch that is gentle, listening, safe, and loving, however, has the potential to enhance embodied self-awareness by activating the bio-behavioral response of **engagement**, both with others and with self (FOGEL, 2009:221).

In this paper, when this doctoral student uses the word "touch," it means the touch with hands that evokes a quality of touch, inducing a responsive movement in myofascial⁸ tissues. This retrieves the feeling of other senses, awakening a healthy communication with

⁶ Interoception: Current concepts describe interoception as a sense of the physiological conditions of the body, which includes a much wider range of physiological sensations, including, for example, muscular effort, tickling, or vasomotor sensations. (SCHLEIP & JAGER, 2012:89).

⁷ Body schema is a system of motor and postural functions that operate below consciousness; does not have a conscious representation (GALLAGHER, 1995:3).

⁸ Myo (muscles) Fascia. The muscle is structurally thus inseparably linked with the fascia organ, or to put it more specifically: It is a part of the fascia organ. In the myofascial system, the contractile elements of the muscles dynamize the fascial network and thus affect both optimum pretension of the tension elements of the tensegrity structure and the movement of the whole system. The muscle cells, therefore, move around in the fascial networks, so to speak like fish in a fishing net. Their movement exercises traction on the fascial structures which transfer into the periosteum, whereby the tensile force is transferred to the bones. Looked at from this angle, there is only one muscle, which "loafs around" in 600 or more fascial pockets (MYERS, 2001).

the ecological internal and external environment that was lost with the trauma. In fact, “touch” in this paper will be synonymous with probing, or palpating, because moving structure can produce a great amount of clinical information that will guide the Somatic Experiencing Practitioners (SEP) while conducting the process toward self-regulation.

Pierre Janet (1925) says that trauma was laid down in the body, and those traumatic memories were state-dependent. Work on a core bodily level gives one access to these shock states; it explores, in nuanced details, in sensory-motor slow motion, the trapped fragments of the past (KAPLAN & SCHWARTZ, 2005 USABP.Vol.5: 34).

Treatment remains a complex and multifaceted process and must address both cognitive and affective sequelae; healing from trauma creates new pathways for survivors: clinicians and researchers can work together to provide maps for this journey (FALLON & ACKARD, 2002:118).

Stephen Porges, the creator of the Polyvagal Theory,⁹ ensures that mammals negotiate their emotional regulation. If isolated, individuals lose that vagal regulation, become

⁹The Polyvagal Theory: Brief summary from Levine about Porges Polyvagal proposal: “In the human kind, three basic sub-systems of neural energy supports global state of NS and its behaviors and emotions” [...]. Of the three primary instinctual defense systems, the immobility state is controlled by the most primitive of the physiological sub-systems. This neural system (mediated by the unmyelinated portion of the vagus nerve) controls energy conservation and is triggered only when a person perceives that death is imminent (also evoked by intense and unremitting stress) – whether from outside, in the form of a mortal threat, or when the threat originates internally, as from illness or serious injury. Both of these challenges require that one hold still and conserve one’s vital energy. When this most archaic system dominates, one does not move; one barely breathes; one’s voice is choked off; and one is too scared to cry. One remains motionless in preparation for either death or cellular restitution. This last-ditch immobilization system is meant to function *acutely and only for brief periods*. When chronically activated, humans become trapped in the gray limbo of nonexistence, where one is neither *really* living nor *actually* dying. A therapist’s first job in reaching such shut-down clients is to help them mobilize their energy: to help them, first, to become aware of their physiological paralysis and shutdown in a way that normalizes it, and to shift toward (sympathetic) mobilization or engages in preparation for fight or flight. The next step is to gently guide a client through the sudden to the here-and-now and a reengagement in life (LEVINE, 2010:105-106).

hyper-vigilant and begin to demonstrate cardiac arrhythmia; regulation occurs with doses of oxytocin¹⁰ produced to facilitate social engagement (PORGES, 2011).

Stephen Porges says that to be safe with the other is the gateway to the development of a healthy relationship, and that the way the individual feels is what will determine whether they can, or cannot, relax; this state would function as a platform for neural and psychological experiences and that one's feelings depend on the physiological state of the Autonomic Nervous System (ANS).

Porges suggests that therapeutic interventions should be aimed at facilitating the feeling of safety in the client. The greater the disruption of the ANS, the greater the likelihood is of a person developing trauma and syndromes due to changes in brain chemistry, hormonal changes caused by increased production of adrenaline, cortisol and opioids in the body.

In traumatic situations, if the excess energy in the body has not been discharged,¹¹ it causes biological, psychological, emotional, mental and behavioral disorders (PORGES, 2011).

Porges affirms that the brain has areas that support the fight-and/or-flight through the Sympathetic Nervous System (SNS), but if it perceives a life threatening situation, everything changes; in cases of imminent death, the individual begins to use very old survival systems that evolved to preserve the metabolic system in primitive vertebrates, closing the biological motion (PORGES, 2011).

Somatic Experiencing™, **SE**, is a comprehensive theoretical and clinical approach developed by Peter A. Levine, PhD, to help clients work through symptoms and

¹⁰Oxytocin is a hormone secreted by the pituitary gland, and it does not cross the blood-brain barrier from the circulation. One of its main functions is in the birthing process. It relaxes the cervix, stimulates uterine contraction, and stimulates milk production and the “let-down” of milk by the breast. It is associated with states of pleasure around one’s mate, and it promotes sexual arousal and orgasm. It facilitates calmness and maternal-infant bonding. Porges described that it enhances social engagement.(SCAER;2012:72).

¹¹The discharge is the expression of biological motion retained or stored in somatic memory - in the neuromuscular system (PORGES, 2011).

prevention of traumatic stress in a psychotherapeutic setting. The SE method provides a model by which therapists can attune to the deregulated nervous systems of their traumatized clients and restore them to a state of organization; this method integrates GENDLIN'S (1981) "*felt sense*"¹² with SCHORE'S (2006) regulation theory and PORGES with his Polyvagal theory (2001). While clients tell their stories, therapists track moment-to-moment shifts in posture, facial expressions, sounds, gestures and other movements, as well as changes in skin color, musculature, and breath in their client's bodies, as along with their own. In exploring a waking dream, the therapist helps clients bring his/her conscious awareness more fully into their bodies. Together, they track specific subjective details of the sensation; in other words, paradoxically, the simple act of bringing attention to a disorganized area of the body can restore some level of organization there (LEVINE, 1997; USAB.vol.5: 22).

In the SE approach, touch and movement are employed as a resource to encourage containment¹³ and coherence in order to bring inner-body stability. The most familiar tools used for building both coherence and containment within the SE repertoire are: Titration¹⁴ and pendulation.¹⁵ The basic principles of the SE therapeutic intervention model will be explained in Chapter III, item E.

¹²A felt sense is not a mental experience, but physical. A body conscious perception of a situation or person, or an event. An internal aura that covers everything you feel and know about a given subject at a given time. Covers it and communicates to you, an immediate mode instead of every detail (GENDLIN, 1981).

¹³Containment "*is an increased capacity to expand in response to the inner pressure of activation.*" Levine, 2007. Containment, it must be understood, is NOT suppression; it is rather building a larger, more resilient vessel to hold difficult affects (LEVINE, 2010:65). Without appropriate containment, energy mobilized within highly disorganized systems will provoke the very processes that caused the system to become overwhelmed in the first place: unmanageable activation or shutdown (and sometimes, constant oscillation between the two). Once the client can tolerate at least gentle mobilization of some of the bound survival energy in their system, they can allow access to that energy without overwhelm (Levine, 2007- SE Manual).

¹⁴Titrate/titration: It's a SE (TM) tool that uses the smallest amount of activation to cause a shift in the nervous system. Lower the arousal or constriction in small steps. Titration process in SE is when practitioner takes a small bit of disorganization, and contains the system from going into overwhelming

The practice of SE - Somatic Experiencing™ is based on the theory of evolution regarding defense mechanism¹⁶ proposed by Charles Darwin, the Polyvagal Theory by Porges, which provides a secure way for psychotherapists in the neural regulation, and the triune brain theory of Paul MacLean, which is oriented to follow a tracking of physical sensations to cognitive functions, i.e., a path which is traversed from bottom to top. Along the way, Paul Ivan Yakovlev, Russian neuropathologist, in 1948, had proposed to change Cartesian worldview of the central nervous system structures. In his studies he had suggested that just as phylogeny begets ontology, the CNS structures, and by implication of increasingly complex behaviors, have evolved *from within to outward, from below to above* (LEVINE, 2010:252). It was later on that MacLean had associated many specific behaviors suggested by the neuroanatomical pathways laid down by Yakovelev, Nauta and Papez (LEVINE, 2010:256).¹⁷

In his approach, Peter Levine has as an intervention strategy: the identification of bodily signs of frustration, reactions of fight and/or flight, freezing and consequent discharge of neuromuscular sets committed to such frustration. He built a therapy in which the

disorganization. Breaking down stimulus or charge into manageable pieces that can be integrated and moved through successively renegotiation (Levine, 2007).

¹⁵Pendulation: This is an inherent biological rhythm of the nervous system to move between expansion and contraction. It is on a moving from voluntary/mechanical to involuntary/inherent levels to support its rhythm from disorganization to organization and vice versa (Levine, 2007).

¹⁶The various defense mechanism rationalization, repression, etc. arise because the brain tries to arrive at the most probable and globally consistent interpretation of the evidence derived from multiple sources [...] when the evidence is conflicting, however (e.g., if the patient's vision tells one their arm is not obeying her/him commands), then instead of wasting time in conflict or oscillating between alternate decisions, ones cognitive system simply picks one story and adheres to it. [...] in order to do this, it either ignores the conflicting evidence (denial) or actually fabricates new evidence (rationalization). The evolutionary purpose of such defense mechanisms might be that when limited time is available, *any* decision however uncertain are better than an indecisive vacillation so long as it is the best interpretation of the current data. Otherwise, defense mechanism, would soon become maladaptive and threaten the individual's survival. It may be a good thing to repress an extremely traumatic memory in order to avoid being paralyzed with fear. (Ramachandran, 1993:325-328). "we have a tremendous need to impose a sense of order and coherence in our lives" (Ramachandran, 1993:327).

¹⁷See, p. 75 in this paper.

challenge is to support the nervous system in a traumatic response where there is no outlet for the threat.

It re-evaluates the basic environment and modulates its operation to a natural state of *safe* in order to get the person to access the self-regulation. The connection that Levine makes with animal behavior, his studies on ethology,¹⁸ especially the bodily movements that animals make after situations of persecution and/or attack by their natural predators, but also later, in situations of rest, breast feeding and maternal care, consolidates the work of Porges and many neurophysiologists studied by him. One of the functions of the SE approach is to restore the defense systems of fight, flight and/or freezing by highlight the restoration of the guidance system.

Another great inspiration for the development of his method was the opportunity to study with Ida P. Rolf, PhD,¹⁹ with whom he could understand how the defense system is organized through inhibitions imposed by internal and external environment, as well as the dependence of motor activity imposed by the gravity system.

Ida Rolf influenced Peter Levine, and many other theorists and clinicians, with her insistence in making them look through the biological point of view, when examining the gravity as a fundamental influence factor in the human physiology.

With ideas based in the science of the time (late sixties, early seventies), the Alexander Technique and Acupuncture movements growing, he added the gestalt term "felt-sense" of Eugene Gendlin, and thus was born SE, standing out in the scenario of body-oriented

¹⁸Ethology is the study of animals in their natural environment and they points to the “thwarting” of escape as the root of distress-anxiety – (Desmond Morris, *Primate Ethology*, (London: Weidenfield and Nicolson, 1969: and A. Eric Salzen, “Social Attachment and a Sense of Security, “ *Social Sciences Information*, 12, 1967:555-627:USABP, Vol. 2:12).

¹⁹Creater of Rolfing – Structural Integration method

therapies for its pioneering and effectiveness, which led to the formation of many professionals.

In the trauma structure, according to Ramachandran (1998), a rupture occurs –a dissociation in the comprehensive senses system – which is the *modus operandi* of giving and receiving information. In trauma, the way the information is captured through the senses changes; fluid communication is blocked, changing self-perception and the perception of the surroundings of the person going through the traumatic experience.

Godard²⁰ says²¹ that this system, ontological in its nature, is where the motor and sensorial meet; for it is a language where the motor activity and sensory rely as much to give as to receive information. That implies a relational presence and attitude of the therapist with the client, with the space and with the world. For Godard, the space²² is the common language for sensorial, so he emphasizes the "*haptic system*" proposed by Gibson (1972), which is a system of communication and relationship.

Godard seeks the physiological basis of the theory of motion and its neural control; his work promotes an optimization motion's function and gait resilience, besides favoring a free and full breath.

²⁰Hubert Godard, French movement theorist, educator has developed a system of working with the deep gravitational mechanism of the brain involving a sophisticated complex of physiology, phenomenology, movement theory, psychology and neuroscience (NEWTON, 2008).

²¹Keen's transcription at Godard's classroom in Spain, September 2013.

²²Space: Sense of "where am I", sense of longitude and latitude. Sense of the kinesphere or "peripersonal space" DALTON, 2012:269). Personal space has been classically considered as the cutaneous space, while peri-personal and extra-personal space have been understood as the spaces within and outside immediate reach, respectively (Rizzolatti et al., 1997). Now, there is a large amount of evidence that the actual space of the body exceeds its cutaneous boundaries, encompassing everything that is literally *ready-to-our-own-hands*. Indeed, several neurophysiologists and neuropsychological studies showed that peri-personal space is not only multisensory (i.e. based on the integration of visual, tactile, auditory, and proprioceptive information), but also body-centered (i.e. encoded in somatic coordinates) and, first and above all, motor in nature (GALLESE and SINIGAGLIA, 2011).

Regarding the resolution of traumatic work, he emphasizes (personal communication to the author) that in order to rescue the comprehensive health of a traumatized person, it is required to work before the orientation phase.²³

He believes that a person who developed fixations, inhibitions or injuries in their movements, is the result of a poor adaptation of the primary system of reaction to gravity (which integrates and organizes the physical body three-dimensionally in relation to space) in which the stages of sensorimotor development are inhibited.

Kevin Frank (1995) states that, much of the inhibition of the gravity system originates from proper control of the voluntary system (alpha motor system). One of many of the skills that the Rolfing movement teaches is how to use the cortex to inhibit parts of oneself.

From the point of view of development, one must learn how to gather the flow of movement in order to have control over the environment and the body. Godard is supported by epistemology, philosophy of dance history, current research in neuroscience, theoreticians in the sensorimotor development, as psychiatrists, psychologists such as Sherrington, Wallon, Gibson, Bullinger, Gracovetsky, Ramachandran, among others, which the author will mention in Chapters V and VI.

In Godard's latest studies of movement education, sourced from James Gibson's work, he encourages the incorporation of "*Haptic System*,"²⁴ with the therapist providing his/her body to be this innate vehicle of communication system in which people and animals

²³ "The body's orientation with respect to gravity was determined by a group of reflexes that sets the body segment's collective orientation and stabilizes the orientation against external disturbances" (MASSION et al., 2004;STUART, 2005:621-643). In SE we look for restore the orienting system first in order to go deeper in the renegotiating trauma experience. Through Godard's perspective, Tonic Function as a body complex system that reacts to the gravity has to be reorganize first.

²⁴ "*Haptic System*" Gibson defined the haptic system as "The sensibility of the individual to the world adjacent to his body by use of his body". Gibson and others emphasized the close link between haptic perception and body movements (WIKIPEDIA, Google).

communicate via touch (gamma touch).²⁵ Godard said that this quality of presence, the action of yielding, conducts the body with the environment that can release one's weight into gravity. As the weight of body mass is given over to gravity, a corresponding sensation of lift rises through one's structure supporting other gestures and movement expression (CAROL and TAHATA, 2012; GODARD, 2013); to yield is to sense and to allow weight, giving and receiving information. Yielding action supports the primary orienting relationship between body as matter and the field of gravity ones are embedded in (CAROL & TAHATA, 2012). One of the ways individuals orient is through touch. One can know where individuals are at any given moment in part through the places where they are physically, literally, touching the world (DALTON, 2012:267).

Godard emphasizes that the areas of the hands, feet, eyes and occipital muscles, are full of "*spindles*" fibers (sensory system working with motor neurons: alpha and gamma that are regulated by the limbic system) for the purpose of tonic regulating.

Research shows that hands and feet contain mechanoreceptors that are sensitive to pressure and reflexively related to the muscles of stabilization. Stimulation of the interface between hands or feet when they are touching is one of the starting points for stabilization of the body as a whole (DALTON, 2012:267). Godard says that in reality, probing tools (hands, feet, occipital, and eyes) are considered more as sensory organs and therefore are essential tools for therapeutic work in touch and movement, stating that adequate touch and holding are essential to the bonding process and to physical and psychological well-being. Touch may be thought of as a basic sense in that most life forms respond to being touched, while only a subset have sight and hearing; in Godard's model, one uses the stimulation of

²⁵Gamma touch: There are two kinds of motor neurons which innervate muscles: the alpha motor neurons and the gamma motor neurons. Movement is more efficient when the sensitivity of stretch reflexes is lowered and the gamma motor neuron loop of the low brain is traveled.(JUHAN, 1987:194).The gamma motor neuron loop engages movement which is more graceful efficient and spatially aware. It is a key trigger to shifting muscular tonus and gravity relationship (JUHAN, 1987:195; Frank, 1994:15).

sensations in the hands and feet in closed chain exercises to help trigger the activity of the stabilizer system as a whole (DALTON, 2012:267).

Another highlight Godard brings in his remarks is the attention that is needed to give the *Tonic Function*,²⁶ which according to WALLON (1949:136) is the "predominant factor in human psychological and motor development." The Tonic Function model proposed by Godard (FRANK, 1995:12 - 20 Rolf Lines) focuses on the response of gravity on the body as a unifying principle for the intrinsic motion; the act of paying attention to the sensations, it is a movement and this is a movement that can affect the quality of subsequent movements.

Levine's work associated with the work of Godard allows optimization and demonstrates how the perception changes the motion; in trauma, the control system of gravity, the Tonic Function, is prevented from its ideal functionality in the movement, because the trauma also creates an inhibition of emotional expression. There is a fundamental understanding that every trauma has an emotional component. Levine teaches that from the experience of helplessness and no way out of the threat emerges freezing. From the point of view of development, it is necessary to learn joining the flow of movement to take control over environment and of bodies (FRANK, 1995 12-20).

The author has been a Clinical Psychologist since 1978, with several advanced courses in the area of psychology and movement, having as her main activities: co-teaching the *Sense-Perceptual Training* method with its creator, Professor Ruben Alfredo Garcia, an Argentine, choreographer coming from the Laban school; *Consciousness by Dancing*, training with French dancer, Sylvie Lagache; training in *Structural & Movement*

²⁶Tonic Function - Sherrington (1909) defined the tonic function as "the activity of postural muscles in certain fixed joints, solidary with each other positions, which together make up the attitude" (WALLON, 1949:136). In Chapters V and VI will update the tonic function studies by Hubert Godard.

Advanced Certified Rolfing since 1989; and lastly, the international training and teaching of advanced level Somatic Experiencing.TM Through the activities mentioned, and fifteen years working with the transformation of trauma at SETI - Somatic Experiencing Trauma Institute. The author has observed the superior basis and effectiveness of the SE technique for the recovery of cognition and emotional integrity of affected individuals by traumatic events in the most varied origins of shock or development occurrences.

However, in most cases, clinical practice was consolidating the need to enrich the embodiment of the client and therapist to deal with inhibitions in the body. Mostly to interact and exchange with the environment and with others, as an action based on life, the dynamism of how to use updated tools and how the therapist resonates to the client's process, is essential to the ability to renew itself. In Trauma, the capacity for renewal is lost, as the client tends to use old resources to respond to new events (CASPARI, 2005) and thus creates fixations. These patterns of fixation may prevent, restrict or distort the movement. And to undo this repetitive behavior in re-enacting, very common in the traumatized person, is a need to work directly with the perception of the body in relation to spatial orientation. With traumatic shock, the perception of the internal space is reduced due to the dissociation, incapacitating the person to remain in its grounding, instead, causing disorientation in relation to the gravitational system.

However, the concept of spatial orientation already has been envisioned by Levine, in the Somatic Experiencing approach. When Levine created his psychotherapeutic SE map, he emphasized the attention to the Ergotrophic and Trofotrophic polarity in the

Autonomic Nervous System,²⁷ a concept that is completely congruent with the model of Godard on two directions (heaven and earth). Trofotrophic means attention, and the sense of response from within. Ergotrophic means attention to responses to phenomena outside the body (FRANK, 1995). It can also be described as the "felt-sense" or a sense of the internal environment of the weight within the body. The other direction is the feeling or sensation of the outer seats in the space outside the body. In order to draw attention to these two poles of perception, we have elicited intrinsic motion. Levine says that trauma is a fixation in distortion of perception from the internal experience. The theory of Tonic Function from Hubert Godard is a contribution to SE to improve the potential of the movement and offer other opportunities that will expand and potentiate healthy and integrating action. Godard, through his studies of motion analysis and phenomenology of perception of space, reveals himself through somatic re-education exercises, using touch and movement appropriate to evoke *haptic communication* and allow interaction between the sensorial and motor skills. The perception is critical for spatial orientation. Thus, the re-education of movement depends on the perception means to address the way a person organizes internal and external space.

In a healthy person, the physiological systems have an integrated organization, with its sub-systems that favor a great tone; revealing a coherent body in motion, a good neural emotional regulation, and an integration of senses that can also enhance an internal and external world in balance. In a person who goes through a traumatic experience, such physiological mentioned changes, the memory structure, posture, coordination are also affected and the person no longer functions as before. But a new adaptation is created, and the person lives within this new context with its limitations and fixations into a new

²⁷Increases or decreases in ambient as temperature, noise, pain, and pyrogenic agents will produce attenuated PNS tone and increased SNS activity. Consistent with this functional description of the ANS, Gelhorn (1967) labeled the PNS as trophotropic system and the SNS as an ergotropic system (PORGES, 2011:65).

world organization. As further explained in Chapter II, one will understand the blockages and restrictions of a traumatized person and how his/her physiology adapted to this situation.

What is proposed in this thesis is to present a model of somatic re-education through Hubert Godard's Tonic Function, where the work of SE is enhanced specially regarded to uncouple the physiology of the person who has strong fixed image. Trauma victims can benefit through Movement Education to facilitate their embodiment and to restore the integration of the senses.

To build the theoretical and experimental justification of this proposal, theoretical and practical aspects considered necessary will be examined, based on the most current knowledge of neuroscience and referenced papers by authors considered significant to the theme.

Chapter II will present the phenomenon of Trauma, how it's defined, types of traumas, their physiology, their memory and how trauma affects the body, the mind and the brain. This detailed chapter is intended to have grounded knowledge, equipped with proposals from the most renowned names of scientists and clinicians in the treatment of trauma.

Chapter III brings an overview on evolutionary psychology and biology with a very new Gibsonian ecological perspective of bodily self-awareness. This chapter also offers studies on how the body in action shapes the self. Further, this chapter includes useful information for the clinician to understand the functioning of the nervous system, the brain and its plasticity, and additional information about The Polyvagal theory.

In Chapter IV there will be a brief account of the development of somatic psychology, neuronal emotional development, and the Social Engagement System and how SE consolidates its practice using this theory towards the resolution of the proposed topic.

Chapter V will be covering Body Language, phenomenology of perception and space, and the neurobiology of sensory and motor language. It contains a thorough and current study of each function of mechanoreceptors (exteroception, interoception and proprioception) involved in the function of giving and receiving information through the sense organs and the relationship with body tissues, the Myofascia.

Chapter VI presents studies of Godard on Tonic Function and his studies on the development of movement / space and its relation to the appearance of Psychology. It presents the work of Dr. Ida Rolf, the precursor of somatic and movement work that underlies the work of SE. A lineage of Dr. Rolf's followers recognize her amazing ideas, which have been updated to be more contemporary. Robert Scheilp, et al, has been researching and collecting other studies about the function of fascia, as you will find in this same chapter, on how dysfunctional fascia can be related to trauma.

Further in Chapter VI, the author of this paper proposes a more direct intervention of touch and movement in the sessions of SE. The idea is as the rapport and interaction/synergetic process starts between client and therapist (and / or any time the dissociative state appears), the awareness of Tonic Function also comes up; as such, the yielding to gravity in the three physical planes, spatial orienting through focusing or peripheral vision is introduced, in order for the embodiment to be facilitated. As the Somatic Experiencing Practitioner (SEP) navigates during the process, when it is needed, some of the movement direct tools can be invited to the process in order to access specific spatial organization that may still be missing in the sensory-motor developing. For this chapter, the author recommends referring to the previous chapters, in particular how to use the map of SE, such as identifying in which defense system the client is engaged, the knowledge about the phenomenon of trauma symptoms and their consequences. Thus, it facilitates the reader's

understanding on how it will be possible to transform fixations into new possibilities. A methodology (chapter VII) and procedures study is self explanatory. It is very inspiring to acknowledge that the more touch and movement used within the resonance during SE sessions, the more easily it can evoke one's intrinsic biological rhythm. The conclusion in chapter VIII states that using the Hubert Godard's pedagogy, explained in Chapter VI, added to SE, has provided this author with plenty of theoretical and basis research support to speculate that the implicit memory of trauma can be modified by touch which evokes body intelligence.

The way this thesis was built shows the complexity of the material related to understand the phenomenon of trauma and its treatment. This is only a small piece of the big picture.

Chapter II **PHENOMENON OF TRAUMA**

II.A WHAT IS TRAUMA?

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

Seriously injured patients are at high risk for developing Post-traumatic Stress Disorder (PTSD²⁸) and related co-morbid²⁹ conditions, such as depression and substance abuse/dependence (BRYANT A., O'DONNELL L., CREAMER M., McFARLANE C., CLARK R., SILOVE D., 2010). Between 10-40% of physically injured American civilians may go on to develop symptoms consistent with a diagnosis of PTSD (SHIH A., SCHELL L., HAMBARSOOMIAN K., BELZBERG H., MARSHALL N., 2010). PTSD makes an independent contribution to post-traumatic functional limitations and diminished quality of life above and beyond the impact of injury severity and medical

²⁸ Post-traumatic Stress Disorder (PTSD) is characterized by a constellation of distressing and/or impairing symptoms that occur after experiencing, witnessing, or being confronted with a traumatic event that includes an actual or perceived threat to the self or others. PTSD involves repeated and intrusive memories related to the trauma (thoughts, dreams/ nightmares), avoidance of situations that are reminders of the trauma, and hyperarousal as irritability, reduced concentration, exaggerated startle response (JITENDER S., BRIAN J., MURRAY B., TRACIE O., CLAIRE F., GORDON A., 2007).

²⁹ Co-morbidity refers to the occurrence of two syndromes in the same patient. Defined literally, every pair of syndromes where the diagnosis of one does not categorically exclude the diagnosis of the other is potentially co-morbid. Determining whether both disorders occur in the same patient at different times or concurrently may help suggest the mechanism of co-morbidity (KRISHNAN, K., 2005)

conditions (ROBERTS P., KITCHINER J., BISSON J., 2009). PTSD is associated with increased costs to society; these costs appear to be, in part, secondary to increased health care costs (WALKER A., KATON W., RUSSO J., CIECHANOWSKI P., NEWMAN E., WAGNER W., 2003). Since September of 2001, PTSD has been of major interest because it is arguably one of the most prevalent and debilitating consequences of terrorism-related incidents.

According to Levine (1999), trauma³⁰ lies upon the instinctive physiology. Levine does not see the event as a determining factor, therefore trauma is not perceived as deriving from the nature of the event itself, but the determining factors are found in the relationship of trauma with the body and its capacity for neuroplasticity,³¹ as well as the level of resilience³² in the nervous system. In the very time a stressful situation takes place, it is the availability of resources or the lack thereof to deal with and to cope with stressful situations is what shall determine the traumatic potential of the stressing event (LEVINE, 1997).

As defined by Freud, trauma occurs when there is a breach in the organism's protective barrier against stimulation in the nervous system³³ coupled with a lack of available resources to modulate such experiences in which then brings about an overwhelming

³⁰The notion of trauma suffered transformations, but it was never completely abandoned in Freud's work. Finds its culmination in the fundamental formulations as in *Beyond the Pleasure Principle* (1920) and *Inhibitions, Symptoms and Anxiety* (1926). Freud posits that terror, anguish without mediation and / or a disproportionate psychic pain, are the leading causes of traumatic neurosis. The passive experience of the traumatic event is due to the nature of the episode, which prevents the motor or verbal response necessary for the discharge of affect, reinforced by the surprising nature of the event. Freud points out, "one to remember not accompanied by affection is almost always totally ineffective" (1893, p 32.) And further emphasizes: " the trauma refers to an excess of excitement not downloaded" (Sabourin, 1988).

³¹Neuroplasticity is the ability of the nervous system to modify the connections amongst neurons.

³² Mancini Bonanno proposed that resilience to potential trauma be defined as "the ability of adults in otherwise normal circumstances who are exposed to an isolated and potential highly disruptive event, such as the death of a close relation or a violent or life-threatening situation to maintain relatively stable, healthy levels of psychological and physical functioning, as well as the capacity for generative experience and positive emotions" (BONANNO, Mancini, 2009:20-21).

³³"*Overstimulation*" was added by Levine.

state of impotence. Trauma is thus not defined by the causing event but rather by the results of an overcharging of stimuli provoked in the organism; when any organism perceives overwhelming mortal danger (with little or no chance for escape) the *biological* response is a global one of paralysis and shutdown.³⁴

II.A.1 Ethologists call this innate response *tonic immobility* (TI):

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

A paralysis state³⁵ becomes a “default” response to a wide variety of situations in which one's feelings are highly aroused (LEVINE, 2010:23-24); for Levine, “*Trauma arises when one’s human immobility responses do not resolve; that is, when one cannot make the transition back to normal life, and the immobility reaction becomes chronically coupled with fear and other intense negative emotions such as dread, revulsion and helplessness.*” And for him, after this coupling has been established, “*The physical sensations of immobility by themselves evoke fear;*” a traumatized individual, Levine affirms, has become conditioned to be fearful of his or her internal (physical) sensations that now generate the fear that extends and deepens (potentiates) the paralysis. Fear

³⁴ According to the polyvagal theory (see chapter III), being in shutdown (immobility/freezing/or collapse) or in sympathetic/hyperactivation (fight or flight) greatly diminishes a person’s capacity to receive and incorporate empathy and support. Traumatized people dominated by shutdown are physiologically unavailable to calming and sharing feelings and attachment (LEVINE, 2010:111).

³⁵ It is a state where traumatized people are stuck in the primitive root of immobility with its greatly reduced capacity for reading face, bodies and emotions; they become cut off from the human race (LEVINE, 2010:111).

begets paralysis, and fear of the sensations of paralysis begets more fear, promoting yet a deeper paralysis. In this way, a normally time-limited physiological adaptive reaction becomes chronic and maladaptive. The feedback loop closes in on itself; in this downward spiral, the vortex of trauma is born (LEVINE, 2010:68). Trauma disrupts the organization of the internal experience of internal homeostatic balance, and trauma can be turned into many symptoms as a result of that dysregulation also defined as dissociation.³⁶ The events that threaten life can leave a person in a very restricted state by inhibiting the sympathetic and parasympathetic high load, which results in a "locking" of the natural flow of body function; the two systems, the sympathetic and parasympathetic are co-activated at the same time: analogous to accelerating and braking simultaneously in a car. I mean, the individual overload; you're nervous to the point that can trigger the alarm system and paralyze their activity system. Bodily reactions are innate, power-endowed to survive in a state of readiness to act, and if these muscular tensions that are organized by the brain are not used, in part lie in a stream of neural impulses from the spinal cord to the *thalamus* (headquarters of sensory transmission) and in another part of the brain, the cerebellar tonsils are still signaling the persistent presence of danger and threat, even though the danger and the threat no longer exist anymore.

If the muscles and viscera are ready to react to danger, the mind will say that there is still reason to fear (Levine, 2010:169). This hyperactivation causes an irresistible impulse to identify the source of the threat or danger because of the guidance system sensorimotor; and if you cannot find the source of the threat, danger signs, the mind will continue firing warning sensations, emotions, thoughts or repetitive images obsessively

³⁶ Dissociation may be characterized by loss of memory for an event, and memory is particularly impaired in dissociative disorders. See chapter II.

seeking the causes in the past and / or future, since the body continues to warn the brain (Levine, 2010:170). When it is perceived (consciously or unconsciously) that it is in danger, the defensive postures necessary for protection are mobilized in the body; instinctively the body deviates, shrinks, bends down and hardens to fight or flee, and when you cannot use one of these two strategies, the body freezes or collapses, and the energized voltage remains stagnant in the muscles. Trauma can be conceptualized as stemming from a failure of the natural physiological activation and hormonal secretions to organize an effective response to threat, rather than producing a successful fight or flight response the organism becomes immobilized (BESSEL van der Kolk, 2006:282).

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

II.B – TYPES OF TRAUMA:

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

Following are some examples for different trauma experiences:

II.B.1-Trans-generational trauma:

It concerns the legacy and heritage of psychic components that are propagated from generation to generation among the families or among all members of humankind. Suicide, murder, bankruptcy, sexual abuse in the family, land robbery of others in the past, addiction, jealousy between siblings, experiences of war and so many other examples of trauma, experienced within a family that were swept under the rug for years, we can regard as transgenerational trauma. This is only a simple example.

Genes – functional units that make up our DNA – provide the information that directs our bodies' basic cellular activities. Research on the human genome has shown that the DNA sequences of any two individuals are 99.9% identical. However, that 0.1% variation is profoundly important, contributing to visible differences, like height and hair color, and to invisible differences, such as increased risks for, or protection from, heart attack, stroke, diabetes, and addiction. Genes influence the numbers and types of receptors in the brains, how quickly our bodies metabolize drugs, and how well we respond to different medications. Recent advances in DNA analysis are enabling researchers to untangle complex genetic interactions by examining a person's entire genome at once. These genome-wide association studies (GWAS) identify subtle variations in DNA sequence called single-nucleotide polymorphisms (SNPs) – places where individuals differ in just a single letter of the genetic code. If a SNP appears more often in individuals with a disease than those without, it is presumed to be located in or near a gene that influences susceptibility to that disease. Building on GWAS results, scientists gather

additional evidence from affected families, animal models, and biochemical experiments to verify and understand the link between a gene and risk for a disease.

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

Addiction is defined as a compulsive physiological need for and use of a habit-forming substance (as heroin, nicotine, or alcohol) characterized by tolerance and by well-defined physiological symptoms upon withdrawal; *broadly*: persistent compulsive use of a substance known by the user to be physically, psychologically, or socially harmful. Addictions can include, but are not limited to, drug abuse, exercise, sex and love, food, internet and gambling. Classic hallmarks of addiction include impaired control over substances or behavior, preoccupation with substance or behavior, continued use despite consequences, and denial. Habits and patterns associated with addiction are typically characterized by immediate gratification (short-term reward), coupled with delayed deleterious effects (long-term costs). Physiological dependence occurs when the body has to adjust to the substance by incorporating the substance into its "normal" functioning. This state creates the conditions of tolerance and withdrawal. Tolerance is the process by which the body continually adapts to the substance and requires increasingly larger amounts to achieve the original effects. Withdrawal refers to physical and psychological symptoms experienced when reducing or discontinuing a

substance that the body has become dependent on. Symptoms of withdrawal generally include, but are not limited to, anxiety, irritability, intense cravings for the substance, nausea, hallucinations, headaches, cold sweats, and tremors. Substance dependence can be diagnosed with physiological dependence, evidence of tolerance or withdrawal, or without physiological dependence. DSM-IV substance dependencies include:

- 303.90 Alcohol dependence
- 304.00 Opioid dependence
- 304.10 Sedative, hypnotic, or anxiolytic dependence (including benzodiazepine dependence and barbiturate dependence)
- 304.20 Cocaine dependence
- 304.30 Cannabis dependence
- 304.40 Amphetamine dependence (or amphetamine-like)
- 304.50 Hallucinogen dependence
- 304.60 Inhalant dependence
- 304.80 Polysubstance dependence
- 304.90 Phencyclidine (or phencyclidine-like) dependence
- 304.90 Other (or unknown) substance dependence
- . 305.10 Nicotine dependence

II.B.2-Existential trauma:

An existential injury that explores the psychosocial basis of traumatic experience; the combination of both psychological and sociological dimensions, which has profound existential resonances. It can be applied to trauma at any stage in the life course; child

abuse is used as an example of how trauma can have a significant and detrimental effect on identity development, invoking a need for a commitment to trauma recovery.

II.B.3-Threat trauma:

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

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

When one is flooded by rage, the frontal³⁷ parts of the brain “shutdown.” Because of this extreme imbalance, the capacity to stand back and observe one’s sensations and emotions is lost; rather, one *becomes* those emotions and sensations. Hence, the rage can become utterly overwhelming, causing panic and the stifling of such primitive impulses, turning them inward and preventing a natural exit from the immobility reaction. Maintaining this

³⁷See chapter Three

suppression requires a tremendous expenditure of energy. One is, essentially, doing to oneself what experimenters have done to animals to reinforce and protract their immobilization. Traumatized individuals repeatedly frighten themselves as they begin to come out of immobility. The “fear-potentiated immobility” is *maintained from within*. The vicious cycle of intense sensation/rage/fear locks a person in the biological trauma response (LEVINE, 2010:66).

Natural disasters include events that are beyond human control, such as earthquakes, tornadoes, floods, and social dislocation from the natural world and one’s community. It also includes events that are beyond an individual’s control, such as war or terrorism, which result in the same kind of fear and dislocation at both a community and individual level (LEVINE, 2007).

How an individual reacts to a traumatic event or an ongoing sense of danger depends on both, their personal risk factors and coping strategies.

II.B.4-Loss Trauma:

Loss leads to trauma: loss or fear of loss of a loved one is central in this category. Loss situations involve ‘problems’ (i.e. loss of something or someone) that cannot be solved by or with design. In the first stage, a practitioner has to be embodied with a deepening of understanding about the phenomenon of human loss, and to study the current role of design in loss situations. Loss situations are divided in two phases: pre-loss phase and post-loss phase. The pre-loss phase concentrates on fostering human resilience ability to loss yet to happen; and the post-loss phase explores the coping strategies and emotions regulating process after loss has happened.

II.B.5-Bonding Trauma:

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

II.B.6-Birth Trauma:

Birth is a great initiation and rite of passage; during birth, internalized strengths are developed that become a resource for the personality and for life development. However, difficult births imprint shock responses;³⁸ under stress one can over-identify with this birth template and appear pushy, passive, withdrawn, in control, or resistant. Such behavior wreaks havoc on intimate relationships, is mostly unconscious, and linked to survival activation; activation produces emotional reactivity and prevents one from releasing birth imprints. Activation hijacks the nervous system and limits behavior options that are more nourishing for self and others (BROOK: 2012:91).

II.B.7-War trauma:

With the growing number of countries involved now days in armed conflicts, more adults and children have come to suffer the atrocities of war, and also feeling consequences from wars from the past.

³⁸ By definition *shock* is a jolt, a scare, a start, terror, jostle, or surprise. It can be wild, astonish, daze, paralyze, stun or stupefy ones (Webster Dictionary). Shock occurs in response to an overwhelming event or a chronic low-grade stressor; the body goes into high alert and responds with a fight/flight/freeze and/or withdrawal. Shock creates template responses that organize future experiences; in shock, the body freezes and the psyche dissociates.

Displacement, witnessing violent acts, bearing arms, being victims of direct hostilities, are some of the traumatic experiences children and adults face in war-torn countries; this brings such overwhelming experiences that have an impact on the development of children, their attitudes toward to society, their relationships with others, and their outlook on life in general.

Studies of soldiers from prior wars conducted many years after combat have shown associations between combat-related post-traumatic stress disorder (PTSD) and physical health problems. Research conducted on veterans from the recent war in Iraq has already established the presence of a high prevalence of PTSD (12%- 13%) during the first 3-4 months after their return home (Charles Engel, et al, 2007). The high prevalence of PTSD and its strong association with physical health problems among Iraq war veterans have important implications for delivery of medical services. Combat veterans with serious somatic concerns should be evaluated for PTSD.

II.B.8-Attachment disorders:

Refers to serious conditions in which children and young children don't establish healthy bonds with parents or caregivers. A child with reactive attachment disorder is typically neglected, abused or orphaned; it develops because the child's basic needs for comfort, affection and nurturing aren't met and loving, caring attachments with others are never established. This may permanently change the child's growing brain, hurting the ability to establish future relationships.

Attachment feelings and separation pain evolved as mammals developed a need for social support and when the offspring began to be born without the ability to survive without the caring and support of the adult animals. A panic system emerged to provide

a sensitive emotional barometer that would engage the full attention of the care-givers. If the social contact was lost, the organism experienced a painful feeling of separation, and the animal cried out in protest in an attempt to regain the vital contact and care (Pankseep, 1998; HART, 2008:187-188). A child, who has early experiences of frightening, incomprehensible, and uncontrollable arguments between adults, may later react with anxiety when hearing others engaging in loud arguments. Separation anxiety is closely linked to the attachment system, which is integrated with the pleasure circuit that is activated when ones are together with attachment figures (HART, 2008:198).

II.B.9- Emotional or psychological trauma:

Emotional or psychological trauma is the result of extraordinarily stressful experience that shatters the sense of security, making one feel helpless and vulnerable in a dangerous world. People are also more likely to be traumatized by a new situation if they've been traumatized before – especially if the earlier trauma occurred in childhood. The developmental themes related to such issues as neglect or abuse become so severe that they are experienced as potentially life-threatening. When the child is unable to integrate developmental disturbances or challenges, the body ego begins to lose important functional areas, which impedes future growth. The sensorial field becomes reduced or divided, and this key system of integration will be inhibited (LEVINE, 2007). Experiencing trauma in childhood can have a severe and long-lasting effect; children who have been traumatized see the world as a frightening and dangerous place. When childhood trauma is not resolved, this fundamental sense of fear and helplessness carries over into adulthood, setting the stage for further trauma. Childhood trauma results from anything that disrupts a child's sense of safety and security, including: an

unstable or unsafe environment, separation from a parent, serious illness, intrusive medical procedures, sexual, physical or verbal abuse, domestic violence, bullying, etc.

Research³⁹ has consistently shown strong associations between affective disorders and substance use disorders. Specifically, people with mood disorders are at increased risk of substance use disorders. Affect and addiction can be related in a variety of ways as they play a crucial role in influencing motivated behaviors. For instance, affect facilitates action, directs attention, prepares the individual for a physical response, and guides behavior to meet particular needs. Moreover, affect is implicated in a range of concepts relevant to addiction: negative reinforcement and positive reinforcement, behavior motivation, regulation of cognition and mood, and reasoning and decision making. Emotion-motivated reasoning has been shown to influence addictive behaviors via selecting outcomes that minimize negative affective states (while maximizing positive affective states).

II.B.10 - Illness Trauma:

Research has increasingly targeted seriously on life-threatening illness as traumatic events, and a growing literature on PTSD among medical patients has developed (e.g. cancer, heart attack, HIV diagnosis). The developments have helped broaden and enrich the investigation of psychological trauma, but differences between stressors and more traditionally studied sources of trauma bring up questions about the application of PTSD to this population. In physical injury, the underlying factor is that the stimulus or threat is inside the body. Since there is no external threat, active defenses can't be used, and the body goes into a mode of passive conservation. In this type of trauma, the

³⁹www.drugabuse.gov

practitioner must balance the need for trauma resolution with the need for physical recovery. In general, while the active physical healing process is taking place, trauma recovery work will focus on first aid and on supporting the conservation and withdrawal process, and will work in only a limited way with high levels of activation. Physical injury can potentialize traumatic experiences because they may need to fall into surgery, anesthesia, hospitalization, allergic reactions and so on (LEVINE, 2007).

Several mechanisms to explain the co-occurrence of PTSD with physical illness have been posited in the literature. First, direct trauma-related injury may lead to both PTSD and physical conditions. The association between PTSD and chronic pain has been hypothesized to be related to mutual maintenance. Expertise suggests that pain serves as a reminder of the trauma and that arousal, triggered by the reminder, promotes avoidance of pain-related situations (ASMUNDSON G., COONS J., TAYLOR S., KATZ J., 2002).

Epidemiological data is still inconclusive about the relationship of Trauma, diseases and its co-morbidity. Some diseases related to Post-traumatic Stress Disorders: Depression; Alcohol and Substance use disorder; Anxiety Disorder; Panic Disorder; Obsessive-compulsive disorder; Social Phobia; Eating disorder; Attention-Deficit/Hyperactivity Disorder; Personality Disorder; Migraine; Multiple Sclerosis; Cushing's syndrome; Arteriopathy with sub-cortical infarct and leukoencephalopathy; Brain tumor; Head trauma; Asthma; Obesity; Diabetes; Hypothyroidism; Polycystic Ovarian syndrome; Renal failure; Skin rash; chronic pain, gastrointestinal disorders, Irritable Bowel and several other syndromes. More recently, several studies aimed at assessing the medical and social impact of major depressive disorder associated with co-morbid medical illness. Most researchers have focused on the association of major depressive disorder with specific medical

problems: coronary artery disease; congestive heart failure; myocardial infarct; stroke; diabetes; cancer; autoimmune diseases; Parkinson's disease and dementia. When analyzing the overall impact of medical illness on patients with major depressive disorder, the presence of co-morbid medical illness was found to be associated with a higher prevalence of major depressive disorder. Other investigators found that co-morbid medical illness is a risk factor for major depressive disorder. However, in other studies, the severity of baseline medical co-morbidity in patients with major depressive disorder did not correlate with severity of depression (Fava et al, 2003).

II.B.10.1 - Considerations on the section B.10:

Traumatic experience often involve a threat to life or safety, but any situation that leaves you feeling overwhelmed and alone can be traumatic, even if it doesn't involve physical harm. Any type of trauma can be installed if an event happens unexpectedly, if you are not prepared for it, if you felt powerless to prevent it, if it happens repeatedly or even if someone was intentionally cruel and especially if it happens in childhood.

It is important to mention that not all potentially traumatic events lead to lasting trauma; some people rebound quickly from even the most tragic and shocking experiences (it is a great resilient system); others are devastated by experiences that, on the surface, appear to be less upsetting.

A number of risk factors make people susceptible to trauma; people are more likely to be traumatized by a stressful experience if they are already under a heavy stress load or have recently suffered a series of losses.

Most traumas occur in the context of interpersonal relationships, which involve boundary violations, loss of autonomous action, and loss of self-regulation. When

people lack sources of support and sustenance, such as is common with abused children, women trapped in domestic violence, and incarcerated men, they are likely to learn to respond to abuse and threat with mechanistic compliance or resigned submission (BESSEL van der Kolk, 2006:283); Bessel affirms that if the brutalization has been repetitive and unrelenting, they are vulnerable to continue to become physiologically dysregulated and go into states of extreme hypo-and hyper-arousal, accompanied by physical immobilization. Often, these responses become habitual, and, as a result, many victims develop chronic problems initiating effective, independent action, even in situations where, rationally, they could be expected to be able to stand up for themselves and take care of things (BESSEL van der Kolk, 2006:283).

II.C. TRAUMA RESIDES IN THE PHYSIOLOGY OF DEFENSE SURVIVAL

RESPONSE (LEVINE, 1976):

Defensive responses are initiated as soon as an animal identifies, through the guidance system, that the danger is imminent.

The physiologically preprogrammed instinctual responses to danger determine what type of survival response will be used in the split second response, which occurs in the moment of danger. The correct answers are those that favor the survival.

When responses of defenses are intact, the amplitude of the strategies allows an adaptation against the magnitude of the danger; but in traumatized persons, defensive responses may not be present or be confusing, and people lose their ability to orient themselves to the danger accurately.

In unresolved trauma, previous experiences interfere with perception and delicate interplay between instinct and learned behavior; this perception of failure will increase effective defense activation, which in turn can trigger the immobility response.

The physiology of survival responses is controlled by the autonomic nervous system, especially the reptilian brain and the limbic circuit.

One of the critical aspects in trauma renegotiation is the completion of incomplete survival responses, in particular orienting, fight, flight and freeze responses; interrupting or thwarting these responses at different stages in the threat response cycle produces subtly different disturbances in the physiology, which will in turn require slightly different interventions for resolution (Levine, SE-MANUAL, 2007 Copyright. B2.3). In the threat response, the movement from perception of threat into active defense may happen in milliseconds, with no apparent transitional phases; in an over-responsive nervous system, startle may be the habituated response to any novelty in the environment, but it won't be followed by specific defense when there is no actual threat.

The cycle of activation progresses as follows:

- a) When there is novelty, one stops and notices the external environment and evaluates if it is or not threatening.
- b) If the source of threat still is there, the startle happens almost simultaneously with the arrest response that includes mobilization of the chemical and physical resources needed to respond to threat in order to prepare for action.
- c) The potential for threat is assessed as being high. The defense orienting response is now done in the context of specific threat (LEVINE, SE-Manual, 2007 - Copyright: B2.3). If threat does not materialize, physiology returns to the resting state after activation level is reduced via normal self-regulatory processes; if threat requires active

defense, completion of the fight, flight or freeze sequence (if defense is successful) leads to discharge of the high activation levels of the threat response, and the physiology returns to equilibrium via normal recovery processes.

Specific defense responses are: Fight, Flight and Freeze or Tonic Immobilization.

II.C.1 Fight:

Fighting is the defensive response initiated in situations that call for aggression, or when it seems necessary or possible to overcome a threat directly, or when flight seems unavailable or unsuccessful; when the fight response is thwarted, and flight is unavailable, the freeze response will be the natural result (SE- MANUAL, copyright, 2007:B2.11).

II.C.2-Flight:

Flight is initiated when the perceived magnitude of the threat is such that fighting seems unlikely to succeed, when fighting has failed, or when the threat is non-specific enough that direct confrontation is unavailable; when flight is unavailable, either the freeze response will ensue, or a last-ditch attempt to fight will sometimes be provoked (SE MANUAL, Copyright©, 2007:B2.14).

II.C.3-Freeze or Tonic Immobility:

The freeze, or immobility tonic response, is not a conscious choice in the hierarchy of the threat response cycle; it happens automatically when excitation or activation reaches a certain physiological threshold; the freeze is like a circuit breaker that shuts down the

physiology when it is overloaded. The freeze is a profound physiological state, derivated from deep homeostasis alteration and has a tremendous amount of activation contained within it (SE MANUAL, Copyright©, 2007 - B2.16).

II.C.4 - Cycle of Activation to danger & Hyperactivation:

Activation is an activity that gives energy in the survival responses when danger is perceived or when they feel a threat (Levine, 1997); when the situation is serious enough to threaten their survival, the amount of energy mobilized will be much higher than mobilized in any other life situation. Thus, hyperactivation cannot be controlled voluntarily, but also with many instinctive processes (Levine, 1997-120).

II.C.5-Hyperactivation of the Nervous System:

When responding to a life-threatening situation, hyperactivation is initiated by the constriction of the body and reduction of awareness of the environment so that all the attention is directed to the threat - thus ensuring - hyper-vigilance; the nervous system acts to ensure that all efforts be concentrated to find a solution to the threat. The constriction alters breathing, muscle tone and posture of the person; blood vessels of the skin of the extremities and the viscera constrict so there is more blood available to the muscles that are tensed and prepared to take appropriate defensive action. Hyperactivation and constriction cooperate to make the person capable of performing a task he/she could never run under normal conditions; when the constriction cannot sufficiently focus the energy of the body to defend itself, the nervous system evokes other mechanisms to curb hyperactivity, such as freezing and dissociation (LEVINE, 1997:121).

II.C.6-Dissociation:

Dissociation is a distortion of objective reality that includes the distortion of time and perception, to break the continuity of experience. If dissociation occurs a fundamental disconnection between the person's body, or part thereof, or a part of the experience occurs; there is a split between the person and their emotions, thoughts, sensations and memory or part thereof. It is as if consciousness to move away from the present moment is a means of protecting personal integrity; in this state of analgesia, the victim can witness the event as if it were out of the body, as if it were happening to someone else. Dissociation is a means of enabling a person to support experiments that are beyond the possibilities of being supported at impact or that happen. It is a defense that allows a person to have the appearance of being integrated; you can move on and support and / or engage in some form; is a means adopted to be in the world, and is a response that usually happens without having his/her consciousness. "*Dissociation is an analgesic effect 'human' due to a flood of endorphins, which make up the system of relief of human suffering produced by the body itself and similar to morphine*" (LEVINE, 2010-58).

Dissociation has an important role to prevent access of images and / or uncomfortable, traumatic sensations, but at the same time prevents the traumatized person to work in the resolution of their symptoms, perpetuating the state of impotence; dissociation may also be characterized by loss of memory for an event, and for memory that is particularly impaired in dissociative disorders.⁴⁰ Parts of the body may become paralyzed, clumsy, or anesthetic, a condition called *conversion disorder*, or *hysteria* (SCAER, 2012:106).

Hyperactivation is the result of a core of traumatic reaction composed of increased activation, constriction, dissociation and sense of powerlessness; impotence is closely

⁴⁰ See symptoms of trauma.

linked to the primitive biological response of facing a terrifying threat with the freezing response. If the throttle is hyperactivation of the nervous system, then the overwhelming sense of helplessness is your brake (Levine, 1997). Recognizing that the amount of energy in the system is greater than that which can be supported by the body, the phenomenon of state "default," as it is called by ethologists, occurs: the response of tonic immobility (paralysis) is one of three main instinctive reactions that may assist reptiles and mammals when faced with the threat that a predator is; this occurs when active reactions (like wrestling) will probably not be efficient to escape or eliminate the source of threat (LEVINE, 2011-56). This state of default or pretending to be dead is "not merely a biological survival tactic that animals and humans experience when being paralyzed or numbed with fear".

II.C.7-Neurophysiology of Trauma:

As Bessel understands, the neurophysiology of trauma is indeed "the brain that is impacted by aggressive stimulus" and becomes hyperactive in trying to solve the problem. Not finding the right answer, the neural system translates this aggression as a physiological⁴¹ adaptation to their strategies for survival, and dysfunction developed within the degree or severity of the traumatic experience. "*When someone is exposed to extreme stress, many brain systems are activated to deal with this stimulation*" (BESSEL VAN DER KOLK, 1996).

⁴¹ Hans Selye spent his career studying and defining stress and the nature of the body's adaptation, which he called the "general adaptation syndrome (GAS)(SCAER, 2012:95)

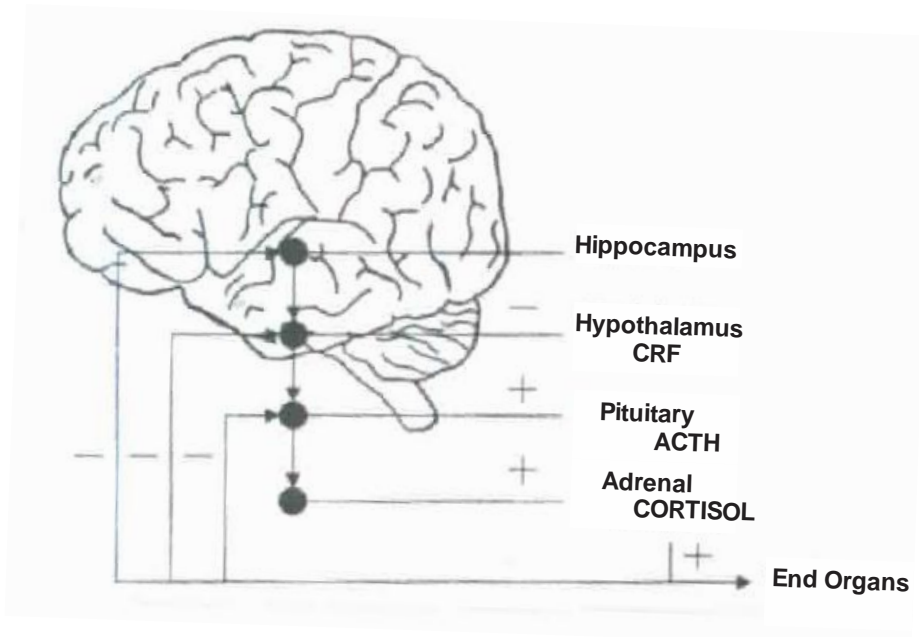
II.C.8-Biological Alteration an ongoing stress:

The emotion of fear is something that one would not try if there were choice; fear is clearly a very important and necessary emotion for survival. Fear conditioning is probably the neurophysiological basis for being traumatized. It activates the *amygdala* and triggers the arousal system of the fight/flight response, in effect consolidating the traumatic memory (SCAER, 2012:140). Under conditions of threat or stress, a group of bio-behavioral response modes become activated automatically, sending a cascade of stress hormones, immune-suppressants, and sympathetic neurotransmitters into the body to activate the skeletal muscles and inhibit the activation of the gut muscles during states of vigilance, mobilization, and immobilization; this process begins in the arousal systems of the brain, the amygdala and the limbic system, but falls short of the physiology of the flight/fight response (SCAER, 2012:129). Stress physiology involves the study of either physical or emotional stressors that disrupt homeostasis and also the study of the bodily responses that operate to return the system to normal homeostasis. The first recognition of the stress response that could be deleterious, was made by Hans Selye, who pioneered the concept that chronic stress could cause disease (Selye and Tuchweber, 1976). The stress response engages the *hypothalamus*, pituitary and adrenal glands on an axis known as HPA;⁴² this axis is the main mobilizer of energy in the body for all kinds of responses, not just fight and flight. If the overactivated amygdala is due to incomplete traumatic experience of oppression, ANS gradually becomes unable to mobilize without firing responses of fight or flight, or the stress response. It is particularly appropriate in understanding the deleterious processes that can affect the *hippocampus*. Under normal conditions the HPA axis carries out an appropriate acute

⁴²The HPA axis is the main part of the endocrine system that controls reactions to stress and other bodily processes that use energy, such as digestion and immune system response.

response to stress (see theFigure); there is an endocrine cascade starting with the brain, continuing to the pituitary, and ending with secretion of GCs (glucocorticoids) by the adrenal gland. Negative feedback loops operate at each of these levels to restore the system to normal homeostasis; however, during conditions of chronic stress, such as occurs in depression, alterations occur in the system so that the feedback mechanisms do not operate normally and there is damage to hippocampal neuronal cells (GODMANN et al 1984; Holsboer et al 1987; Sapolsky et al 1991; Young et al 1991).

Figure 1 – A representation of the relationship between the hippocampus and the hypothalamic-pituitary-adrenal (HPA) axis in response to stress. The activation of the HPA axis leads to elevated cortisol and to possible hippocampal damage. This hippocampal atrophy may interrupt inhibitory influence on the hypothalamus, in turn, resulting in increased corticotropin-releasing factor (CRF) levels with diminished adrenocorticotropic hormone (ACTH) response



Source; SHELINE, 2000:794.

II.C.9-Motor Activity in trauma & Stress response:

Long-term threat and stress is associated with muscle tension and muscle pain, resulting from the chronic activation of the threat response neural networks (BESSEL VAN DER

KOLK, 1996; YEHUDA, 2004:65), in which the muscular system is inhibited as part of the freeze response that mobilize survival energies by HPA axis (JOHNSON, 2004).

There are three types of muscles in the body: skeletal, smooth, and cardiac. Skeletal muscles control the physical movements of the body by attaching to bone and contracting to move body parts across the joints. Smooth muscles are found in most of the internal organs, including the gut, respiratory tract, arteries and veins, bladder, reproductive tracts and uterus. Skeletal muscles are more structurally complex than smooth muscles: skeletal muscles are composed of bundles of muscle cells (also called muscle fibers) that form a single motor unit; each motor unit is regulated by a single neuron that contracts all the cells in that motor unit at the same time (Ramnani, 2006: YEHUDA, 2004:65).

The brain and the body are parts of a common interactive system: any outside stimulus or input to the brain must first be registered by the sensory organ systems of the body, and the brain relies on the body to provide all information having to do with function in general, not just survival; what's happening in the body continuously changes the brain. The flip side of this relationship is that the brain, in response, also directs and changes the body. Learning of a motor skill by the brain is dependent on the body's ability to adapt and respond to feedback messages from the brain that direct the somatic musculature (SCAER, 2012:110).

II.C.10-Phenomenon of paralysis or tonic immobility: shock state:

Ethology is the study of animals in their natural environment and points to the “thwarting” of escape as the root of distress-anxiety.⁴³

⁴³ Desmond Morris, *Primate Ethology*, (London: Weidenfield and Nicolson, 1969; and A. Eric Salzen, “Social Attachment and a Sense of Security”, *Social Sciences Information*, 12, 1967):555-627; *USABP*, Vol.2:12.

Ethologists call this phenomenon an *involuntary tonic immobility*; these studies demonstrated that despite that wild animals are frequently subjected to situations of threat to life and share the same physiological mechanism of survival with humans, they are rarely traumatized. They have instinctive and natural autonomic processes of self-regulation that counteract the stress response experienced in each event (LEVINE, 1997).

When attacked by a cheetah on the African plains, an antelope will first attempt to escape through directed-oriented running; if, however, the fleeing animal is cornered so that escape is diminished, it may run blindly, without a directed orientation, or it may attempt to fight wildly and desperately, frantic against enormous odds. At the moment of physical contact, often before injury is actually inflicted, the antelope abruptly appears to go dead: it not only appears dead, but its autonomic physiology undergoes a widespread alteration and reorganization. The antelope is, in fact, highly activated internally, even though outward movement is non-existent. Prey animals are immobilized in a sustained (cataleptic-catatonic) pattern of neuromuscular activity and high autonomic and brain wave activity; sympathetic and parasympathetic nervous systems responses are also co-activated, like brake and accelerator, working against each other. In tonic immobility, an animal is either frozen stiff in heightened contraction of agonist and antagonist muscle groups, or in a continuously balanced, hypnotic, muscular state, exhibiting what is called “wavy flexibility.” In the hypnotic state, body positions can be molded like clay, as is seen in catatonic schizophrenics; there is also analgesic numbing. Tonic immobility, murderous rage, and non-directed flight are such examples.

Ethologists have found wide adaptive value in these immobility responses: freezing makes prey less visible and non-movement in prey appears also to be a potent inhibitor of

aggression in predators, often aborting attack-kill responses entirely;⁴⁴ immobility can buy time for prey. The predator may drag frozen prey to its den or lair for later consumption, giving it a second chance to escape.⁴⁵ Aggression-inhibiting responses, freezing by prey animals, may provide a signaling and decoy affect, allowing conspecifics, who are farther away, a better chance for escape in certain situations. Loss of blood pressure may also help prevent bleeding when injured. An immobile prey animal is, in sum, less likely to be attacked; further, if attacked, it is less likely to be killed and eaten, increasing its chances of escape and reproduction. In a world where most animals are both predator and prey at one time or another, analgesia is a “humane” biological adaptation.

Freezing is the last-ditch, bodily response where active escape is not possible. Where flight and fight escape have been (or are perceived to be) unlikely, the nervous system reorganizes to tonic immobility; both flight-or-fight and immobility are adaptive responses. Where the flight-or-fight response is appropriate, freezing will be relatively maladaptive; where freeze is appropriate, attempts to flee or fight are likely to be maladaptive. Biologically, immobility is a potent adaptive strategy where active escape is prevented; when, however, it becomes a preferred response pattern, it becomes the crippling, fixating experience of trauma.⁴⁶ Underlying the freezing response, however, are the flight-or-fight and other defensive and orientation preparations that are activated just prior to the onset of freezing (LEVINE, 2003, USABP.Vol.2:12-14).

⁴⁴ Gallup and Maser, “Catalepsy and Catatonia,”:350-54.

⁴⁵Gallup and Maser, “Catalepsy and Catatonia,”:350-54. (*Ibid.*354.).

⁴⁶When one is flooded by rage, the frontal parts of the brain “shutdown.”[...] Hence, the rage can become utterly overwhelming, causing panic and the stifling of such primitive impulses, turning them inward and preventing a natural exit from the immobility reaction. One is, essentially, doing to oneself what experimenters have done to animals to reinforce and protract their immobilization. Traumatized individuals repeatedly frighten themselves as they begin to come out of immobility. The “fear-potentiated immobility” is *maintained from within*. The vicious cycle of fear and immobility (fear-potentiated immobility) prevents the response from ever *fully* completing and resolving as it does in wild animals (LEVINE, 2010:66).

II.C.11-Critical Importance of the Freeze Discharge or the motor act of completionDefense Response:

II.C.11.1 By Levine⁴⁷, 1976:

An organism responds to environmental change through a continuous integration of motor response with sensory data (both from inside and outside its boundaries). The response to changes, either in the external environment or internal visceral shifts, requires appropriate action of the neuromuscular skeletal system; feedback from the effector organs and the external senses not only determines whether a particular action is “successful” or not, but is the integral link both in its execution and timing.

Towards understanding the role played by external effector organs (muscles) in the regulation of autonomic activation in the resolution or accumulation of stress, we look first at some of the functional connections between the autonomic and somatic nervous system at the level of a muscle group; each skeletal muscle is composed of many fiber bundles which are aggregates of several thousands of microscopic fibers. It is the parallel development of tension in these extrafusal fibers, stimulated by their spinal alpha neurons, which is responsible for mechanical contraction and movement.⁴⁸ There are also small bundles (comprised of about ten fibers) called intrafusals; these fibers are innervated by the gamma efferent motor system.⁴⁹⁵⁰ Within the intrafusals are two kinds of afferent sensory nerve endings: centrally in the nuclear sac region are the annulospiral receptors, and at either side of these, in the myotubal region, are the flower spray endings (FOGEL:

⁴⁷ From the Accumulated Stress thesis by Peter A. Levine, 1976.

⁴⁸ The alpha neurons are a part of Yakovlev’s outer and middle “conscious” neo-cortical sphere (LEVINE, 1976).

⁴⁹ The gamma efferent system can be stimulated directly from various points in the medulla and brainstem (LEVINE, 1976).

⁵⁰ In Yakovlev’s system they derive more from the middle and inner sphere in close connection with the visceral-autonomic (LEVINE, 1976).

188:189); both of these receptors fire proportionately to degree of stretch. Since the intrafusals are arranged “in parallel” with the working fibers, contraction leading to movement slackens tension on the spindles and decreases their frequency of firing. When, on the other hand, the intrafusals alone are stimulated by their gamma neurons, the contraction is not strong enough to cause muscular movement and sends back afferent impulses to spinal and supra-spinal centers identical with those, as though the entire muscle had been passively stretched. Alpha moto-neurons are then stimulated so as to “restore” the muscle to its original position (even though no stretching actually took place).⁵¹

With these relations in mind, let's look at a hypothetical example of a simple reflex of withdrawal to a “localized stress” stimulus: irritation. The initial response, muscle activation and withdrawal of the appropriate body part (e.g., the flex withdrawal of an arm upon touching a hot object), will, if successful, eliminate the provoking stimulus. The appropriate muscle is then released (“discharged”),⁵² of course, with the withdrawal and allowing the muscles to return to their previous state. This decreases impulses from the afferent spindles, removing a potential source of re-activation to sympathetic centers, and allows a parasympathetic rebound discharge to re-establish the autonomic balance. The fact of somatic (muscular) discharge is crucial, because most somatic afferents at high frequencies augment central sympathetic activity as shown by Gellhorn's experiments.⁵³ An absence of appropriated phased somatic discharge, as the

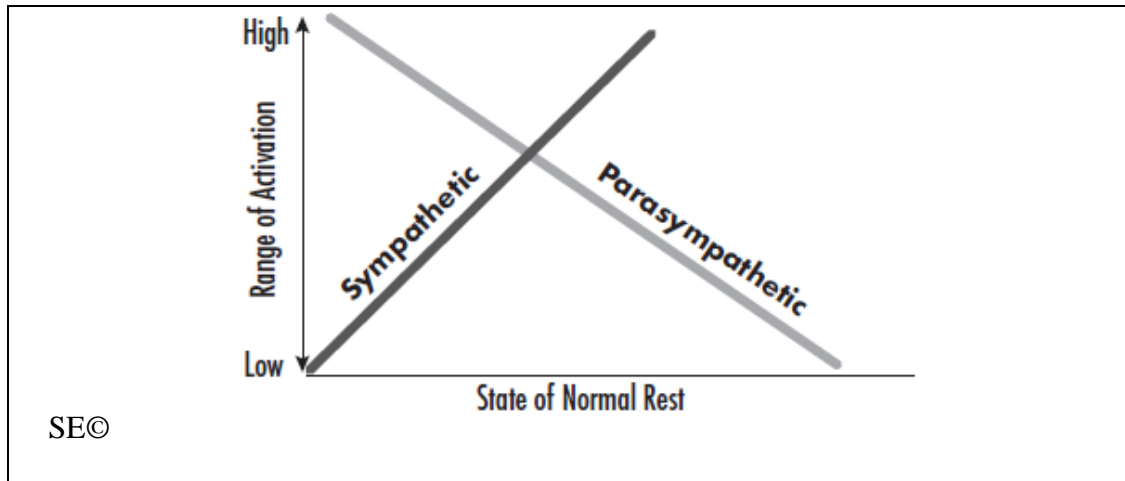
⁵¹ This type of mechanism is the basis of the many antigravity reflexes whereby a change in weight is countered by increased muscle tension in maintaining constant position. (The knee jerk elicited by the physician with his hammer). The same reflex prevents the knee from collapse under changing loads (LEVINE, 1976).

⁵² The basic charge and discharge rhythm of the activation and de-activation cycle of the NS (LEVINE, 1976).

⁵³ Gellhorn's experimental data on the hypothalamus, has shown that while brief periods of sympathetic activation evoke a compensatory parasympathetic rebound, stimulation which lasts for over ten to fifteen seconds is followed by reinforcement of the sympathetic response which may persist for extended time intervals (LEVINE, 1976).

response to autonomic activation, is an important mechanism in the accumulation of stress (LEVINE, 1976), as shown in diagram below:

Figure 2– Autonomic Nervous System Balance in Reciprocal relationship.



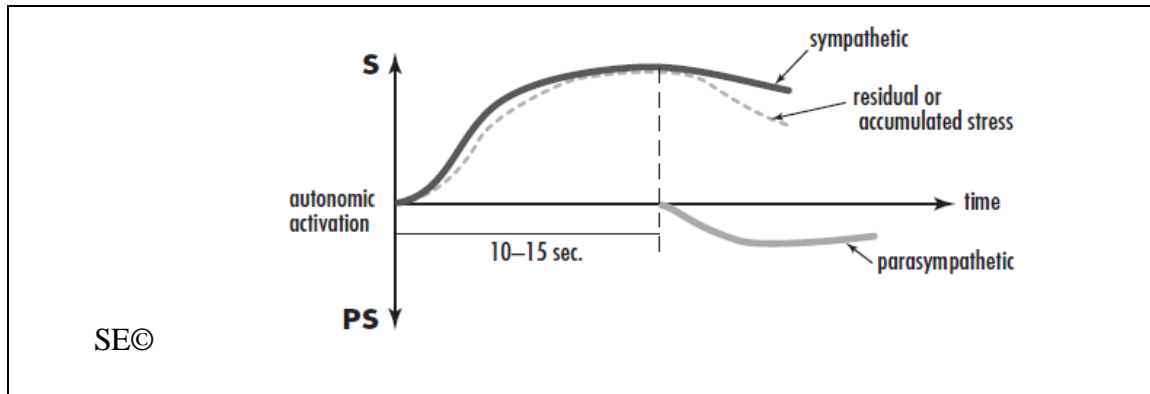
Source: SE MANUAL, Copyright®, 2007

Situations, whereby an organism is physically restrained, probably do not happen all that often in nature. Even if the articular segments are not physically immobilized, however, the action of the gamma system in diffuse activation is such that, in contradiction to the law of mutual reciprocity, flexor-extensor agonist-antagonist tonus both augmented simultaneously. This push and pull will cause a partial immobilization of the joint, thus limiting the capacity to move: the longer the “irritation”⁵⁴ or noxious stress situation persists, the greater the sympathetic tone that will be developed, the “somatic power” that will be contained, and the motor discharge that will be required to “reset” the autonomic imbalance created. It is not necessary for local reflex irritation to organismic immobility to occur exactly, affirms Levine (1976). If the “noxious agent” is compelling enough it would be eliminated by one of a number of mechanisms long before immobilization; if the “noxious agent” is more subtle, however, it is not unlikely

⁵⁴ This “irritation” is accumulated stress, or residual stress that is trying to find an exit or a intrinsic movement (LEVINE, 1976).

that one or more body segments within the background of a more global activation (of the sympathetic system) may remain un-discharged (LEVINE, 1976).

Figure 3– Accumulated Stress



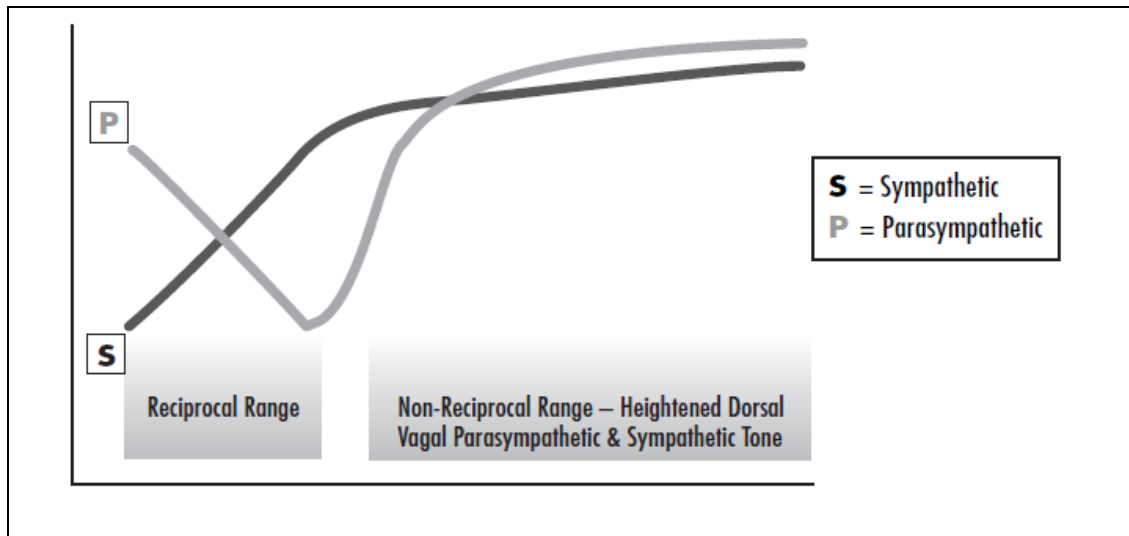
Source: SE MANUAL, Copyright®, 2007

There are a number of situations in which the tendency to go through the “discharge” seems to be thwarted – the animal simply does not seem to have the capacity to access this instinctual behavior (SCAER: 2012:98). Laboratory animals, especially those subjected to experimental surgical procedures, seem to have the same inhibition of this natural behavior. Pavlov commented that when he took his dogs out of their cages and carried them upside down by their legs to the operating table, they remained “frozen” in the last posture they had assumed before they were laid down, with their legs fully extended just as they had been carried. He called this “animal hypnosis,” but they were in fact in a freeze (SCAER, 2012:98-99). They intuitively understood that the freeze discharge is life affirming and somehow necessary for survival in the tooth-and-claw culture of the wild (SCAER, 2012:99). But discharges, as Scaer has described, apparently were not noted in Pavlov’s dogs (SCAER, 2012:98-99). This type of involuntary motor behavior in human who live in complex urban or suburban societies, is very rare to observe. But when this type of shaking does occur after an accident, passersby and even emergency technicians will try to get the person to “calm down.”

Obstetrical nurses have related to Scaer frequent episodes of shaking by the mother after she has given birth. However, as a culture, we seem to be embarrassed by unseemly, exaggerated behavior. The freeze discharge is one type of this behavior, often perceived as violent, vehement, or “hysterical” expressions of emotions like grief or terror. Many non-Western cultures routinely support vehement expressions of grief, including ritual wailing, tearing of clothes, and falling prostrate to the ground. Scaer suggests that these acts of physical expression are culturally sanctioned rituals that provide a means of “discharging” the physiological element of grief and do indeed constitute the freeze response (SCAER, 2012:99).

If the stimulation of the sympathetic nervous system (SNS) lasts longer than fifteen seconds, the parasympathetic activity is initially lower; if longer still, there is a reversal effect. With increasing arousal of the SNS, a point is reached where the reciprocal relationship between the parasympathetic & sympathetic is lost; at this point, the parasympathetic system rises as well. When a system is functioning within this range, we see unstable behaviors and unstable physiologic states: the system is in chaos and responds abnormally. The system is dysregulated and functioning within a narrow range; therefore, it is less resilient (LEVINE, 1976: SE Manual: A1.18, Copyright[©], 2007). Once the client’s physiology is functioning in this non-reciprocal range, the therapist can no longer trust in the parasympathetic system or resource (LEVINE, 1976: SE Manual: A1.18, Copyright[©], 2007).

Figure 4– ANS – non Reciprocal Relationship



Source: SE MANUAL, Copyright©, 2007

Once the client's physiology has returned to a more normal reciprocal range, they have full access to the stability provided by resilient parasympathetic function⁵⁵ (LEVINE, 1976:SE MANUAL, A1.18, Copyright©, 2007). Until here relied Levine's studies from 1976, and after that, Stephen Porges developed the Polyvagal Theory in which he states that there are two filogenetic branches in the parasympathetic branch, one older called Dorsal Vagus system, unmyelinated and an earlier called Ventral Vagus system, myelinated. The ventral vagus system (ventral part of vagus nerve located at brainstem) in primates has evolved to modulate instincts with social adjustments in order to enable social engagements; using the new evolutionary nervous system (Social Engagement System from Porges's Polyvagal theory), for calming down ones who are under freeze or hyperactivation of nervous system responses or to sustain the optimal homeostasis

⁵⁵ This finding by Levine pushed him to developed his method called SE and it is a is result from several years of multidisciplinary studies of wild animals, brain physiology under stress, ANS functioning, biology, biophysics. Levine feels indebted to the great scientific tradition and lineage of the ethologists he has met, and most thanked to Nikolaas Tinbergen, Konrad Lorenz, Heinz von Holst, Paul Leyhausen, Desmond Morris, Eric Slazen and Irenaus Eibl-Eibesfeldt, Ernest Gellhorn, Akhter Ahsen, Wilhem Reich, Philip Curcuruto, Richard Olney, Richard Price, Dr. Ida Rolf, Dr. Virginia Johnson, Stephen Porges, Bessel van der Kolk; (see Peter's Acknowledgments, 2010:vii).

state. The knowledge from Porges's - The Polyvagal theory became to be the base of Levine's method to evaluate behavior of the ANS.

If the freeze discharge doesn't occur, all of those memories (see chapter III) are stored as if the threat still exists, because the sensorimotor body messages of the act of flight-fight are never extinguished; and thereafter, any cues linked in any way to the experience of the unresolved threat will trigger the arousal/fight/flight response that was never completed, at least not in procedural memory⁵⁶ (SCAER, 2012:100). The autonomic nervous system operates under an optimal, measured and well-regulated cycling called *homeostasis*; any process that is evolving or changing by unpredictable influences is going to present a challenge to homeostasis. In mammals, homeostasis involves cycling between sympathetic and parasympathetic dominance, within controlled limits. The peak intensity of each autonomic state is relatively mild, and well within the limits of comfort and the safety of the organ systems of the body (SCAER, 2012:103-104).

Restoring homeostasis might well be equated with providing an environment for healing. Homeostasis is associated with the optimal control of the autonomic nervous system by the ventral vagal nucleus, and can be measured by optimal heart rate variability⁵⁷ The mammalian autonomic nervous system increases the intensity and degree of oscillation of the system to the extremes of its physiological tolerance by the repetitive or excessive stimulation of either the sympathetic or parasympathetic waves (SCAER, 2012:104).

⁵⁶ Or implicit memory as you can see at chapter III.

⁵⁷The variation in heart rate with inhalation and exhalation.

II.C.11.1.1 - Trauma and Procedural memory:

Trauma is a consequence of the procedural memory for the failed physical attempt at surviving, which continues to replicate the movement pattern to no avail; the victim froze in the face of helplessness and never went through the act of “completion” of that failed attempt and thus extinction of the traumatic memory. As a result, the unconscious memory retains the threat as being always present, ready to be triggered by any cues to the event; one obvious solution to that dilemma is to allow the aborted movement pattern to emerge and then continue the act to its victorious completion (SCAER, 2012:145). The freeze “discharge” is a completion of the act of self-defense, and it extinguishes procedural memory of the trauma; this is the approach that Peter Levine proposes to access self-regulation. And when a “discharge” occurs in a client during Somatic Experiencing psychotherapy, it looks not only like the act of self-defense but also very much like the patterns of movement in hysteria. Both of these states also reflect the repetitive movement patterns that Levine calls “tics,” which also represent incomplete replications of failed muscular acts of self-defense. Finally, the body parts that take part in tics, tremendously disorganized tremors and emotional disorganizing likely in hysteria discharge, are dissociated and it can result in a severe dysregulation, that is based in several kinds of symptoms and syndromes. To reverse this kind of complex trauma, this paper proposes to engage Touch & Movement from Godard’s Movement education in the SE approach to help clients to access the Tonic Function’s system to facilitate embodiment in order for emotional neural regulation (see chapter VI).

Trauma is corruption of the perception of time – experiencing the past as being in the present – this can guarantee that the traumatic experience is destined to recur again and again, because this false procedural memory is stored in our survival bank of memories for future use. This state of persistent storage of such traumatic procedural memories as

still being present, or imminent, is the substrate for what denominates trauma or PTSD (SCAER, 2012:100). Under threat, the brain is especially finely attuned to these “somatic markers,” and will store them all in procedural memory; after all, the brain might need these markers in the future to warn against threat. In the absence of the freeze discharge, they will be stored in the survival memory banks as being ready to recur with the faintest cue reminiscent of the experience. This means that even though the event is over and one survived it, the entire external and internal world remains a reservoir of somatic cues for what is perceived as an imminent traumatic event. The primary symptoms of PTSD reflect the autonomic and procedural memory-based malfunction of the limbic, emotional brain in trauma. The cues are related to sympathetic arousal via the amygdala, and parasympathetic avoidance and or freeze via the dorsal vagal nucleus; they are alternating in an exaggerated fashion that reflects the abnormal autonomic cycling. Trauma, indeed, is characterized by the disruption of homeostasis; it is a disease of the brain and of the body’s essential systems (SCAER, 2012:105). Trauma is a corruption of the perception of time, affirms Scaer (SCAER, 2012:101).

II.C.12 - Nature and Intensity of Trauma (Trauma symptoms):

Levine, (2010:268) says: “Trauma is not a disease; it is “dis-ease.” When the body is feeling uneasy, it sends messages; the purpose of these messages is to inform that something inside doesn’t feel right, and it needs attention. If these messages go unanswered, over time, they evolve into the symptoms of trauma; the first symptoms that are likely to develop after an overwhelming event are (LEVINE, 2010):

a) Hyperarousal : It may show up as physical symptoms, where increase in heart rate, sweating, difficulty breathing (rapid, shallow, panting, etc), cold sweats, and tingling

muscular tension occurs; it also may show up as a mental process, where increase in thoughts, mind racing, and worrying occurs.

b) Constriction: Constriction alters a person's breathing, muscle tone, and posture for efficiency and strength; blood vessels in the skin, extremities, and internal organs constrict so that more blood is available to the muscles that are tensed and prepared to take defensive action.

c) Dissociation (including denial): Denial is probably a lower-level energy form of dissociation. The disconnection may occur between the person and the memory of her/his feelings about a particular event (or series of events). He or she can deny that an event occurred, or can act as though it was unimportant; for instance, when one loses someone they love, or when one is injured or violated, he or she may act as though nothing has happened, because the emotions that come with truly acknowledging the situation are too painful.

d) Feelings of helplessness, immobility, or freezing: If hyperarousal is the nervous system's accelerator, a sense of overwhelming helplessness is its brake. The helplessness that is experienced at such times is not the ordinary sense of helplessness that can affect anyone from time to time; it is the sense of being completely immobilized and helpless. It is not a perception, belief, or a trick of the imagination; it is real: the body cannot move.

Other early symptoms that begin to show up at the same time or shortly after those are (LEVINE, 2010):

- Hypervigilance (being "on guard" at all times)
- Intrusive imagery or flashbacks
- Extreme sensitivity to light and sound

- Hyperactivity
- Exaggerated emotional and startle responses
- Nightmares and night terrors
- Abrupt mood swings; i.e. rage reactions or temper tantrums, frequent anger or crying
- Shame and lack of self-worth
- Reduced ability to deal with stress (easily and frequently stressed out)
- Difficulty sleeping

Several of the symptoms above can also show up later.

The next symptoms that may appear are (LEVINE, 2010):

- Panic attacks, anxiety and phobias
- Mental “blankness” or “spaciness”
- Avoidance behavior, avoiding places, activities, movements, memories or people
- Attraction to dangerous situations
- Addictive behaviors-eating, drinking, smoking, etc.
- Exaggerated or diminished sexual activity
- Amnesia and forgetfulness

Inability to love, nurture, or bond with other individuals, fear of dying, or having a shortened life.

The final symptoms' groups are the ones that generally take longer to develop; in most cases, they may have been preceded by some of the earlier symptoms. However, there is no fixed rule that dictates when and if a symptom will appear. This group includes (LEVINE, 2010):

- Excessive shyness
- Diminished emotional responses
- Inability to make commitments
- Chronic fatigue or very low physical energy

Immune system problems and certain endocrine problems such as thyroid dysfunction, environmental sensitivities, psychosomatic illnesses, particularly headaches, migraines, neck and back problems, chronic pain, fibromyalgia, asthma, skin disorders, digestive problems, spastic colon and severe premenstrual syndrome

- Depression, feelings of impending doom
- Feelings of detachment, alienation and isolation — "living dead"
- Reduced ability to formulate plans

The symptoms of trauma can be stable (ever-present), unstable (will come and go, i.e. under stress), or they can remain hidden for decades; usually, they do not occur individually, but in groups. They often grow increasingly complex over time, becoming less and less connected with the original trauma experience.

It is important to understand that any or all of these symptoms can appear no matter what kind of event caused the trauma; and, these symptoms can and will disappear when the trauma is healed. In order to heal trauma, a person needs to learn to trust the messages that the body is sending; the symptoms of trauma are internal “wake-up calls.”

“If we learn how to listen to these calls, how to increase the awareness of our bodies, and, finally, how to use these messages, we can begin to heal our traumas” (LEVINE, 2010:268).

II.C.12.1 PTSD - Post-Traumatic Stress Disorders:

The Diagnostic and Statistical Manual of Mental Disorder (DSM-IV), defines trauma as: “The symptoms of a person who experienced, witnessed, or was confronted with an event or events that involved actual or threatened death or serious injury, or a threat to the physical integrity of self or others.” Trauma requires that “the person’s responses involved intense fear, helplessness, or horror” (427-428; SCAER, 2003:1-2). The DSM is now in its fifth edition, but the definition of trauma remains the same. Studies of war veteran soldiers published in 1994 revealed that PTSD symptoms⁵⁸ were roughly representative if three definable emotional states occur:

- The first was abnormal manifestation of *arousal*, including exaggerated startle response, hypervigilance, sleep disorders, and irritability – all clearly due to an exaggerated sympathetic state.
- The soldiers also had abnormalities of their systems of *memory*, including flashbacks of distressing events, nightmares, and exaggerated arousal with exposure to any cues of their traumatic events.
- And finally, they had symptoms of *avoidance*, including amnesia for traumatic events, avoidance of activities reminiscent of these events, detachment and estrangement from others, and numbing emotions.

Diagnostic Criteria for Posttraumatic Stress Disorder⁵⁹ -PTSD:

⁵⁸Levine prefers to call post-traumatic stress “response” instead of a disorder, as he understands it to be a natural biological reaction to overwhelming life events.

⁵⁹Material compiled from Dr. Stephen A. Daniel, 2013 (IUGS).

A. The person has been exposed to a traumatic event in which both of the following were present:

-1. Person experienced, witnessed, or was confronted with an event or events that involved actual or threatened death or serious injury, or a threat to the physical integrity of self or others.

-2. Person's response involved intense fear, helplessness, or horror.

B. The traumatic event is persistently re-experienced in one (or more) of the following ways:

-1. Recurrent and intrusive distressing re-collections of the event, including images, thoughts, or perception.

-2. Recurrent distress of the dreams of events.

-3. Acting or feeling as if the traumatic event were recurring (includes a sense of reliving the experience, illusions, hallucinations, and dissociative flashback episodes, including those that occur on awakening or when intoxicated). Note: In young children, trauma specific reenactment may occur.

-4. Intense psychological distress at exposure to internal or external cues that symbolize or resemble an aspect of the traumatic event.

-5. Physiological reactivity on exposure to internal or external cues that symbolize or resemble an aspect of the traumatic event.

C. Persistent avoidance of stimuli associated with the trauma and numbing of general responsiveness (not present before the trauma), indicated by 3 (or more) of the following:

- 1. Efforts to avoid thoughts, feelings, or conversations associated with the trauma.
- 2. Efforts to avoid activities, places, or people that arouse recollections of the trauma.
- 3. Inability to recall an important aspect of the trauma.
- 4. Markedly diminished interest or participation in significant activities.
- 5. Restricted range of affect (e.g., unable to have loving feelings).
- 6. Sense of a foreshortened future (e.g., does not expect to have a career, marriage, children, or a normal life span).

D. Persistent symptoms of increased arousal (not present before the trauma), as indicated by two (or more) of the following:

- 1. Difficulty falling or staying asleep.
- 2. Irritability or outbursts of anger.
- 3. Difficulty concentrating.
- 4. Hypervigilance.
- 5. Exaggerated startle response.

E. Duration of disturbance (symptoms in Crit. B, C, and D) is more than 1 month.

F. The disturbance causes clinically significant distress or impairment in social, occupational, or other important areas of functioning.

Conceptualizing PTSD:

Symptoms can be grouped into three primary symptom clusters and have been often referred to as the "triad."

- 1) Re-experience
- 2) Avoidance
- 3) Arousal

Lang (2000) suggested a mnemonic device of DREAMS to aid clinicians in determining a diagnosis of PTSD:

- Detachment
- Re-experiencing the event
- Event had emotional effects
- Avoidance
- Month in duration
- Sympathetic hyperactivity or hyper vigilance

Associated Features:

PTSD has a number of other possible symptoms or associated features such as guilt and/or interpersonal problems.

- Interpersonal problems are common among those exposed to a trauma with an interpersonal element (i.e. abuse), and the associated symptoms are often referred to as the *Interpersonal Constellation* and symptoms may include:
 - Impaired affect modulation
 - Self-destructive and impulsive behavior

- Dissociative symptoms
- Somatic complaints
- Feelings of: ineffectiveness, shame, despair, hopelessness, "permanently damaged," constant "threat"
- Loss of beliefs
- Hostility
- Social withdrawal
- Social impairment
- Personality Change

Prevalence:

- Approximately 60% of men and 51% of women report experiencing at least one traumatic event in their lifetime.
- 10% + of men and 6% + of women reported FOUR or more types of traumatic events during their lifetime.
- Estimated lifetime prevalence of PTSD in the total population = 7.8%
- Estimated lifetime prevalence: Women=10.4%
- Estimated lifetime prevalence: Men= 5 %

Conclusion:

PTSD was found to have a unique impact on several measures of short-and long-term disability, overall well-being, and suicide attempts.

Previous studies in veterans and general population samples have not conducted such stringent analyses by adjusting for the effect of common mental disorders and medical morbidity.

These findings underscore the importance of careful screening for PTSD symptoms among patients presenting with other mental disorders and physical disorders.

Individuals presenting with PTSD symptoms should also be carefully screened for comorbid disorders and suicidal behavior.

II.D MEMORY OF TRAUMA AND STRESS:

According to Bessel Van der Kolk, the brain is continuously forming world maps: maps of what is safe and what is dangerous, so that the individual's brain becomes activated. It carries an internal map of who is in relation to the world and this is part of your system memory. This type of memory is a system of implicit memory. For example, if one was abused as a child, their brain turns it into *"I'm a terrible person for whom bad things happen, and I better be on the alert to see who will hurt me now."* These constructs are stored in the brain circuitry and processes related to recognition of reality and decision for future experiences. When people experience bad events, the brain becomes overwhelmed and drops the traumatization. The thalamus, receiving the sensory information in the central brain, is where the picture is switched off and can't be stored in the form of the complete brain. *"People remember images, places, sounds, smells and tastes without context; stimulation of a moment of reality, tends to bind perceptions with some degree of similarity of the past, and the present triggers*

emotional states that are not consciously recognized as history but as part of the actual context of the time of actual experience." (VAN DER Kolk, 2005)

Joseph Le Doux agrees; there are two ways to access the memory of the trauma. For him, information reaches the sensory system through the visual cortex and auditory cortex; this sensory information is transmitted to the thalamus, which is the center of sensory information, and all arrive at the structure of the limbic system.

According to Le Doux, there are:

1) A more rational and conscious memory, which is declarative or explicit memory, called the high road, i.e. can send information to higher brain structures such as the hippocampus.

2) A memory procedure called low road is unconscious, innate and is a memory that is very vague, which is available with the need for survival. The low approach is a relay that can send information to the lower limbic brain structure, called the amygdala (lower in relation to the anatomy and also evolution). This information is transmitted through a rapid amygdala circuit that determines whether or not a hazard exists; the amygdala then activates the hypothalamus (which is responsible for the survival responses: fight, flight, freeze, feeding and reproduction); it inhibits muscle systems as part of a freeze mobilizing the energy survival through the HPA axis. Moreover, the thalamus can send sensory stimulation of the hippocampus (which is involved with memory rational, explicit), as a way to get more information before interpretation of the amygdala on any threat. This review takes longer than the automatic response of the low road, taken by the amygdala; the highroad tries to process the route and get some information in

memory that is useful to solve the problem (Johnson, 2004). The primary function of the brain is thus to solve the problems while keeping the organism's survival.

The amygdala is disproportionately reactive to small stimuli in a traumatized person, and even though the higher brain communicates this is not a threat, the primitive brain (low road) triggers the fear response; the amygdala is called "the organ of fear" and as the intuitive center of the brain, turns detected threats into hyper-enabling activities of fundamental battle with the neocortex, ie, the emotional center fighting for control of rational thinking.

To be able to act quickly enough in times of danger, the brain has developed a strategy to set aside thinking and making conscious decisions, allowing the amygdala to do all the work (Johnson, 2004).

In **stress**, in seconds, the person **perceives the threat** and the fight-or-flight response is triggered; but if the brain can access the response adequate defense, physiology is restored and the stress dissipates in minutes. This means there's an adaptive physiological response available in the system and homeostasis is restored. The physiological instruments are activated with phenomenal accuracy and speed in order to protect the body from any threat. If the person who experiences a state of acute stress or chronic and continuous stress, where the body and neural reactions endowed with innate power of survival are in a state of readiness to act but it is not used, a response continues to signal the persistent presence of danger and threat, even though they no longer exist.

Trauma occurs when a person **perceives a threat but does not access the defense response** because there isn't enough power, or, in some way, the fight or flight response is not accessible; unconscious memory, inadequate response in a similar situation in the

past, blocks the search for an adequate defense response to the current threat: that is to say there arises an adaptive physiological response and the person **has no way out** of this dilemma. The amygdala has the ability to cause waves of adrenaline during recall of traumatic events. If anyone was assaulted in an armed robbery or just being a helpless witness of this urban violence, at some point in the future, the memory of the event comes and all autonomic response will be played. This means that the person not only remembers being mugged, but also is emotionally stirred when this memory arises. This emotional turmoil triggers the feedback loop of the traumatic memory triggered by the amygdala; the neural mechanism of suspension of the dorsal vagus system activity, the most primitive survival response in accordance with the Theory of Polyvagal Porges – Tonic Immobility⁶⁰ or Paralysis, as the fight or flight response is not activated, the person is immobilized or paralyzed with fear.⁶¹ The person will remain frozen, in a state of analgesia, dissociated by the shock and can witness the event as if it were out of the body, as if it were happening to someone else. This fear response, however disabling it is, has the primary goal of maintaining life, to protect - even when you do not have time for careful evaluation. The amygdala can keep fear alive and vestigial memory of that fear can keep indefinitely.

⁶⁰ Levine (2010) considers Kahlbaum one of the earliest pioneers to scientifically study tonic immobility. Kahlbaum called T.I. *catatonia* when, in 1874, he wrote, “*In most cases catatonia is preceded by grief and anxiety, and in general by depressive moods and affects aimed against the patient by himself.*” (LEVINE, 2010:56). Levine says “*I believe, that both immobility and a significant exposure to fear or grief need to occur for (transient states of) tonic immobility to be converted to a paralysis/self-induced depressive feedback loop – that is, to a state of chronic catatonia, or (arguably) posttraumatic stress disorder*” (LEVINE, 2010 :56-57).

⁶¹ “*My clinical work has confirmed that immobility can be encountered with or without fear, I believe that it is only when the immobility becomes inextricably and simultaneously coupled with intense fear and other strong negative emotions that we get the entrenched trauma feedback loop in the form of persistent posttraumatic stress disorder*” (LEVINE, 2010:56).

II.E. HOW TRAUMA AFFECTS THE BODY:

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

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

II.E.1 - Severe dysregulation from developmental trauma:

“The milk of human kindness, such an essential nutrient in making life bearable, all too often fails to have a significant impact on the despair, rage, and terror of people with histories of trauma and abandonment” (BESSEL van der Kolk, 2011:xi).

If children are exposed to unmanageable stress, and if the caregiver does not take over the function of modulating the child's arousal, as occurs when children are exposed to family dysfunction or violence, the child will be unable to organize and

categorize experiences in a coherent fashion. Unlike adults, children do not have the option to report, move away or otherwise protect themselves: they depend on their caregivers for their very survival (BESSEL van der Kolk, 2005:404). This kind of exposure can breakdown the affect regulation and create a severe dysregulation; as having a history with a chronic lack of tuning in with caregivers, predisposes people to have difficulties in managing negative emotions later in life (DOZIER et al., 1999; BESSEL VAN DER KOLK, 2011:xii). Sadly, deficient affect regulation presented in early childhood causes children to have little control of adverse experiences. It is compounded by the resulting off-putting behaviors in the face of stress, such as temper tantrum and emotional withdraw, and their crying and clinging when they feel abandoned. They also have no such control over showing their excitement when they are delighted. They depend on their adult caregivers to take action after they signal their distress; then that caregiver needs to figure out what is going on and needs to change the conditions in order to restore the homeostasis of the child. Throughout the life cycle, the presence of familiar and trusted human beings continues to have a profound effect on the modulation of autonomic arousal (BESSEL A. van der Kolk, 2006:278). Emotional abuse, loss of caregivers, inconstancy and lack of chronic tuning, has shown as main reasons for a variety of psychiatry disturbances (DOZIE, STOVALL, & ALLBUS, 1999: ADAM, 1996; BESSEL van der kolk, 2011:xii).

Attachment research, starting with Jonh Bowlby, have long shown that the internal regulatory processes of an individual reflect, to a large degree, the attunement with external sources of regulation in life (BESSEL van der kolk, 2011:xii). John Bowlby says: *“Inner regulatory processes in one reflect a high level of tuning in with external sources of regulation very early in one’s life”* (BOWLBY, 1973, 1983; STOVALL-

McCLOUGH, ZORBAS & CHAVUVASTRA, 2008;HOFER, 2006; BESSEL van der Kolk, 2011:xii). Problems with affect regulation have pervasive effects on the development of mind and brain and lead to significant increases in the utilization of medical, correctional, social, and mental health services (DROSSMANN et al., 1990; TEPLIN, ABRAM, McCLELLAND, DULCAN, & MERICLE, 2002; WIDOM & MAXFIELD, 1996; BESSEL van der kolk, 2001:xii).

Many problems of children and adults with histories of chronic trauma and neglect can be understood as efforts to minimize objective threat and to regulate their emotional distress (PYNOOS et al., 1987; BESSEL van der kolk, 2011:xii), and hence they are liable to be labeled as “oppositional,” “rebellious,” ”unmotivated” and “antisocial” (CICCHETTI & WHITE, 1990: WIDOM & MAXFIELD, 1996: STREECK-FISCHER & BESSELF van der Kolk, 2000; BESSEL van der Kolk, 2011:xiii). When a child is overwhelmed by trauma or thwarted by neglect, this developmental sequence is aborted or, if already developed, breaks down, and negative emotions come to dominate his or her existence (LEVINE, 2010:137).

Patients with abuse and neglect histories were helped enormously by the developments in affective neuroscience, which clarified the underlying neurobiology of many problems seen in these patients; Pankseepps’s work particularly is very helpful. He elucidated that the brain structures and neural circuits are involved in the basic emotional systems: seeking, rage, fear, lust, care, panic and play. But understanding the limbic circuits of emotions still did not account for the precipitous shifts you see in patients and their lack of responsiveness to the voices and faces of people who care for them, input that helps most people calm down and regain mastery over their senses. Bessel still had questions remaining: “What happens to the emotional system of one

who has been triggered by subtle, external changes in visual, hearing, olfactory, or kinesthetic stimulation?" (BESSEL van der Kolk, 2011: xiii).

II.E.2 - Trauma affects cognition, feelings and learning:

Trauma victims often begin to isolate themselves socially and emotionally, and retreat into patterns of behavior that avoid any situations that might contain cues related to their trauma history: emotional numbing and clinical depression are prominent. Trauma victims may develop amnesia, not only for events of the trauma but also for portions of their own autobiographical past. Many experience a loss of sense of self and the inability to sense their future. Trauma victims also tend to experience cognitive problems especially involving short-term memory, concentration, and attention, influencing their learning process (SCAER, 2012:106). As a substitute for genuine feelings, trauma sufferers may seek experiences that keep them out of touch – such as sexual titillation or succumbing to compulsions, addictions and miscellaneous distractions that prevent one from facing a now dark and threatening inner life. In this situation, one cannot discover the *transitory* nature of despair, terror, rage and helplessness, and that the body is designed to cycle in and out of these extremes (LEVINE, 2010:137).

After being traumatized, a child's relationship with his or her body often becomes formless, chaotic and overwhelming; the child loses a sense of his internal structure and nuance. As the body freezes, the "shocked" mind and brain become stifled, disorganized and fragmented; they cannot take in the totality of their experience and learn from it. These children, who have become "stuck" at some point along a once meaningful and purposeful course of action, engage in habitually ineffective and

often compulsive patterns of behavior. These often play out in symptoms like those of attention deficit hyperactivity disorder or obsessive-compulsive disorder. The child's uncoordinated, fragmented efforts are not registered as normal, explicit, narrative memories but, rather, are encoded in the body as implicit, procedural memories, including discomfort, constriction, distress, awkwardness, rigidity, flaccidity and lack of energy. Such memories are encoded not primarily in the neocortex but, instead, in the limbic system and brain stem. For this reason, behaviors and memories, cannot be changed by simply changing one's thoughts. One must also work with sensation and feeling – with the totality of experience (LEVINE, 2012: 138). And in this paper, in Chapter VI, the author will suggest a procedure of Movement Education to engage touch and movement for restoring the *haptic system* and spatial organization that still is missing in sensorimotor developing.

II.E.2.1 Disruption in the body, mind and myofascial kinesthetic spheres, as well, effects embodiment & perception:

Individuals with traumatic experiences are disembodied and “disemboweled,” says Levine (2010:282); they are either overwhelmed by their bodily sensations or massively shut down against them. Levine keeps affirming that, “*They are unable to differentiate between various sensations, as well as unable to determine appropriate actions. Sensations are constricted and disorganized. When overwhelmed, they cannot discern nuances and generally overreact. When shut down, they are numb and become mired in inertia. With this habitual deadening, they chronically 'underreact' even when actually threatened and are thus likely to be harmed multiple times.*” They may harm themselves in order to feel something – even if that something is painful. It is because constriction

of sensation obliterates shades and textures in feelings. Levine says that it is “the unspoken hell of traumatization” (LEVINE, 2010:283). To the degree that someone is not embodied, his/her basic instincts – survival and sexuality – become distorted; distortion of self-survival leaves one fearful, angry and anxious. Disembodied sexuality and a lack of the capacity for self-regulation produce the starkly barren landscape of pornography, as well as such disorders as anorexia and bulimia (LEVINE, 2010:284). The compulsions of bingeing and purging (as in bulimia) are a futile attempt to control body sensations – in which a situation is either in a chaotic and overwhelming state or shutdown and numb. Bulimia is an ineffective attempt to rid the body of something that is not-body: something that was forced onto or into the person’s body (LEVINE, 2010:284). Levine continues explaining that there are plentiful other disembodied methods, other compulsions, like overwork, sex, drugs, drinking or compulsive eating; all are ways to suppress, numb or control the body or are misdirected attempts to feel it. However, Levine postulates, without embracing bodily experience, one is left with an empty shell, a narcissistic image of what she or he thinks they are. They are unable to really feel the fullness of him or herself, a fullness formed from a continuous flux of experience. The less the body is experienced as a living entity, the more it becomes an object. The less it is owned, the further it is divorced from anything having to do with one’s core sense of self (LEVINE, 2020:285).

Under ordinary circumstances, physical sensations are a signal for action: “*The body initiates, and the mind follows*” (LEVINE, 2010:135). If one has been traumatized, one’s sensations can become signals not for effective action but, rather, for fearful paralysis, helplessness or misdirected rage; when some of one’s bodily signals become harbingers of fear, helplessness, impotent rage and defeat, that he or she has typically avoided like the plague, comes at a dear cost mentally, emotionally and physically.

While attempting to shut down distressing sensations, one pays the price of losing the capacity to appreciate the subtle physical shifts that denote comfort, satisfaction or warning of clear and present danger; sadly, as a result, the capacity for feeling pleasure, garnering relevant meaning and accessing self-protective reflexes, also shuts down. Levine concludes that one cannot have it both ways; when feelings of dread are held at bay, so are the feelings of joy (LEVINE, 2010:136). When a disruption fails to be fully integrated, the components of that experience become fragmented into isolated sensations, images and emotions. This kind of splitting apart occurs when the enormity, intensity, and suddenness or duration of what happened cannot be defended against, coped with or digested; personal vulnerability, such as age, genetics and gender, also account for this psychic implosion. The result of this inability for the body/mind to integrate is trauma, or at the very minimum, disorientation, a loss of agency and/or a lack of direction.

Trapped between feeling too much (overwhelmed or flooded), or feeling too little (shut down and numb) and unable to trust their sensations, traumatized people can lose their way; they don't "feel like themselves" anymore: loss of sensation equals a loss of a sense of self (LEVINE, 2010:137).

Chapter III

A NEUROSCIENCE UPDATE ON TRAUMA RESOLUTION

III.A – EVOLUTIONARY PSYCHOLOGY’S PERSPECTIVE:

Evolutionary psychology is an approach to the psychological sciences in which principles and results drawn from evolutionary biology, cognitive science, anthropology, and neuroscience are integrated with the rest of psychology in order to map human nature. By human nature, evolutionary psychologists mean the evolved, reliably developing, species-typical computational and neural architecture of the human mind and brain. According to this view, the functional components that comprise this architecture were designed by natural selection to solve adaptive problems faced by our hunter-gatherer ancestors, and to regulate behavior so that these adaptive problems were successfully addressed. Evolutionary psychology is not a specific subfield of psychology, such as the study of vision, reasoning, or social behavior. It is a *way of thinking* about psychology that can be applied to any topic within it - including the emotions (COSMIDES & TOOBY, 1987, 1992, 2002nd ed.).

What distinguishes evolutionary psychologists from many cognitive psychologists is the proposal that the relevant internal mechanisms are adaptations—products of natural selection—that helped ancestors get around the world, survive and reproduce. To understand the central claims of evolutionary psychology requires an understanding of some key concepts in evolutionary biology, cognitive psychology, philosophy of science and philosophy of mind. Philosophers are interested in evolutionary psychology for a number of reasons. For philosophers of science —

mostly philosophers of biology—evolutionary psychology provides a critical target. There is a broad consensus among philosophers of science that evolutionary psychology is a deeply flawed enterprise. For philosophers of mind and cognitive science, evolutionary psychology has been a source of empirical hypotheses about cognitive architecture and specific components of that architecture. Philosophers of mind are also critical of evolutionary psychology, but their criticisms are not as all encompassing as those presented by philosophers of biology. Evolutionary psychology, is also evoked by philosophers who are interested in moral psychology, both as a source of empirical hypotheses and as a critical target (GLENN, 2005).

Evolutionary psychologists focus on psychological adaptations. Organisms and the population offer variety; natural selection guarantees only that what ensues satisfies the two basic constraints of survival and reproduction. This proscriptive orientation shifts the attention to the tremendous diversity of biological structures at all levels. Indeed, one of the main points of modern biological thought is the way in which such a tremendous amount of diversity is not just compatible with, but actually woven into, the basic constraint of maintaining a continuous lineage (VARELA, THOMPSON, ROSCH, 200: 193-205).

In fact, all the issues that are discussed as problems for the adaptationist⁶² account become sources of explanation for alternative viewpoints because they highlight the way in which the enormous diversity constantly generated at all levels in the genetic and evolutionary process both shape and is shaped by the coupling with an

⁶²adaptationist .This view of evolution depends on the conjoint applicability of three conditions:

1^a. The richness of the self-organizing capacities in biological networks

2^a. A mode of structural coupling permitting the satisficing of viable trajectories

3^a. The modularity of sub-networks in which independent processes, interacts with each other by tinkering.

environment. We have already seen repeatedly that such emergent properties provide one of the main lessons from research in neuroscience and the study of self-organizing systems and non-linear networks. Indeed, neurobiologists, developmental biologists, immunologists, and linguists all find themselves in the position of trying to understand how so much profligacy is pruned to provide the substrata for various viable pathways rather than selected along trajectories to match a given external standard (VARELA, THOMPSON, ROSCH, 200: 193-205). Here the evolutionary problem is no longer how to force a precise trajectory by the requirements of optimal fitness; it is, rather, how to prune the multiplicity of viable trajectories that exist at any given point. Varela, Thompson & Rosch continue to say that one of the more interesting consequences of this shift, from optimal selection to viability, is that the precision and specificity of morphological or physiological traits, or of cognitive capacities, are entirely compatible with their apparent irrelevance to survival. To state this point in more positive terms, much of what an organism looks like and is “about” is completely *under-determined* by the constraints of survival and reproduction. Thus adaptation (in its classical sense), problem solving, simplicity in design, assimilation, external “steering,” and many other explanatory notions based on considerations of parsimony, not only fade into the background but must, in fact, be completely re-assimilated into new kinds of explanatory concepts and conceptual metaphors (VARELA, THOMPSON, ROSCH, 200: 193-205).

The view that we call evolution by natural drift can be articulated in four basic points:

- 1) The unit of evolution (at any level) is a network capable of a rich repertoire of self-organizing configurations.

- 2) Under structural coupling with a medium, this configuration generates selection, an ongoing process of satisficing that triggers (but does not specify) change in the form of viable trajectories.
- 3) The specific (non-unique) trajectory or mode of change of the unit of selection is the interwoven (non-optimal) result of multiple levels of sub-networks of selected self-organized repertoires.
- 4) The opposition between inner and outer causal factors is replaced by a co-implicative relationship. Since organism and medium mutually specify each other, under three non-logical three interdependent conditions⁶³ (VARELA, THOMPSON, ROSCH, 200: 193-205).

According to traditional wisdom, the environment in which organisms evolve and that they come to know is given, fixed, and unique. Here, the idea that organisms are basically parachuted into a pre-given in the environment, an allowance that was already empirically familiar to Darwin. Such a moving environment provides the selective pressures that form the backbone of neo-Darwinian evolutionary theory. Richard Lewontin, says: *“The organism and the environment are not actually separately determined. The environment is not an autonomous process but a reflection of the biology of the species. Just as there is no organism without an environment, so there is no environment without an organism”* (VARELA, THOMPSON, ROSCH, 200: 193-205).

Environmental regularities are not described as external features that have been internalized, as representationism and adaptationism both assume. Environmental regularities are the result of a co-joint history, a congruence that unfolds from a long history of co-determination. In Lewontin’s words, the organism is both the subject and

⁶³.adaptationist .This view of evolution depends on the conjoint applicability of three conditions already exposed before.

the object of evolution. This point cannot be emphasized too strongly, for the temptation in the movement toward a non-adaptationist evolutionary view is to retain the organism and environment as separate poles and then to attempt to determine the “proportion” that is played by each –a bit of intrinsic factors plus a bit of external constraints. Susan Oyama has said that: “...unless we learn to see organisms and environments as mutually unfolded and enfolded structures.” In Oyama’s words,

“Form emerges in successive interaction. Far from being imposed on matter by some agent, it is a function of the reactivity of matter at many hierarchical levels, and of the responsiveness of those interactions to each other. Because mutual selectivity, reactivity, and constraint take place only in actual processes, it is these that orchestrate the activity of different portions of DNA, that make genetic and environmental influences interdependent as genes and gene products are environments to each other, as extra organismal environment is made an internal state is externalized through products and behavior that select and organize the surrounding world” (VARELA, THOMPSON, ROSCH, 200: 193-205).

In every reproduction an organism passes on genes as well as an environment in which these genes are embedded. As it is with sunlight or oxygen, our frame of reference is relative. The world is not a landing pad into which organisms parachute: nature and nurture stand in relation to each other as product and process (VARELA, THOMPSON, ROSCH, 2004: 193-205). What is required for evolutionary change is not genetically encoded as opposed to acquired traits, but functioning developmental systems: ecologically embedded genomes (VARELA, THOMPSON, ROSCH, 2004: 193-205).

By and large, biologists like Lewontin and Oyama have not thought through this point with the rigor and consistency it demands. Rather than sweeping this sense of groundlessness under the rug, but by, once again, pitching the internal and the external against each other (which we already know will not work). For them, it needs to develop deeper into this sense of groundlessness and follow through all of its implications, philosophically and experientially. Neural cognitive theory mechanism

approaches are recently co-incorporated in selective Darwinian terms. These so-called selectionist theories follow through the implications of these points to embrace the fully co-implicative nature of organism and environment. For example, Gerald Edelman, a leading exponent of such selectionist theories, expressed to a reporter in a recent interview, “*You and the world are embedded together.*”⁶⁴ Nevertheless, it is not always clear to what extent selectionists are willing to let go of the objectivist convictions that often linger in their writings (VARELA, THOMPSON, ROSCH, 200: 193-205). Varela, Thompson and Rosch have argued that perception consists in perceptually guided action and that cognitive structures emerge from the recurrent sensorimotor patterns that enable action to be perceptually guided. They are saying that cognition is not representation but embodied action and what the world recognizes is not pre-given but enacted through the history of structural coupling. They continued saying that we then raised an objection in the form of the view that perceptual and cognitive processes involve various optimal adaptations to the world. It was this objection that prompted the excursion into evolutionary biology.

III-B – HOW THE BODY IN ACTION SHAPES THE SELF:

Several fMRI studies have demonstrated that the visual presentation of a graspable object automatically recruits the cortical motor system, even in the absence of any motor output (GRAFTON et al., 1997; CHAO and MARTIN, 2000; GREZEN et al., 2003). More recently, a transcranial magnetic stimulation (TMS) experiment investigated the excitability of the primary motor cortex while observing

⁶⁴Edelman’s statement in which the “*Haptic System*” term coined by J. Gibson, fits perfect with Hubert Godard’s Movement Education proposal. Godard says that in order to work as healing practitioner, in the first instance is need to restore the capacity of “*haptic communication*”, the ability to giving and receiving information of environment.

manipulable familiar objects, i.e. a mug with an intact or broken handle (Buccino et al., 2009). The results showed that motor evoked potentials (MEPs) were larger only when the handle was intact, thus indicating that the cortical motor system is critically involved, not only in the detailed programming and on-line control of elementary movements, but also in the processing of the pragmatic features of the surrounding objects: The motor system enables one to perceive them in terms of actual possibilities for action, that is, as effectively *graspable* or not.

All of this seems to be in line, at least at first glance, with the emphasis put on the crucial role of action in the ecological approach to perception by Gibson (1979) and the Gibsonians (Turvey, 1977; Neisser, 1988). For example, Neisser writes that, "*Distinction between perception and action can be made only at the level of theoretical analysis; in ordinary behaviour, they are inseparably fused. Except in special cases, one does not perceive and only then proceed to move. We perceive as we act; often the actions constitute the very characteristics of the ecological self that is simultaneously perceived*" (NEISSER, 1988:40). Now, it is true that according to most ecological theorists, action enables one to pick up invariant information specifying both the environment and the self (GALLESE & SINIGAGLIA, 2011: 126). The perception of an object, therefore is, at a basic level, nothing but a call to arms, so to speak, which regardless of whether one has actually picked the object up, primarily given it to one as a virtual target for action, that is, as something that can be grasped with this or that bodily part (hand, mouth), with this or that grip (whole hand prehension, precision grip), and so on (GALLESE, 2000). The notion that perception might be shaped by action, even when one is not executing any movement, and that such action-oriented perception is an original and primary way of being engaged with the surrounding world, has consequences for the phenomenological account to the way in which one experiences

themselves as bodily selves. Indeed, as in perceiving something as *graspable*, *throwable* or *kickable*. Such power is not to be conceived just as a general ability (MELE, 2002), but it refers to an action possibility; to a possibility that an individual is aware of being actually ready for his/her hands. In perceiving something as *graspable* or as *kickable*, the body becomes a *grasping* or *kicking* body, that is, in terms of a given action possibility. In other words, the experience of the surrounding things can only be accompanied by the experience of oneself as a bodily 'power' for action; as the variety of action possibilities belonging to their own motor repertoire, which contextually becomes ready for the hands (GALLESE & SINIGAGLIA, 2010). To paraphrase Gibson, they say: "*When a man sees the world, he sees his own action possibilities at the same time; or rather, the world and the possibilities are both specified and his awareness can shift*" (GALLESE & SINIGAGLIA, 2011:128).

These findings clearly indicate that peri-personal space is a bodily space characterized by an action-dependent dynamic plasticity (GALLESE & SINIGAGLIA, 2011). The construct of the space of the body, exclusively or primarily as a proprioceptive space, cannot account for this plasticity. They repeat: this is not to deny that proprioception might play a critical role in monitoring various bodily parts. However, the point is that the relationship between action and body space is much stronger and deeper than traditionally thought. It is not exclusively confined to the processing of proprioceptive information enabling the actual execution of a motor action, but it incorporates the motor goal-relatedness that characterizes a basic motor action, as such making it different from every other basic motor action (RIZZOLATTI & SINIGAGLIA, 2007). Merleau-Ponty probably pinpointed better than anyone else, the specific motor intentional nature of the space of the body, when he wrote that bodily awareness is "*...neither the mere copy nor even the global awareness of the existing parts of the*

body, but the active integration of these latter only in proportion of their value to the organism's projects." In other words, this means that my body appears to me as an attitude directed towards a certain existing or possible task. And, indeed, its spatiality is not like that of external objects or like that of: "...spatial sensations, a *spatiality of position*, but a *spatiality of situation*" (MERLEAU-PONTY, 1962:100; GALLESE & SINIGAGLIA, 2011:132).

Finally, one of the most intriguing aspects of the Gallese and Sinigaglia proposal is that bodily self-awareness, as a manifold of action possibilities, provides the common ground for and the distinguishing criterium between *self and other*, at least at a basic level. The discovery of the mirror mechanism for action indicates that the very same action possibilities that shape one's bodily self also makes individuals aware of other bodilyselves, in as much as their action possibilities can be mapped onto one's own individuality (GALLESE & SINIGAGLIA, 2011:137).

III.B.1 - Neurobiology & Evolution:

The evolution of the brain influences brain maturation and personality formation. The genetic make-up is important for the potential of the nervous system, and among the topics of the following chapter are the relationship between genotype and phenotype and the effect of gestation on the nervous system (HART, 2008:19). The magnificence of the nervous system lies in its plasticity in relation to the environment, and neural circuits can develop only when they receive optimum levels of arousal and stimulation. Both the nature and the timing of experiences are important for development. Children and parents reflect the world they have been born into, and the human brain has immense capacity for developing in a user-friendly manner. The brain grows, organizes,

and functions in relation to unique life experiences, and experience modifies all human behavior. But the complexity of the brain also makes it a vulnerable and fragile structure (VARELA & MATURANA, 1992; HART, 2008:16-17).

Emotional and cognitive communication is a characteristic of our species. The growth in the number and complexity of circuit connections is the result of ongoing stimulation in a varied environment, which is probably the biological basis for all subsequent behavioral, emotional, motor and cognitive development. From an evolutionary point of view, the extended childhood is beneficial to humans. The long period of dependency is adapted to meet others whose main especiality is the ability to learn (GLEITMAN, 1995; HART, 2008:18). Human nature is cultural, and culture is important in relation to the transfer of experience from one generation to the next.

Humans are born to communicate and share ideas, and we depend on social exchanges. The infant enters this world and has to engage in human contact, adjust, and learn systems of meaning through constant interactions with the caregivers. Without this exchange, development runs awry, and the humanization process is stunted (HART, 2008:18).

III.C–NEURONAL PLASTICITY:

Brain plasticity, also known as neuroplasticity or cortical remapping, is a term that refers to the brain's ability to change and adapt as a result of experience; modern research has demonstrated that the brain continues to create new neural pathways and alter existing ones in order to adapt to new experiences, learn new information and create new memories.

Psychologist, William James, suggested that the brain was perhaps not as unchanging as previously believed way back in 1890. In his book, *The Principles of Psychology*, he wrote, "Organic matter, especially nervous tissue, seems endowed with a very extraordinary degree of plasticity." In the 1920s, researcher, Karl Lashley, provided evidence of changes in the neural pathways of rhesus monkeys. By the 1960s, researchers began to explore cases in which older adults who had suffered massive strokes were able to regain functioning; modern researchers have also found evidence that the brain is able to rewire itself following damage.

The human brain is composed of approximately 80 billion neurons. Researchers in the past believed that neurogenesis, or the creation of new neurons, stopped shortly after birth; today, it is understood that the brain possesses the remarkable capacity to reorganize pathways, create new connections and, in some cases, even create new neurons (Lent, 2003).

There are four key facts about neuroplasticity:

- It can vary by age: while plasticity occurs throughout the lifetime, certain types of changes are more predominant during specific life ages.
- It involves a variety of processes: plasticity is ongoing throughout life and involves brain cells other than neurons, including glial and vascular cells.
- It can happen for two different reasons: as a result of learning, experience and memory formation, or as a result of damage to the brain.
- Environment plays an essential role in the process, but genetics can also have an influence.

The first few years of a child's life are a time of rapid brain growth: at birth, every neuron in the cerebral cortex has an estimated 2,500 synapses; by age three, this number has grown to a whopping 15,000 synapses per neuron.

The average adult, however, has about half that number of synapses; this occurs because as one gains new experiences, some connections are strengthened while others are eliminated: this process is known as synaptic pruning. Neurons that are used frequently develop stronger connections, and those that are rarely or never used eventually die; by developing new connections and pruning away weak ones, the brain is able to adapt to the changing environment (Kandel).

III.C.1 - Types of Brain Plasticity:

- **Functional Plasticity:** refers to the brain's ability to move functions from a damaged area of the brain to other undamaged areas.
- **Structural Plasticity:** refers to the brain's ability to actually change its physical structure as a result of learning.

Traumatic stressors, such as early trauma, can lead to post-traumatic stress disorder (PTSD); for many trauma victims, PTSD can be a lifelong problem. PTSD is characterized by specific symptoms, including: intrusive thoughts, hyperarousal, flashbacks, nightmares, sleep disturbances, changes in memory and concentration, and startle responses. Symptoms of PTSD are hypothesized to represent the behavioral manifestation of stress-induced changes in brain structure and function. Stress results in acute and chronic changes in neurochemical systems and specific brain regions, which result in long-term changes in brain “*circuits,*” involved in the stress response. Brain

regions that are thought to play an important role in PTSD include: hippocampus, amygdala, and *medial prefrontal cortex*. Cortisol and norepinephrine are two neurochemical systems that are critical in the stress response.

Preclinical and clinical studies have shown alterations in memory function following traumatic stress, as well as changes in a circuit of brain areas, including hippocampus, amygdala, and medial prefrontal cortex, that mediate alterations in memory; the hippocampus, a brain area involved in verbal declarative memory, is very sensitive to the effects of stress. Stress in animals is associated with damage to neurons in the CA3 region of the hippocampus (which may be mediated by *hypercortisolemia*, decreased brain-derived neurotrophic factor [BDNF], and/or elevated glutamate levels) and inhibition of *neurogenesis*. High levels of glucocorticoids seen with stress were also associated with deficits in new learning.

The hippocampus demonstrates an unusual capacity for neuronal plasticity and regeneration; it has recently been demonstrated that changes in the environment, eg, social enrichment or learning, can modulate neurogenesis in *the dentate gyrus* of the hippocampus, and slow the normal age-related decline in neurogenesis.

Traumatic stress has a broad range of effects on brain function and structure, as well as on neuropsychological components of memory; brain areas implicated in the stress response include: the amygdala, hippocampus, and prefrontal cortex. Neurochemical systems, including cortisol and norepinephrine, play a critical role in the stress response. They also play a critical role in memory, highlighting the important interplay between memory and the traumatic stress response. Preclinical studies show that stress affects these brain areas; studies in patients with PTSD show alterations in brain areas implicated in animal studies including (again) the amygdala, hippocampus, *and* prefrontal cortex, as well as in

neurochemical stress response systems, including cortisol and norepinephrine. Treatments that are efficacious for PTSD show a promotion of neurogenesis in animal studies, as well as promotion of memory and increased *hippocampal* volume in PTSD; future studies are needed to assess neural mechanisms in treatment response in PTSD (BREMNER, 2006).

III.D – THE BRAIN – A COMPLEX AND DYNAMIC STRUCTURE & ABILITY OF NEURONS TO CHANGE:

III.D.1 – The Nervous System:

The Central Nervous System: Nerves are bundles of fibers that carry signals to and from the CNS. Motor nerves carry commands from the CNS to muscles and glands; sensory nerves carry input from sense organs (receptors) to the CNS. Different kinds of sensory receptors respond to different kinds of stimuli, which may originate either inside or outside the body. In addition to the familiar “five senses” (vision, hearing, smell, taste and touch) there are also receptors for other stimuli such as pain, temperature, and position (BOOK, 2013).

The Central Nervous System is split by its Somatic or Peripheral/Visceral functions. The CNS is the body’s control center, consisting of the brain and spinal cord. The brain is responsible for consciousness; its functions include perception, emotion, memory, thought and language. The lower parts of the brain are also responsible for some unconscious functions, such as regulation of the endocrine (hormonal) and cardiovascular systems. The spinal cord is responsible for simple reflexes; it also serves as a pathway between the brain and the Parasympathetic Nervous System.

The Somatic Nervous System: The somatic nervous system (SN) is termed as the Nervous System of Life Value, i.e., one that relates the individual with the environment. The Somatic efferent portion of the SN leads to nerve impulses originating centers in peripheral receptors, stating that the center of what is happening is in the environment (outside). On the other hand, the afferent part of the SN leads to skeletal muscle command of nerve centers, resulting in movements that lead to higher integration or relationships with the external environment.

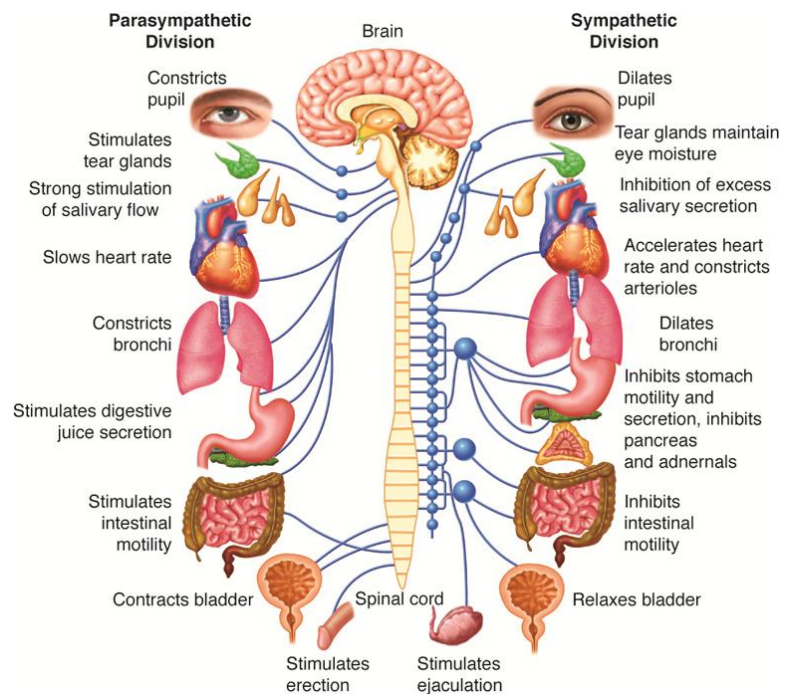
The visceral Nervous

System: The Visceral Nervous System, or the System of Vegetative Life, relates to the visceral structures and is very important for the integration of the activity of the viscera in order to maintain the constancy of the internal

environment,

homeostasis.⁶⁵ As well as the Somatic Nervous System, the Visceral Nervous System also owns a portion of the afferent and efferent elsewhere. The component leads afferent

Figure 5– Autonomic Nervous System



Source: Roberts, 2007

⁶⁵In the mid-nineteenth century, Claude Bernard first used the term homeostasis, which comes from Greek roots homoios, a, on which similar means, the same nature, and stasis, which means stable - remain stable to continue maintaining the same nature. (McEWEN, 2003:19). Canon's original formulation of homeostasis, means "same state", describing the stabilization of internal states According to internal cues present. In a strict sense, homeostasis is a concept that is appropriately applied to a limited number of systems, such as PH, body temperature, and oxygen tension (McEWEN 2003,;LUU & TUCKER, 2003:123).

impulses from the viscera to the CNS and efferent impulses component brings certain areas of the CNS to the visceral structures, therefore ending at the glands, viscera, smooth muscles and heart.

The set of efferent neurons in the SN is called visceral autonomic nervous system and is divided into sympathetic and parasympathetic.⁶⁶

ANS – Autonomic Nervous System: The autonomic nervous system responses lead to smooth muscle cells, the heart, the guts and glands. Unlike the fibers originating in somatic, visceral receptors, many fibers that conduct impulses do not become aware of. It is a result of, important for the realization of, various viscera or viscera-somatic reflexes related rate control blood oxygen and unconscious afferent impulses. The viscera-receptors located in the carotid sinus and carotid body are sensitive to changes in blood pressure and changes in the rate of oxygen in the blood, and we need not be aware of these functions. However, when we are thirsty, hungry or in pain, visceral impulses manifest. Leaving the brain, the nerve fibers of the ANS have their own distribution in the spinal cord. The preganglionic neurons in the spinal cord are located thoracolumbar between T-1 and G-2, while they are located in the SNP in the brainstem within the cranium and sacral cord (S2, S3, and S4).

The Sympathetic Nervous system (SNS): Any situation that involves an element of survival will activate the sympathetic nervous system. The sympathetic branch supports the general mobilization of energy. If one perceives a threat or hears a siren in the street, the sympathetic nervous system increases your metabolic rate and prepares for action.

Whether the situation concerns fear or readiness, the response is the same: the provision

⁶⁶As Porges, there is a different operation. He says that the parasympathetic branch is divided into a primary branch (dorsal part of the brain stem, not myelinated) and other evolutionarily most recent (ventral portion of the brain stem), myelinated, which has the function of processing information with greater speed.

of high arousal. Physiologically, the SNS is expressed through an increase in heart rate, raised blood pressure, faster breathing and increased muscle tone.

The Parasympathetic Nervous System (PNS): This branch activity dominates in calm and safe conditions. It builds energy, which prepares the organism for fight-or-flight responses. The parasympathetic system is in charge of preserving energy and for keeping the basic bodily functions in harmonious balance. It regulates sleep and relaxation and ensures that vital nutrients are transported throughout the body to promote cell growth. Because of its ability to promote a calming stabilization of the body's functions, it is called the calming system of the organism.

The centers of the PNS are situated both above and below the SNS, and there are parasympathetic nerve fibers in several cranial nerves and spinal cord segments. Both the sympathetic and the parasympathetic systems play important roles in anchoring the emotions in the body. The parasympathetic nervous system is involved in the ability to perceive ourselves through bodily sensations. Almost all organs receive fibers from both branches, except the adrenal medulla, the sweat glands, and the blood vessels in the skin and muscles, which only receive fibers from the sympathetic system (ANDRESEN & TUXEN, 1977-1980; HART, 2006:109).

Enteric Nervous System – (ENS). The Enteric Nervous System consists of cells that release certain neurotransmitters, among other functions. The ENS maintains close communication with the sympathetic and parasympathetic nervous systems. The connection between the Central Nervous System (CNS) and ENS lets outside signals influence digestion, just as the ENS is able to affect the CNS via neurons, reflexes and neurochemicals. The response of the digestive system to outside signals depends on a number of things, including the genetic make-up of the ENS; for example, different

people's digestive systems will respond differently to stress situations (GERSON, KIRCHGESSNER, & WADW, 1994; WOOD, 1994). It is no wonder that our digestion is affected by our emotions, and that many emotions are sensed in the gut. This new knowledge of the second vagal pathway, unfortunately, has not permeated the teaching of physiology, which is still dominated by descriptions of the paired antagonism between the sympathetic and parasympathetic components of the ANS (PORGES, 2011 – 264).

III.D.1.1 - The ANS involved in the physiology of stress:

The PNS and SNS represent neural systems that originate in the brainstem and contribute to the regulation of a variety of targeted organs, including the eyes, lacrimal glands, salivary glands, sweat glands, blood vessels, heart, larynx, trachea, bronchi, lungs, stomach, adrenal, kidney, pancreas, intestine, bladder and external genitalia. In general, the PNS promotes functions associated with the body's growth and restoration. In contrast, the SNS promotes increased metabolic output to deal with challenges from outside the body (PORGES, 2011:64).

In general, when a visceral organ is innervated by both the SNS and PNS, the effects are antagonistic. For example, SNS neurons dilate the pupils, accelerate the heart, inhibit intestinal movements, and contracts the vesical and rectal sphincters. The PNS, neurons constrict the pupils, slow the heart, potentiate peristaltic movement, and relaxes the vesical and rectal sphincters. The PNS deals with activities concerned with restoring and conserving bodily energy allowing vital organs to rest. Stimulation of the SNS prepares the individual for the intense muscular action required to protect and defend itself in response to external challenges. The SNS quickly mobilizes the existing reserves of the body (PORGES, 2011:64).

The SNS and PNS are reciprocally innervated, and their responses are coordinated to provide the appropriate internal state to meet shifts in both internal and external demands. The PNS is modulated primarily by internal changes in the viscera. The SNS is primarily activated by exteroceptive impulses via somatic afferent fibers in response to changes in the external environment (PORGES, 2011:64).

The PNS facilitates digestion and conserves energy by slowing the heart rate. In the absence of external challenges (e.g. ambient temperature shifts, noise, pain, pyrogenic agents, etc.), the PNS optimizes function of the internal viscera. In contrast, by increasing metabolic output to deal directly with external challenges, the SNS attempts to optimize the organism's relationship with the environment. Thus, increases or decreases in ambient temperature, noise, pain, and pyrogenic agents will produce attenuated PNS tone and increased SNS activity (GELHORN, 1967; LEVINE, 1976; PORGES, 2011:65).

The contemporary view of the ANS is that it is a complex system containing both peripheral efferent and afferent fibers, as well as central neural structures (PORGES, 2011:65). The ANS responds to both internal and external stimuli. Although the ANS is often viewed as a motor system controlling visceral organs, most autonomic neurons are afferent. ANS afferents are crucial to stressful situations. Afferent feedback from visceral organs often regulates PNS tone and has little impact on SNS tone. For example, distention of the stomach or stimulation of baroreceptors will result in reflexive increases in PNS tone. Afferent feedback from sensory organs produces a different response profile. Autonomic responses to external stimuli, including nociception or attention, produce a decrease in PNS tone. There is a complementary increase in SNS tone only if the stimulus is of high intensity and prolonged duration or is associated with conditions of nociception

or intense stimulation. For example, during exercise, there is a progressive decrease in PNS tone and a parallel increase in SNS tone.

The ANS is continuously servicing the visceral afferents in an attempt to maintain homeostasis and promote physiological stability. This regulatory process is primarily mediated by the PNS. There are disease states that compromise the regulatory function. Some disease states (e.g., hypertension) are characterized by a depression of PNS tone with a compensatory SNS excitation. Other disease states (e.g., diabetes) are characterized by a depression of the PNS tone without eliciting a reciprocal SNS excitation, while the state of yet other diseases may be characterized by dual inhibition (PORGES, 2011:65-66). Shifts in ANS activity that disrupt homeostatic processes seem to characterize the common theme associated with physiologically based definitions of stress and trauma (PORGES, 2011:66).

III.D.1.2 – ANS and Cardiac vagal tone activity and Stress:

Physiology and behavioral processes are dependent on neural feedback. Information is received at the periphery and transmitted to the central nervous system, and appropriate physiology reflexes or overt behaviors are emitted. Feedback loops, typical of many homeostatic processes, produce a rhythmic pattern characterized by phasic increases and decreases in neural efferent output to organs, such as the heart. In many physiologic systems, efficient neural control is manifested as rhythmic physiologic variability, and within normal parameters the greater the amplitude of oscillation, the healthier the individual (PORGES, 2011:68). Individuals with attenuated physiologic variability would then exhibit a lack of physiologic and behavioral flexibility in response to environmental demands (PORGES, 2011:68).

Cardiac vagal tone is reflected in the amplitude of a heart rate rhythm associated with frequency of spontaneous breathing. This rhythmic process has been observed and studied for more than 100 years (PORGES, 2011:69). Heart rate in a healthy human is not steady.

III.D.1.3. – The Heart Rate Variability (HRV):

HRV is based on the fact that our heart rate optimally and routinely fluctuates with each inhalation and exhalation. In a healthy state, when we breathe in, our heart rate increases, and when we breathe out it decreases. This process basically occurs in all mammals. The relationship of this rhythmic shift in heart rate with inhalation/exhalation is a specific measure of homeostasis and emotional and physical well-being. The higher the difference, and therefore the HRV, the more optimal our homeostasis is and the healthier we are likely to be. Low HRV is noted in trauma, PTSD, fibromyalgia, and many chronic disease states (SCAER, 2012:51-52).

The pattern of heart rate reflects the continuous feedback between the central nervous system and the peripheral autonomic receptors. Recent scientific research suggests that consciousness emerges from the brain and body acting together. A growing body of evidence suggests that the heart plays a particular significant role in this process. Far more than a simple pump, the heart, now is recognized by scientists, as a highly complex system with its own functional “brain” (McCARTY, BRADLEY, 2005). Research in the new discipline of neuro-cardiology, shows that the heart is a sensory organ and a sophisticated center for receiving and processing information. The nervous system within the heart enables it to learn, remember, and make functional decisions independent of the brain’s cerebral cortex. Moreover, numerous experiments have demonstrated that the signals the heart continuously sends to the brain influence the

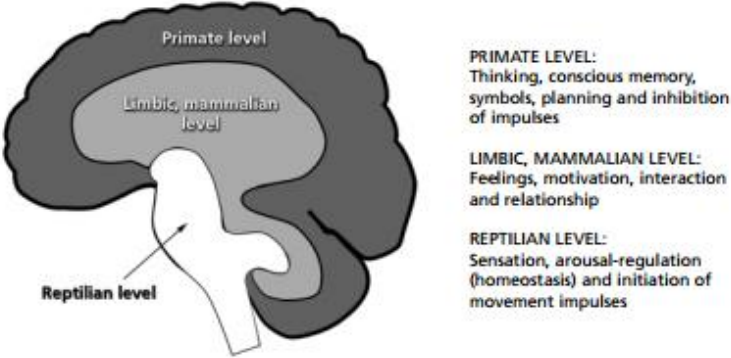
function of higher brain centers involved in perception, cognition, and emotional processing (BRADLEY, 2005).

Heart rate variability is a marker of the efficiency of neural feedback mechanisms and may index healthy status or the individual’s capacity to organize physiologic resources to respond appropriately. Organized variability is due to dynamic feedback and this is characterized by rhythmic deviations from a constant level (PORGES, 2011:69).

III.D.2 – Triune Brain’s model of Paul MacLean:

MacLean (1952 apud. LeDoux 1998) hypothesized three distinct domains in the constitution of the human nervous system, defining it as a triune

Figure 6 – The Paul Maclean Triune Brain Model



Source: Levine, 2010

brain that consists of strata responsible for instinctive actions (reptilian brain), the production of emotions (limbic brain) and the cognitive activities higher order (neocortex). It means there are three clearly distinct neural structures within what was thought as single brain. MacLean methodically demonstrated, by drafting the triune brain that not only has neuroanatomy evolved - from the most primitive to the most refined and sophisticated - but also (as Darwin would have predicted) so has behavior (Levine, 2012:229). MacLean's model, based on a tripartite classification watertight functional specializations, reveals itself currently outweighed by the non-linear neural network operations of the complex dynamic systems model, but the

psychoanalytic perspective and most of Western philosophy, however, still refutes the status of the human condition as something beyond the natural realm, in the face of its peculiar reflective and language skills.

These three intracranial structures represent major neuroanatomical systems developed over a long evolutionary history, through which we inherit all the achievements that preceded and led us to and, moreover, inherited an additional potential of knowledge about human life we did not know and or developed. The idea about brain neuroanatomical organization as conceived by MacLean topographically employs evolutionary ideas and is the closest to the id / ego / superego Freud equivalent. Through the tripartite model "triune brain," MacLean demonstrates that nature builds its newest and most complex structures on the basis of what has preceded and has been shown to be appropriate over the last 50 years. Its basic evolutionary idea - advance the brainstem to the neocortex, the progression from reptiles to primates, mammals passing through - is widely accepted today (JOHNSON, 2011:166). These characteristics summarize the evolution of their own behavior and provide an exact parallel to the stages of child development.

III.D.2.1 – Reptilian Brain:

The reptilian brain or R-system comprises the sensorimotor system and all physical processes that give one the perception of a body and a waking world. The R-system, a way of acting in the world-body, "stores" various learning about the world made by higher cortical systems and is transmitted to the "autopilot" (PEARCE, 1992:58-59).

Freud used a metaphor, "The malaise in civilization," which says that brain is a kind of an archaeological site with a series of settlements placed over each other. The deeper one digs, the further back in time they go. At the deepest level is the reptilian brain, also known as the brain stem, which controls basic metabolic functions of the body, such as heartbeat and breathing. The brainstem has only primitive instincts and repetition, structure that generates and captures internal and external sensations, regulates the homeostatic activation and initiates the kinetic impulses, but is unable to generate emotional complexity or anything that resembles thought. If one only had this system-R, their behavior would be essentially primitive. Incessantly, without emotion or reason, they would be limited to physical survival: food, shelter, sex (survival of the species) and territory.

III.D.2.2 - Limbic Brain:

This second layer is called the paleomammalian brain or, as it is known, the limbic system. It is located where emotions and memory are, mainly stored, including the amygdala, the hippocampus and the hypothalamus. The primary emotions - love and fear, sadness and joy - emerge from this region, coloring afferent stimuli with emotional qualities that are associated with past events stored in the hippocampus or amygdala. It is the level that will interact and relate, share feelings and motivations and experience strong emotional ties in most mammals, such as dogs, cats and horses - not to mention humans closest relatives, the chimpanzees. While some people still adopt reptiles as pets, it is not as common as the mammals mentioned above because of their dynamic repertoire of emotions. There is also an intuitive intelligence that drives the well-being of the subject, and the offspring of the species. This brain is responsible for maintaining

all relationships, the immune system and the organic capability of healing. When emotional complexity is found in other mammals, it is through detecting the existence of the limbic system that operates in the brains (Levine, 2012:229; JOHNSON, 2010:166; PEARCE, 1992:59). This structure, with the help of temporal, and possibly other, structures and lobes of the cortex, provides a more solid and rich intelligence transforming into forms more flexible, adaptable and powerful in behavior. The simple reptilian reaction of revulsion-attraction is elevated to a large complex of polarities as like-dislike, good evil, anger, joy, sadness, happiness, love-hate.

In this circuit one can assume that is the basis of all emotional ties, as in the mother-baby, toddler, family, male-female. It is connected to dreaming, the visions of the inner world, the subtle and intuitive experiences and up to day dreams and fantasies from the neocortex, the neighbor from upstairs. This intermediate emotional system joins the three brains, promoting unity, or drawing attention to a couple of others as needed. It can put the lower intelligence in service of the upper and vice versa - and can also put the intellect in the service of defense in a lower real or imaginary emergency system.

III.D.2.3 - Primate Brain or Neocortex Brain:

On top of the brainstem and limbic system is the neo-cortex, the two hemispheres spreading across the surface of the brain likethe foam lining of a cycle helmet (JOHNSON, 2010:166). This is the most characteristic component of human brain architecture. As humans, primate cousins have something close to it in size, which is five times larger than its downstairs neighbors together. In this neuroanatomical store house, the prevalence is rationality, thinking, conscious memory, the development of symbols and the important role of inhibition of impulses. (LEVINE, 2012:229).

Here one plans, studies means of predicting and controlling the environment in which the world and people live; reflects on mortality and morbidity; experiences interiors and worlds apart; negotiates restrictive, aloof laws; invents religions and philosophies, as well speculates on the fate of humanity. If it is developed, that neocortical circuit provides empathy, compassion and love (PEARCE, 1992:60-61). When immediate action is changed because of long-term interests, when communication through complex sentences or being engrossed in abstract thoughts - when what most characterizes human intelligence is displayed, means that ones are mostly using the neocortex (JOHNSON, 2010: 166).

III.D.2.4 - Considerations:

The neocortex is divided into hemispheres, each with their specialties, two neighboring low. Although these basic types of the brain contain large differences in structure and chemical composition, the three are intertwined and should work together as a single brain (threefold). Each of the three structures has its own functions, features and behaviors, and can, to some extent, act "literally" - within its own structure and according to their particular specialties. The three are aimed vertically to act as an integrated unit. Through this tripartite connection, the most basic instincts and intelligence play a completely different character, having, moreover, the intellect of our higher brain in an emergency. Through the operational development, the higher brain can also influence its standardization systems on the two lower neighbors, and change them in varying degrees, and even "intervene ontological constructs" (PEARCE, 1992:61). This is the brain in all its multiplicity. Humans are part reptile, part mammal,

primate, and part Homo sapiens. We are a walking set of patterns, waves and groups of neurons that fire synchronously (Johnson, 2010:169).

The triune model is widely accepted today. Although the three systems operate as one piece, to a certain extent one can tune channels and energy and focus attention on one at a time and use either of them in the name of the other. When one gets stuck in concerns with homeland defense and survival, the higher brain intellect and emotions of the limbic system are used to channel attention, focusing on self-defense. These systems, on behalf of the lower top, can also be used, as in invention and creative thinking.

The brains of lower order are refined when placed at the service of the neocortex. Even though the neocortex can act directly on the sensory apparatus and influence all the actions, these funds are channeled through the limbic or emotional brain for general operations of cataloging, memory, learning and respect. The emotional brain acts to integrate with the neocortex in all our pictures and interior creative visions. If not for the sensory brain - motor, one could not speak or write. If not for the limbic system, one could not communicate. If not for the more advanced brain, one could not think how thinking was possible today. It was believed that every truly cerebral action took place in the neocortex. The two older brains were considered vestigial leftovers or appendices. Current research indicates the opposite: that most of one's experience comes from the action of the two primitive brains. The reptilian brain providing one's notion of environment-world; and the limbic system, the notion of relationships, memory and individual ego. The centers provide quick, instinctive, emotional responses in situations. The general progression that goes from the brain stem to the limbic system and the neocortex is a more accurate assessment of the internal divisions of the psyche than the old myths of the id, ego and superego (WILSON, 1988; JOHNSON, 2010:167).

III.D.3 – The brain and its complexity in function and anatomy:

The brain consists of a dense cellular network. Most of these cells are called support cells (glial cells), whose main purpose is to support the neurons. Among other things, support cells release growth factors that keep the neurons fit, mobilize energy, and convert certain neurotransmitters to waste transported out of the nervous system. Some are support cells form the white, fatty sheaths (myelin) that surround and insulate the long axons (white matter). White matter (neural pathways), consists of neural circuits, whose functions include connecting the various regions of the cortex. The grey matter is a vast network comprising 70-80 per cent of our neurons.

The cortical surface layer is often called the neocortex because it is the most recent evolutionary development. All grey matter beneath the neocortex is called subcortical. The neocortex is highly folded and accounts for about half of the cerebral hemispheres. It is folded into ridges and fissures that would be able to cover a surface of some twenty square meters; it is only 1.5-4.5 mm thick and contains some twenty billion neurons. It is a highly organized structure, and most of its region contains six separate layers (DAMASIO, 1994, HART, 2006:43-44). It has been calculated that the total length of the neuronal pathways in the human brain corresponds to four times the circumference of the Earth. The myelinated nerve fibers make up about 40% of all brain tissue, and the connections between the neurons provide endless possibilities for communication, which is the essential organizing principle of the brain. Every single neuron connects to thousands of other neurons through axons, an indication of the flexibility and potential of our nervous system in relation to information processing and storage (GJERUM & ELLERTSEN, 2002; HART, 2006:43-44).

From the pineal gland in the center of the brain, each brain module is doubled. Every structure is represented in both hemispheres. The two hemispheres are linked by thick bundles of long nerve fibers through the corpus callosum, the anterior and posterior commissures (HART, 2006:43-44).

Between the neuron and the dendrite is a gap called *synapse*. The signal is able to cross this gap because every axon is able to release a transmitter substance through the neuronal terminal. All neuronal communication takes place through the synapses, and the formation of synaptic connections is controlled by an intimate interaction between genetic and environmental factors (PERRY, 2002; HART, 2006:43-44).

Neurotransmitters may be excitatory, which implies that the receiving neuron is stimulated; or inhibitory, which implies that it becomes more difficult for the following neuron in the sequence to give off a nerve impulse. Inhibitory synapses are important for the brain's ability to suppress information that is not considered relevant. Excitation (activation) and inhibition are the two basic processes in the brain, and it is the sum of excitatory and inhibitory effects reaching a given neuron that determines whether it passes on a nerve impulse (TERZCHNER, 2002; HART, 2006:43-44).

III.D.4 - The Brain: a dynamic and integration structure:

The brain has a high degree of plasticity and is capable of altering neural circuits through influence from environmental interaction (SIEGEL, 1999; HART, 2006:75-76). When the system fails to maintain the rigid state, the chaotic state eventually ensues. The integration of neural connections is strengthened through countless waves of learning, and the nervous system keeps switching between rigidity, chaos,

and harmony. The brain seeks to integrate one moment with the next, which promotes flexible adaptation. Synchronized neuronal integration creates coherent experiences, and a change in state influences a phase shift, which involves disorganization and subsequent reorganization of synchronized integration. Neural networks do not engage in random activities because behavior is governed by patterns established through previous learning. When a phase shift occurs, the nervous system will seek towards previous familiar levels of integration before it is able to reorganize at a higher level. The nervous system always tends towards structure and familiarity. For example, experiments have shown that the human brain is unable to produce random sequences of numbers; the brain inevitably falls into a pattern that imposes some sort of order on the sequence (COZOLINO, 2000; HART, 2006:76-77).

III.D.5 – The basic neural structures related to trauma therapeutic approaches

and its functions:

The *Locus coeruleus*, regulates the **noradrenalin**. This structure increases activity if a unit of information seems novel or potentially dangerous. It is connected to the SNS and often referred to as the trauma center of the brain (ALLEN, 2002; HART, 2006:102). Fear increases the activation potential of the *locus coeruleus* and releases noradrenalin, which increases heart rate, blood pressure, glucose metabolism, respiratory rate and muscle tone. Regulating the respiratory rate, relaxing, and meditating seem to inhibit neuronal firing in this area. The *ventral tegmental nucleus* and *substantia nigra* contain the neurotransmitter **dopamine**. This is projected toward the *basal ganglia*, the *limbic system* and the prefrontal cortex, helping the organism to execute motor patterns and involuntary movements. This

dopamine pathway is stimulated by positive facial expression and activates emotionally rewarding processes. Also, the dopamine pathway contains high concentrations of the body's own opioids, "endogenous morphine" (SCHORE, 1994; HART, 2006:102). These areas play a key role in stress management and have a significant influence on the regulation of arousal, affects, attention, the startle response and sleep (PERRY, 1990; HART, 2006:102). The *raphe nuclei* contains the neurotransmitter **serotonin** and are balanced through sleep-wake rhythms. PAG (*periaqueductal grey matter*) located at the top of the brainstem modulate pain perception and also induces pleasant and unpleasant sensory experiences. The area is also activated in fear reactions, such as fight-or-flight behavior, in grief reactions and in pleasure. PAG is involved in most affective processes (DAMASIO, 1999; PANKSEPP, 1998; HART, 2006:103) and probably inhibits the attachment cry response (DAMASIO, 2003; HOFER & SULLIVAN, 2001; LeDOUX, 2001; PURVES et al., 2001; SOLMS & TURNBULL, 2002; HART, 2006:103). *Tectum* provides a primitive representation of the entire body; i.e., a combination of internal and external body sensations. This sensory integration provides a sensorimotor map of the body that activates basic action generating mechanisms, such as approach or avoidance behavior, that are closely related to pleasure and displeasure (SOLMES & TURNBULL, 2002; HART, 2006:104).

The *colliculus* area processes orientation responses and provides a sense of the body in the world. The areas provide a basic motor image of the body. The visual, auditory, tactile, and other sensory stimuli come together through polymodal areas (AUSTIN, 1998; HART, 2006:104).

The sensorimotor self-representation develops from the interaction of *tectum*, *colliculus* areas, and circuits in the PAG. The *colliculus* areas are closely connected to the premotor cortex, where motor plans and intentions arise.

All mentioned structures above register changes in the body's internal environment, such as heart rate, blood pressure, etc.

Proprioceptive systems⁶⁷ provide a sense of the body's position in space. These sensations involve various modalities such as pressure/touch, warmth/cold, pain, and the kinesthetic sense, which is based partly on one's sense of the limbs in motion (MATHIESEN, 2004; HART, 2006:104). The proprioceptive sense is crucial for the affective sense of self, and most of the above structures are vital to emotional regulation.

III.D.6 - Brain Structures of Motor /Emotions (Sub-cortical & Limbic systems):

The **diencephalon**. Is mainly made up of three structures: the thalamus, the hypothalamus, and the basal ganglia, all of which help to coordinate information from the brainstem. These three structures are all involved in regulating affects and motor functions at a basic unconscious level.

III.D.6.1 - The Thalamus:

The thalamus receives sensory impulses from the entire body, except for the olfactory pathways, and distributes them to various areas within the neocortex and the limbic system. It is believed that the thalamus is in charge of receiving and processing information from the outside world, while the basal ganglia handles motor behavior and action (GOLDBERG, 2001; HART, 2006:125). The thalamus integrates motor functions, distributes impulses from the cerebellum to areas that coordinate movements (*basal*

⁶⁷ From latin: *proprius, capio*, capture, receive. Vide chapter V

ganglia) and to the motor cortex. It is an important system in relation to orientation, behavior and attention. It also enables the use of the senses; it is active both during sleep and in the waking state, and it constantly distributes signals to the cortex (thinking), the basal ganglia (automated movements), and the limbic system (memory and emotions). The thalamus enables coordination, regulation, and environmental interactions (DAMASIO, 1999; TREVARTHEN, 1989, 1990; HART, 2006:126). Out-of-body⁶⁸ experiences lie partly in the *thalamus*. When all the neural connections at the back of the thalamus dissociate at once, coherent proprioceptive sensation disappears, as this is the area that collects visual and auditory impressions, vestibular input and other sensory impressions.

III.D.6.2 –The Basal ganglia:

Activation of the *basal ganglia* causes automatic excitement and adjusts arbitrary movements as characterized by the *extrapyramidal* motor system. While the *cerebellum* creates temporal rhythm in actions, the *basal ganglia* refines motor sequences and stores them in organized motor programs. The *basal ganglia* filter both: potential movement alternatives and the thoughts, ideas, and notions that reach the consciousness (BRADLEY, 2000; MACE, 2004; SCHATER, 1996; HART, 2006:127). The *basal ganglia* consist of several structures: *putamen*, *caudate nucleus* and the *nucleus accumbens*. While the *putamen* controls automatic movement, the *caudate nucleus* controls automatic thought and functions as a filter that regulates which thought products are to be acted out, and which are to be ignored. Feelings of love and devotion are associated with high activation levels in the *caudate nucleus* (FISHER, 2004; HART, 2006:127). Stimulating the *nucleus accumbens* may lead to hyperactivity and

⁶⁸Dissociative state or disembodied.

fewer thoughts (AUSTIN, 1998; HART, 2006:127). Disorders in the connections between the basal ganglia and the prefrontal cortex may cause attention disorders and hyperactivity. This area also appears to be involved in all forms of compulsory desire and dependency (GOLEMAN, 2003; HART, 2006:128).

III.D.7 –The Limbic System:

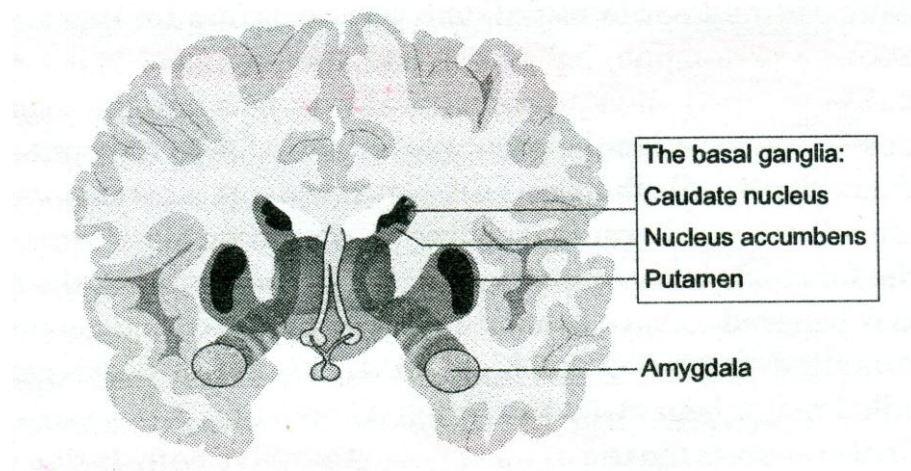
It is characterized by functional links with emotions and memory, and the system is often described as the “emotional brain.” Limbic activity is an emotional motivating structure, whose function is to filter what happens internally and externally. The limbic area interacts through a number of circuits that connect three main structures: the hypothalamus the amygdala, *and* the hippocampus. The system is involved in increasing or reducing arousal and imbues perceptions with affective or emotional value (BRADLEY, 2000; HART, 2006:130).

III.D.7.1 -The hypothalamus:

Its role is to integrate autonomic endocrine and motor processes into behavior that is appropriate in relation to the basic needs of the organism. While the thalamus monitors the outside world, the hypothalamus monitors internal states within the organism and helps keep them within adaptive and balanced levels (BRODAL, 2000; GOLDBERG, 2001; HART 2006:128).

III.D.7.2 – The Amygdala:

Figure 7 – The basal ganglia



Source: HART, 2006

The amygdala processes sensory impressions and is a crucial structure in the networks that regulate fear and aggression. It develops during the *fetal* period and is functional from birth. It is generally agreed that during the first years of life the amygdala is of global importance for all emotional learning, and that it is the structure that enables us to sense emotional reactions intuitively.

Fear is probably the oldest emotion of the limbic system, a further development of the startle reaction. All forms of anxiety reactions, panic, phobias and so on, are related to amygdala activation.

The amygdala has a monitoring function and constantly scans for sensory stimuli throughout the brain, preparing the organism to act at the slightest sign of danger. It has reflexive reactions to sudden intense sensory impressions, which are rapidly assessed in relation to any threats, and it is activated through perception that appears frightening or

scary. As a structure that registers fear it is involved in reactions related to fight-or-flight behavior and freezing, and in the release of aggression (DAMASIO, 1994; LeDOUX, 2001; HART, 2006:131). Electric stimulation of the amygdala results in increased alertness, heart rate and respiration (NEWBERG, D 'AQUILI, & RAUSE, 2002:hart, 2006:131). The amygdala is capable of releasing religious experiences that trigger pleasure circuits, and that the amygdala has a large number of morphine receptors, it is capable of causing changes in consciousness (COZOLINO, 2000; PANKSEPP, 1998; HART, 2006:132).

The amygdala receives input from two sources: quick and rough input from the *thalamus*, and slower but more complete representations from the prefrontal cortex. The circuitry that travels via the direct pathway from thalamus to amygdala is primitive, and that might explain why emotions may be strong enough to overpower rational thinking. Many emotional reactions are formed without any form of conscious or cognitive involvement. Even if the stimuli that are associated with danger no longer exist, the amygdala still releases a fear reaction, unless areas of the prefrontal cortex are able to inhibit the reaction. For example, the association of a sound (e.g., screeching brakes or clothes being torn), a smell (e.g., the smell of dewy grass), a movement (e.g., a threatening hand), or an observation (e.g., a particular constellation of stars) associated with a highly traumatic event may trigger a fear reaction independent of consciousness, over and over again. The extinction of fear conditioning appears to involve prefrontal regulation of the amygdala (DAMASIO, 1994; LeDOUX, 1989, 1994, 1998; HART, 2006:133).

Fear is learned by coupling a sensation, an emotion, a movement or a thought with unpleasant stimuli such as pain, shock, shame etc. The amygdala recognizes previous experiences, and for the rest of the person's life it is able to link a fear stimulus with

anxiety or fear. The memory function of the amygdala is implicit, which means that it is not normally open to conscious processing. In humans, amygdala damage makes it difficult to form an impression of trust levels, where feelings of anxiety are extinguished. Apparently, the loss of the ability to experience and express anxiety makes one unable to register this emotion in others (BLAIR, 1999; COZOLINO, 2000; DAVIDSON, PUTNAM, & LARSON, 2000; GALLESE, 2001; LeDOUX, 1998;SCHORE, 1994, 2003a: HART, 2006:134).

III.D.7.3 – The Hippocampus:

The hippocampus has extensive connections to the prefrontal cortex and is involved in learning and memory (COZOLINO, 2000; HART, 2006:135).

The hippocampus is vital to short-term memory and relates memories to time and place (LeDOUX, 1998:O'KEEFE & NADEL, 1978; HART, 2006:136). It is especially associated with conscious (explicit memory) and input from the amygdala is involved in activating the recognition of emotionally charged memory tracks (LeDOUX, 1998: HART, 2006:136). The hippocampus is considered a super convergence zone, able to convert unconscious (implicit) memory tracks into conscious (explicit) images or internal representations. The hippocampus has a regulatory function, and its discrimination function enables it to regulate the arousal system. The hippocampus is unable to trigger emotions directly, but, due to its regulatory effect on other areas of the brain, it exercises great influence on a person's mental state (NEWBERG, d'AQUILI, & RAUSE, 2002, HART, 2006:137).

III.D.7.3.1 - Sensitivity to stress:

A high activation level in the amygdala and the sympathetic nervous system may inhibit the function of the hippocampus. Repeated or chronic stress seems to inhibit the development of neurons in the area of the hippocampus where new stem cells are developed, and atrophy in this area has been observed in connection with post traumatic stress disorder (PERRY, 1994; SAPOLSKY, 1998; VAN DER KOLK, 1996; HART, 2006:137).

III.D.8 – The Cortical Systems:

The back section of *the frontal lobes* is the *motor cortex*, which is able to exercise volitional control over muscle contractions. In front of this area is *the premotor cortex*, which coordinates the movements of individual muscle groups. The rest of *the frontal lobes* are called the prefrontal cortex, the area that generates impulses and plans for action sequences.

The prefrontal cortex cooperates with the body-sensing areas within *the parietal lobes*, and together they account for much of what is defined as intelligence.

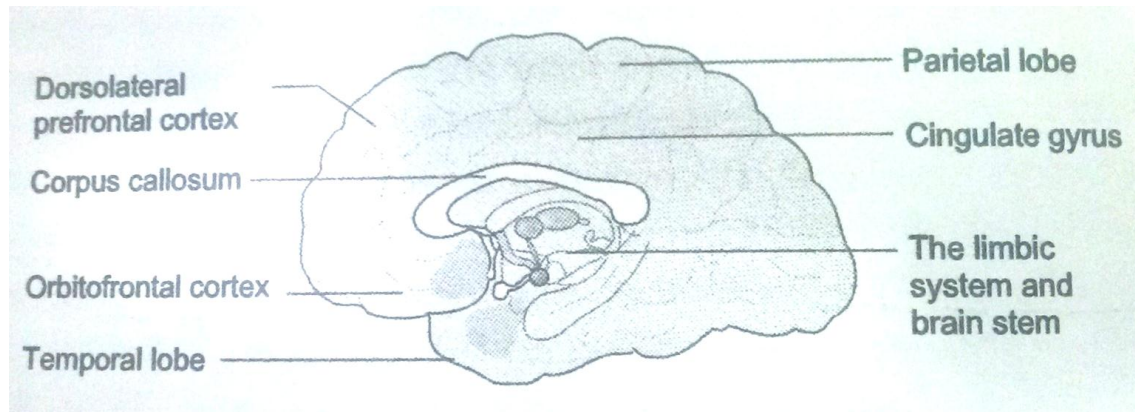
The prefrontal cortex and *the parietal lobes* are situated in *the neocortex*. At the base of the prefrontal cortex, in the transition zone between *the limbic system* and the prefrontal cortex, lie a number of structures in charge of coordinating emotional, body-sensing, and rational structures. The *cingulate gyrus* perceives emotions, just as *the visual cortex* perceives visual impressions, and they are a prerequisite for our ability to engage in

human relations and to feel sympathy and empathy. While *insula*⁶⁹ is involved in registering pain, the *cingulate gyrus* associates the pain with its qualitative feeling (COZOLINO, 2006; RAMACHANDRAN, 2003; HART, 2006:143). The area is a “social attachment system” on top of the *insula*, which draws attention to physical injury. The *insula* enables us to be aware of physical injury, while the *cingulate gyrus* lets us attribute emotional aspects to the sensation of pain. The *cingulate gyrus* induces emotional behavior related to attachment and caring behaviors (LeDOUX, 1998; SCHORE, 2001a; HART, 2006:143). The activation of the area offers a sense of safety and relatedness because it has a high concentration of morphine receptors. It enables maternal caring, vocal communications to maintain contact with attachment and play behavior (MacLEAN, 1985; HART, 2006:143). The *posterior cingulate gyrus* regulates social behavior, attachment behavior, and our capacity for play. Damage to this part disrupts the drive to play and generate mental images, and attachment behavior and caring behavior disappear (DAMASIO, 1994; JOSEPH, 1993; VAN DER KOLK, 1987; HART, 2006:143). The *anterior cingulate gyrus* plays an essential role when we have to act counter to innate or early acquires impulses. When an activity is being trained, and has not yet become automated, the *anterior cingulate gyrus* is activated. It also contains *spindle neurons* (KANDEL, 2005; HART, 2006:144). The *spindle cells* are rich in receptors for the neurotransmitter serotonin, dopamine, and vasopressin and are also found in the *orbitofrontal cortex*. These kinds of cells are found only in higher primates, responsible for making social intuition limber (COZOLINO, 2006; HART, 2006:144).

⁶⁹ Known as an association area for the senses of hearing and equilibrium.

III.D.8.1 – The parietal lobes:

Figure 8– Dorsolateral prefrontal cortex, orbitofrontal cortex, cingulate gyrus and parietal lobes.



Source: HART, 2006.

The parietal lobes help to give a sense of one's own presence in the world and an internal subjective space. This area helps one to locate a position in space and to coordinate and compare the sensed position with the outside world. The area helps one determine the location of objects in relation to the organism.

The *medial area* processes movements. Damage in this area disrupts the ability to know the direction or speed of a moving object (d'ÁQUILI & NEWBERG, 1999; RAMACHANDRAN, 2003; HART, 2006:145). The connections between the *parietal lobes* and the *frontal lobes* account for much of human intelligence. They also merge to form abstract and metaphoric representations (GOLEMAN, 2003; HANSEN, 2002; HART, 2006:145). The *parietal lobe* receives sensory input from all sensory modalities, especially auditory and visual material, and lets the organism generate a three-dimensional sensation of the body. The *left parietal lobe* is in charge of generating a mental sensation of the physical body, while on the right it is related to the sensation of a body image (RAMACHANDRAN, 2003; HART, 2006:146). The

parietal lobes in the left hemisphere generate the brain's spatial sense of self, while the *right parietal lobe* generates a sense of physical space for the self to inhabit (SCHORE, 1994; HART, 2006:146).

III.D.9 – Insula:

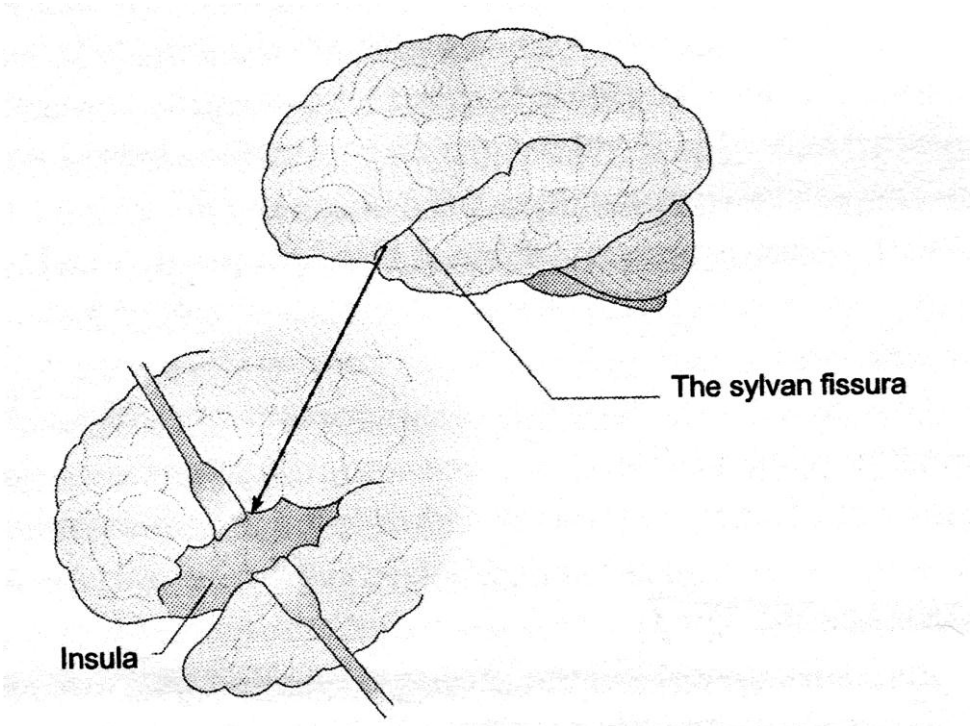
The insula is the area associated with senses of hearing and equilibrium and it provides an intuitive sense of emotions. When *the medial part of the insula* is activated, pleasant feelings are generated through touch, and it is possible to sense a response to loving skin contact. *The front part of the insula* is activated by negative stimuli (BARTELS & ZEKI, 2004; HART, 2006:146).

The cingulate gyrus and the *insula* play important roles for mental involvement and provide ongoing information about the body's condition. The *insula* records changes in the autonomic nervous system and perceives pleasure or physical comfort/discomfort. This area is where pain impulses from the body's organs and internal parts are sensed, and where the organism becomes conscious of pain. The *right hemisphere insula* is dominant in relation to body experiences and integrates representations of the somatic state. Emotions are based on body sensations, and damage to the *insula in the right hemisphere* eliminates the awareness of one's own body states (DAMASIO, 1994; ERIKSSON, 2001; OKEEFE & NADEL, 1978; SCHORE, 2001a; HART, 2006:147). While the *posterior parietal lobes* register kinesthetic aspects of facial and body movements and separate self from others, the insula integrates them with the areas that process motor functions and emotions. The *insula* plays a key role in the development of the sensation of self and self-awareness in which later enables the development of *insight* (COZOLINO, 2006; HART, 2006:147). The *insula* contributes to a sense of the somatic self and to intuitive sensations

of self and others. The mirror systems contribute to an immediate sense of the emotions of an observed other. Mental images and body sensations are building blocks for internal self-representations and empathy. Without a sense of our own body we lose our sense of meaning, our capacity for abstract thinking, and our ability to relate to ethics, art, etc (COZOLINO, 2000; SCHORE, 1994; HART, 2006:148).

III.D.10 – The prefrontal cortex:

Figure 9– The insula in the parietal lobes



Source: HART, 2006.

The prefrontal cortex is the most complex system in the brain, and it consists of a veritable symphony of perceptions from many sensory modalities, which enable abstract thinking. It converts signals from all sensory areas to images, thoughts, and body states, which are represented continuously (TREVARTHEN, 1990; HART, 2006:148).

The prefrontal cortex is crucial for maintaining emotional stability. It is capable of altering thoughts and actions on the basis of associative changes. It controls primitive behavior and basic emotions by inhibiting impulses and overriding systems governed by reflexes and instincts.

The many connections between the prefrontal cortex and the rest of the *neocortex* forms the basis for human imagination and for our ability to generate complex ideas based on a multi-modal system of sensations. This area enables us to go on mental function with an internal ability to decode what is on another person's mind, providing a sense of one's particular subjectivity (FANAGY, 2003; MAIN, 1999; SCHORE, 2003a; SIEGEL, 1999; HART, 2006:149). This is the "*thinking brain*," which enables us to generate long-term plans and strategy considerations (GADE, 1997; HART, 2006:149).

The prefrontal cortex is of great importance in affect regulation. It contains no primary sensory areas: its function is to control activity in other regions and to carry out associations of highly processed information from other neural systems.

It is in the prefrontal cortex that perceptions gain meaning, the future can be predicted, and thoughts, feelings, and sensations can be selected for further considerations, while others, deemed less significant, are ignored. It is a key structure for recognition and short-term memory, functions in the prefrontal cortex are important as a working memory and in relation to recalling stored memory such as facts, rules, etc.

Alexandre Luria called the prefrontal cortex the "organ of civilization," and even minor damage causes apathy, indifference, or behavior bereft of social inhibition and responsibility (COZOLINO, 2000; HART, 2006:151).

III.D.11 – The Orbitofrontal Cortex:

It regulates both parasympathetic and sympathetic components and controls the activation of the vagus nerve in the *brainstem*. It plays an important role in arousal regulation. When the *orbitofrontal cortex* functions optimally, it is one of the few brain regions with knowledge of every single activity taking place at any given time within the organism (DAMASIO, 1994; SCHORE, 1994, 2003a; HART, 2006:151). Damage to the *orbitofrontal cortex* leads to a lack of impulse control, a lack of emotional inhibition, and a drive for immediate gratification, and the affected person does not consider his or her actions wrong, has a crude sense of humor and leads to flatness of emotions and a “loss” of personality. The *orbitofrontal cortex* has special neurons that respond to facial expressions and gaze contact, and processing in the *orbitofrontal cortex* contributes to the experience of stimuli as familiar, meaningful and personal (BLAIR, MORRIS, FRITH, PERRETT, & DOLAN, 1999; COZOLINO, 2000; LeDOUX, 1998; SCHORE, 1994; HART, 2006:152).

The *orbitofrontal cortex* is able to inhibit the activation of inappropriate acts. When there is a failure to inhibit the *subcortical structures*, the result is uncontrollable impulsive outbursts that are inexplicable to the individual. So, this capacity depends on the ability to restrain distress, i.e., to control the impulse of frustration. Luria (1973) pointed out that the orbitofrontal cortex enables self-control and inhibition of affective outbursts. This structure incorporates social aspects of the personality. This area manages strong affects and processes complex symbolic representations. It enables facial recognition expressions and internal mental representations, which in turn allows the child to modulate affective response by maintaining an internal representation of the caregiver’s response to an act (DAVIDSON & SLAGTER, 2000; GOLDMAN-RAKIC,

ISSEROFF, SCHWARTS, & BUGBEE, 1983; LURIA, 1973; SCHORE, 1994, 2003A; HART, 2006:154). This is crucial for the ability to add an emotional dimension to rational thinking and for the link between mentalization and emotions.

Cortical inhibition of and control over *subcortical structures* are essential for affect regulation. As the *orbitofrontal cortex* continues to develop, expanding and extending its fibers into the *limbic system* and into the brainstem, children develop a growing capacity for regulating their emotions and for finding ways to regulate their behavior in relation to others. Children rely on others for comfort, but they gradually develop the ability to self regulate (BECHARA, DAMASIO, 2003; BRADLEY, 2000; HART, 2006:156).

The *orbitofrontal cortex* is an important factor in our sense of identity; it is *non-verbal* and develops through patterns of affect regulation. It plays an important role in the exchange between the internal and the external environment and enables us to act on mental knowledge without having to think about it (CHUGANI, 1996; DAMASIO, 1994; SCHORE, 2003b; HART, 2006:157). The *dorsolateral prefrontal cortex* is an important structure in relation to the working memory, as it allows us to retain a piece of information long enough to manipulate it in our mind. The area enables us to organize and reorganize, and it contains the ability to resist diversions and the temptation of responding prematurely. This part has special connections to the *motor cortex* (DIAMOND, 2000; HART, 2006:158). While the *orbitofrontal cortex* is involved in implicit behavior regulation, the dorso lateral prefrontal cortex is involved in explicit regulation, and when experiences are placed in a context of time and place, this area and the hippocampus are activated (BRADLEY, 2000; COZOLINO, 2000: VAN DER KOLK, 2000; WILSON, O'SCALAIDHE, & GOLDMA RAKIC, 1993; HART, 2006:159). Damage to the dorso lateral prefrontal cortex makes it difficult to

control and focus conscious attention, to carry out calculations, and to draw appropriate and logical conclusions.

The prefrontal cortex is the brain region that most distinctly separates man from other mammals.

III.E – THE POLYVAGAL THEORY:

III.E.1 New perspectives for adaptation to Autonomic Nervous System:

III.E.1.1 The Polyvagal Theory:

The revolutionary work of Stephen Porges provided us a "treasure map" - eloquent, well reasoned and clearly grounded - the psychophysiological systems that govern the traumatic state, especially in the Somatic Experiencing approach of Peter Levine (Levine, 2010:97), applied by many psychiatrist and neuropsychologists: Bessel van der Kolk, Allan Schore, Daniel Spiegel, Antonio Damasio, Robert Scaer. Porges' Polyvagal Theory offers ways to understand mechanisms mediating symptoms observed in various physical, behavioral and psychiatric disorders, including autism, depression, PTSD and other disorders. The answers to the resolution of trauma focus on the vagus nerve, tenth cranial nerve in its two different branches (vago dorsal and vago ventral) that form the parasympathetic system.

III.E.1.2 The cranial nerves:

The cranial nerves, at an early stage in evolution, controlled body and self-regulation functions such as breathing, blood circulation, digestion. In social animals the cranial nerves have developed ever more components that regulate communication and emotional attunement. This part of the *brainstem* motivates selective attention, focusing, and motor functions (TREVARTHEN, 2004: 53-78; HART, 2006:104).

Darwin focused on facial expressions when he defined emotions, and he was of the opinion that these expressions were understood to mean the same in all cultures. He hypothesized that neural circuits connect facial expressions with activity in the brainstem and influence our breathing and heart rate. When an emotional state arises, the heart rate changes instantly, which in turn influences brain activity. Inspired by Darwin, Porges (1995, 1996, 1997) elaborated Darwin's emotional theory, and in this effort he focused on the cranial nerves. Porges points out that the ANS and the brain-body link is transmitted through the tenth cranial nerve (*the vagus nerve*, which means the wandering nerve). Together, the fifth cranial nerve (*the trigeminal nerve* or *triplet nerve*), which is responsible for facial *tactile* sensations, and the seventh cranial nerve (*the facial nerve*), which controls the facial muscles, connect facial expressions with body sensations and enable humans to produce emotions and communicate them through facial expressions. This neuromuscular system is in charge of sensing and controlling all the small facial muscles.

Most of the time, facial muscles are controlled by unconscious mechanisms. The facial cranial nerves contribute to a sense of the facial muscles and play a role in the way we are affected by other people's facial expressions (mirror neurons). We form mirror images of other people's emotional expressions throughout our facial muscles

(DAMASIO, 1999). The emotion of joy activates only muscle movements around the eyes, and certain facial expressions change our posture (EKMAN, 2003). “Much of the brain activity you find with genuine enjoyment occurs only if the muscle around the eye is engaged” (GOLEMAN, 2003-129). Altering a facial expression to match a particular emotion causes physiological changes that accompany the emotion.

The *vagus* nerve (*the tenth cranial nerve*) is the longest of the brain nerves, and it has a large supply area. It consists of a paired double nerve that projects from the *skull* through the *jugular foramen* and continues as two thick strands along the *pharynx* and *esophagus*, through the *chest cavity* and *diaphragm* to the *abdomen*. Along the way it sends out fibers to the organs: *esophagus*, *lungs*, *heart*, *gall bladder*, *stomach*, *intestines*, *liver*, etc. The *vagus* nerve also consists of fibers that lead impulses from the organs to the parasympathetic center in the *brainstem*, which trigger reflexes that regulate organ function. It is a part of the calming branch of the nervous system, the parasympathetic system within the ANS. The *vagus* nerve is connected to the *respiratory system*, the *heart*, and the *gastrointestinal system*. The *cranial nerves* connect body and brain and enable us to sense emotions in the body, as when grief or pain “cuts like a knife.” Its *afferent* (sensory) and *efferent* (motor) fibers provide a quick feedback system that manages the *homeostatic regulation* of the physical and emotional state.

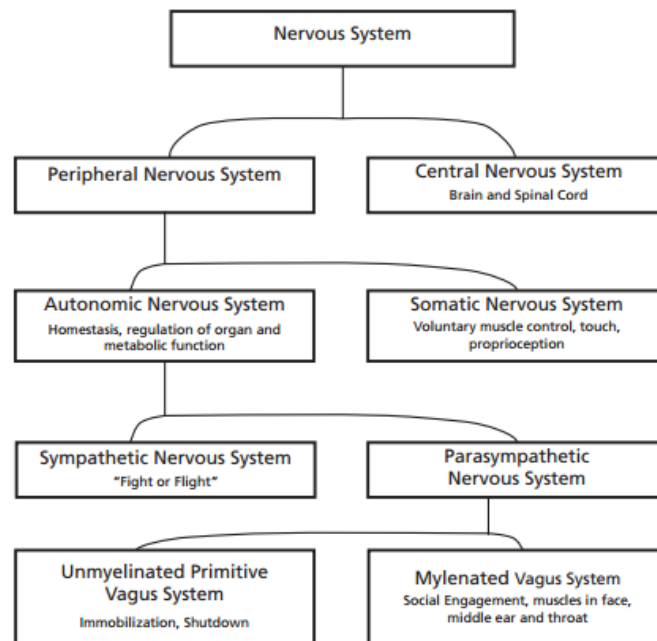
III.E.1.3 Mammalian Modifications of our Evolutionary Heritage: - A Polyvagal

Theory:

The (Polyvagal) theory emphasizes the *phylogenetic* dependence of the structure and function of the *vagus*, the primary nerve of the parasympathetic nervous system. Three phylogenetic stages of neural development are described. The first stage is characterized

by a *primitive un-myelinated vegetative vagal system* that fosters digestion and responds to novelty or threat by reducing cardiac output to protect metabolic resources. Behaviorally, the second stage is characterized by a spinal sympathetic nervous system that is capable of increasing metabolic output and inhibiting the primitive behaviors necessary for “*fight or flight.*” The third stage is unique to mammals and is characterized by a *myelinated vagal system* that can rapidly regulate cardiac output to foster engagement and disengagement with the environment. In addition, the mammalian vagal system has an inhibitory effect on sympathetic pathways to the heart, and thus, promotes calm behavior and pro-social behavior”(PORGES, 2002; SE-Manual, Copyright, 2007). Figure below is from *In an Unspoken Voice*, by Levine, 2010:

Figure 10– Simplified Block Diagram of the Polyvagal Components



Source: Levine, 2010

III.E.1.4 The ANS adaptative responses:

According to Porges' theory, the Autonomic Nervous System (ANS) is actually not comprised of two reciprocal systems (parasympathetic and sympathetic), but, rather, of three sequential systems that follow brain evolution: Dorsal Vagal System (DV) – Sympathetic Nervous System (SNS) & Ventral Vagal System (VV).

DV: part of the Parasympathetic Nervous System, the most primitive of the ANS branches and un-myelinated. This ancient system is an oxygen conservation system and causes the shutdown (Freeze) seen in severe trauma.

SNS: the SNS is primarily a system of mobilization (Fight/Flight), language of survival through action, un-myelinated and takes a lot of metabolic energy.

VV: Found only in mammals, this newer system supports engagement “*facial linking & making friends to solve problems*” (PORGES, 2001; FHE Manual Copyright 2007: A1.11).

In studies and surveys of Porges and his team, the polyvagal theory makes a very important distinction. The theory says that we have two very common defense systems associated with the fight or flight behavior, and that makes the body move in hazardous environments. What mobilizes the defense system of fighting and fleeing from danger is the threat to the preganglionic neurons. The immobilizing system is the SNP. The Dorsal Vagus is immobilized with fear at the threat to survival, and the vacant Ventral immobilizes, unafraid to bind and socialize. As this defense system involving the ventral vagus nerve of the parasympathetic system is more evolved, myelinated⁷⁰, smarter, it creates the opportunity to

⁷⁰Myelin sheaths: Are white, fatty sheaths made of myelin from certain types of glial cells in which axons are wrapped up and produce higher speed on processing information in the NS.

dispose of hypervigilance or adjacent reactions triggered by the amygdala when the body moves in said hazardous environments. Linking, and emotions behaviors have adaptive function. Stephen Porges gave a name to this system of Social Engagement - *The Smart Nerve*. When faced with a threat, primarily due to the phylogenetic hierarchical order, one opts for a defense strategy through the new and recently evolved (myelinated vagus) circuits, one tries to socialize primarily to mediate the situation and avoid further stress to the system; and when this newest circuit does not work and does not help to navigate internally by insuring the status in relation to the external environment, using older, less evolved neural circuits, it evolved into a defense system in order to maintain a neural basic regulation. The polyvagal theory finds, therefore, that there are three systems of defense. The best known is the fight or flight, promoting mobilization in hazardous environments, triggered by the sympathetic branch of the ANS. The system that promotes the defense response of immobilization, when faced with threats of imminent danger to life or experiences as such, is the parasympathetic primitive, reptilian dorsal vagus. And the third, which is able to thaw the ventral vagus in which promote security and thereby expand the affective capacity is the latest called the ventral vagus, the system of social engagement that can regulate the previous two. Thus ones have answers to safety, danger and life threatening situations. These responses are adaptive (2011; *apud* PORGES CEZIMBRA, 2012).

III.E.1.5 A Neuroception:

Porges has coined the term *neuroception* to describe how neural circuits distinguish whether situations or people are safe, dangerous, or life-threatening. Because of our heritage as a species, neuroception takes place in primitive parts of the brain, without conscious awareness. The detection of a person as *safe* or *dangerous* triggers

neurobiologically determined prosocial or defensive behaviors. Even though one may not be aware of danger on a cognitive level, on a neurophysiological level, the body has already started a sequence of neural processes that would facilitate adaptive defense behaviors such as fight, flight or freeze.

A child's (or an adult's) nervous system may detect danger or a threat to life when the child enters a new environment or meets a strange person. Cognitively, there is no reason for them to be frightened. But often, even if they understand this, their bodies betray them. Sometimes this betrayal is private; only they are aware that their hearts are beating fast and contracting with such force that they start to sway. For others, the responses are more overt. They may tremble. Their faces may flush, or perspiration may pour from their hands and forehead. Still others may become pale and dizzy and feel precipitously faint (PORGES, 2011:12).

According to Porges, prosocial behavior will not occur when neuroception misreads the environmental cues and triggers physiological states that support defensive strategies. To create relationships, humans must subdue these defensive reactions to engage, attach and form lasting social bonds. Humans have adaptive neurobehavioral systems for both prosocial and defensive behaviors (PORGES, 2011:14).

III.E.1.6 Social engagement and Defensive behavior: Adaptive or maladaptive strategies:

Social engagement and defense behaviors may be adaptive or maladaptive, depending on the level of risk that is present in the environment. From a clinical perspective, the defining gestures of psychopathology may include either a person's inability to

inhibit defense systems in a safe environment or the inability to activate defense systems in a risky environment – or both. Only in safe environments is it adaptive and appropriate to simultaneously inhibit defense systems and exhibit positive social engagement behavior (PORGES, 2011:13). Faulty neuroception – that is, an inaccurate assessment of the safety or danger of a situation – might contribute to the maladaptive physiological reactivity and the expression of defensive behaviors associated with specific psychiatric disorders (PORGES, 2011:13).

When the nervous system detects safety,⁷¹ one's metabolic system demands adjusting. Stress responses that are associated with fight and flight – such as increases in heart rate and cortisol mediated by the sympathetic nervous system and hypothalamic-pituitary-adrenal axis – are dampened. Similarly, a neuroception of safety keeps one from entering physiological states that are characterized by massive drops in blood pressure and heart rate, fainting, and apnea – states that would support “*freezing*” and “*shutdown*” behaviors. If neuroception identifies a person as safe, then a neural circuit actively inhibits areas of the brain that organize the defensive strategies of fight, flight and freeze. Slight changes in the biological movements that one sees can shift a neuroception from “safe” to “dangerous.” When this shift occurs, the neural systems associated with prosocial behavior are disrupted, and the neural systems associated with defensive strategies are triggered.

⁷¹ Functionally, when the environment is perceived as safe, two important features are expressed. First, bodily state is regulated in inefficient manner to promote growth and restoration (e.g. visceral homeostasis). This is done through an increase in the influence of mammalian myelinated vagal motor pathways on the cardiac pacemaker that slows the heart, inhibits the fight-or-flight mechanisms of the sympathetic nervous system, dampens the stress response system of the HPA axis (e.g. cortisol), and reduces inflammation by modulating immune reactions (e.g. cytokines). Second, through the process of evolution, the brainstem nuclei that regulate the myelinated vagus became integrated with the nuclei that regulate the muscles of the face and head. The link in the bidirectional coupling between spontaneous social engagement behaviors and bodily states. An integrated social engagement system emerged in mammals when the neural regulation of visceral states that promote growth and restoration (via myelinated vagus) was linked neuroanatomically and neurophysiologically with the neural regulations of the muscles controlling eye gaze, facial expression, listening, and prosody (PORGES, 2007a, 2011:56).

In the presence of a safe person, the active inhibition of the brain areas that control defense strategies provides an opportunity for social behavior to occur spontaneously. The appearance of a friend or caregiver would subdue the neural circuits in the brain that regulate defensive strategies. As a consequence, closeness, physical contact, and other social engagement behaviors become possible. In contrast, when situations appear risky, the brain circuits that regulate defense strategies are activated. Social approaches are met with aggressive behavior or withdrawal (PORGES, 2011:13).

III.E.1.7 Immobilization with fear and without fear:

Most of us are familiar with fight and flight behaviors, but know less about the defense strategy of immobilization, or freezing. This strategy, shared with early vertebrates, is expressed in mammals as “death feigning” (PORGES, 2011:14). In humans, one observes a behavioral shutdown, frequently accompanied by very weak muscle tone. Also observed are physiological changes: heart rate and breathing slow down and blood pressure drops.

Immobilization, or freezing, is one of most ancient mechanisms of defense in the human species. Inhibiting movement slows the metabolism (reducing need for food) and raises the pain threshold. Mammals immobilize themselves for essential prosocial activities, including conception, childbirth, nursing and the establishment of social bonds. For example, when an infant nurses, the mother has to restrain her movements. When a child is embraced, the child is functionally immobilized. Reproductive behaviors also involve a degree of immobilization. However, **immobilization with fear** elicits profound, potentially lethal, physiological changes (i.e., dramatic slowing of heart rate, cessation of breathing, and dropping of blood pressure). Through the process of

evolution, neural circuits in the brain that were originally involved in freezing behaviors were modified to serve intimate social needs. Over time, these brain structures grew receptors for a neuropeptide known as *oxytocin* which is released during the birth process and nursing. It is also released in the brain during activities that help establish social bonds. Thus, when one senses that the environment is safe, the release of oxytocin allows an individual to enjoy the comfort of an embrace **without fear**. But if the nervous system identifies someone as dangerous, although oxytocin may be released, one struggles against the attempted embrace (PORGES, 2011:14).

III.E.1.8 Social Engagement:

To develop a social bond, it is not enough to inhibit defense systems. People must also be physically close to each other. This is true whether they are a mother and baby forming an attachment relationship or two adults forming a social bond.

If social bonds depended on voluntary motor behaviors, then the human newborn would be greatly disadvantaged: The neural regulation of the spinal motor pathways is immature at the time of birth and takes several years to develop fully. Fortunately, social engagement does not depend on how well one can regulate limbs and move the body. Voluntary limb and trunk movement require neural pathways linking the cortex to spinal nerves (i.e., corticospinal pathways). Social engagement depends, rather, on how well individuals can regulate the muscles of the face and head via pathways linking the cortex with the brainstem (i.e., corticobulbar pathways). These are the muscles that give expression to the face, allow one to gesture with the head, put intonation into the voice, direct one's gaze and permit them to distinguish human voices from background sounds. Corticospinal pathways to spinal nerves regulate

the muscles that control the trunk and limbs; corticobulbar pathways to cranial nerves regulate the muscles of the face and head. The neural pathways from the cortex to these nerves (i.e., corticobulbar) are myelinated sufficiently at birth to allow the infant to signal a caregiver by vocalizing or grimacing and to engage the social and nutritional aspects of their world by gazing, smiling and sucking.

The neural regulation of the muscles of the face and head influence how someone perceives the engagement behaviors of others. This neural regulation can reduce social distance by allowing humans to make eye contact; vocalize with an appealing inflection and rhythm; display contingent facial expressions; and modulate the middle-ear muscles to distinguish the human voice from background sounds more efficiently (PORGES, 2011:15). When the tone of these muscle is reduced, which occurs spontaneously in response to a neuroception of danger or a life threat in the external environment (e.g., a dangerous person or situation) or the internal environment (e.g. fever, pain, or physical illness), you can notice: the eyelids droop; the voice loses inflection; positive facial expressions dwindle; awareness of the sound of the human voice becomes less acute; and sensitivity to other's social engagement behavior decreases (PORGES, 2011:15).

It is important to remember that neuroception of danger or a threat to life can occur with respect to the external environment or the internal environment. Even flat (rather than angry) facial affect might prompt a neuroception of danger or fear and disrupt the development of normal, spontaneous, interactive and reciprocal social engagement (PORGES, 2011:15).

III.E.1.9 Social Engagement System – face/heart

As mammals evolved from primitive vertebrates, a new circuit emerged to detect and to express signals of safety in the environment (e.g., to distinguish and to emit facial expressions and intonation of vocalizations) and to rapidly calm and turn off the defensive systems (i.e., via the myelinated vagus) to foster proximity and social behavior. This recent neural circuit can be conceptualized as a social engagement system. The Social Engagement System involves pathways traveling through several cranial nerves (i.e., V, VII, IX, X, and XI) that regulate the expression, detection and subjective experiences of affect and emotion. Neuroanatomically, this includes special visceral efferent pathways regulating the striated muscles of the face and head (i.e., special visceral efferent) and the myelinated vagal fibers regulating the heart and lungs. The social engagement system is an integrated system with both a somatomotor component regulating the striated muscles of the face and a visceromotor component regulating the heart via a myelinated vagus. The system is capable of dampening activation of the sympathetic nervous system and hypothalamic-pituitary-adrenal axis activity. By calming the viscera and regulating facial muscles, this system enables and promotes positive social interactions in safe contexts.

The Polyvagal Theory suggests that the heart is innervated not only by the dorsal (top) vagal nucleus, but also by fibers from another brainstem nucleus called the *nucleus ambiguus*, or ventral (bottom) vagus nucleus. The dorsal vagal nucleus lies near the top of the medulla: the ventral vagus nucleus more toward the bottom. The ventral vagal nucleus is present only in mammals and also plays a role in regulating the heart rate. The ventral vagus “keeps a lid” on the heart rate in mammals so they don’t “burn out” because of their need for speed and high energy expenditure. It acts as a regulator of the

fight/flight response inhibiting it until the prey mammal has a chance to access the severity of the potential danger. But it also contributes greatly to an optimal, high HRV and therefore appears to be a player in the maintenance of optimal homeostasis.

The unique thing about the ventral vagus nucleus is that it is surrounded closely by the nerve centers for the muscles of the head and neck, including those that govern the *orient response*. The other muscles represented in that region include those for moving the face/facial expression, dampening excessive vibration of the eardrum, speaking or vocalizing, moving the jaw and tongue and swallowing. All of these muscles are very different from other skeletal muscles. They are all derived from the muscles of the *gill arches* from the early embryonic state and are innervated by the brain, not the spinal cord. The muscles that develop from them are quite special and are critical for communication and for survival in general. Human animals have facial muscles that are by far the most complex and numerous of any species. The same applies to the muscles of the tongue, pharynx and vocal cords. Providing facial expressions and oral communication, these muscles are critical in the process of connection and bonding between mothers and infants, members of the family and tribe and the population in general. The muscles supporting hearing in the middle ear also participate in this process of mammalian connection. They dampen or release vibration in the eardrums and select for sound frequencies specific to the human voice, a process called *prosody*. Social, tribal and maternal infant bonding are critical factors in sustaining homeostasis (PORGES, 2003, SCAER, 2012:52-53). The vagus is primarily a sensory afferent nerve. The ventral nucleus of the vagus nerve is born in the nucleus ambiguus. A portion regulates the muscles of the larynx and pharynx, where prosody is strongly linked to the neural regulation of the heart. And the other part regulates striated muscles of the face via the facial nerve, the trigeminal nerve interacting with the nucleus

ambiguous. When a person smiles or hears voices, the vagal system of the heart is connected. The neuroscience stops at search motor fibers, but only 20% of the nerve fibers are motor, 80% of them are sensory. This information comes from the viscera and goes to the control system that mimics facial expressions, and the system is irradiated onto the cortex, using part of our brain only when we are safe. When caught, it turns off that part of our brain connected to the cranial nerves and social engagement (PORGES, 2011:191-193 cited CEZIMBRA, 2102). These critical nerve centers in mammals, located in the reptilian brainstem and allied with the ventral vagal complex, also appear to be essential to the maintenance of homeostasis through the process of communication and connection, and by modulating cardiac response to threat (PORGES, 2003, SCAER, 2012:52-53). If the neural tone does not work well in the larynx / pharynx, for example, prosody will not work well. All this is connected to the heart and bronchi on the striated muscles of the face and motor control of the heart and bronchi. For prosody to work, there needs to be contact via eye-to-eye, facial expression, humor or affection. Atypical posture during engagement promotes difficulty in safety regulation and hypersensitivity to sound. At birth, bidirectional communication between face and heart is the core of social engagement (PORGES 2011 apud CEZIMBRA, 2012).

III.E.2 - Vagal Tone:

The most readily indexed measure of PNS is derived from the heart rate pattern. The amplitude of respiratory sinus arrhythmia (RSA) provides a validated and easily obtainable index of PNS tone via the cardiac vagus (PORGES, 1986). With modern technology it is possible to monitor online the changing influence of the vagus on the heart and to estimate shifts in general vagal tone (PORGES, 1985). Physiologic and

behavioral processes are dependent on neural feedback. Information is received at the periphery and transmitted to the central nervous system, and appropriate physiologic reflexes or overt behaviors are emitted. Feedback loops typical of many homeostatic processes produce a rhythmic pattern characterized by phasic increases and decreases in neural efferent output to organs such as the heart. In many physiologic systems, efficient neural control is manifested as rhythmic physiologic variability, and within normal parameters the greater the amplitude of oscillation, the healthier the individual. Thus, the amplitude of rhythmic physiologic processes may index the status of the individual's nervous system and capacity to respond. In other words, the greater the amplitude of organized rhythmic physiologic variability, the greater the response potential or possible range of behavior. Individuals with attenuated physiologic variability would then exhibit a lack of physiologic and behavioral flexibility in response to environment demands (PORGES, 2011:68). The basic emotions are related to autonomic function and how they relate to survival, needs to be integrated in cardiopulmonary regulation. Porges notes the relationship between Respiratory sinus arrhythmia (RSA) and cardiopulmonary processes with special visceral efferent cranial nerves is related to vocalization, feeding, breathing and facial expression (PORGES, 2011: 142; cited CEZIMBRA 2013).

Chapter IV

HISTORY OF SOMATIC PSYCHOLOGY

Somatic Psychology, also called *body psychotherapy*, integrates a larger scope of body related phenomena, like the analysis of nonverbal communication (HELLER, 2012:3).

IV.A - BODY DEFINITION:

Any individual plant or animal is a body, a designation also used for animated entities. According to William James, the brain, hormones, and veins are parts of the human body (HELLER, 2012:3).

Damasio defines the term *body* for all the physiological dynamics of an organism – the nervous system, hormones, muscles and breathing (DAMASIO, 1999:29). This remains the most familiar usage of the term *body*.

The term *body* is equivalent to the term *organism* used by most biologists in which specifies “*a living being endowed with organs whose totality constitutes a living being*” (LAMARCK, 1802, Heller, 2012:3). Regarding usage of the term *organism*, Darwin wrote, “*The relation of organism to organism [...] is the most important of all relations.*”

In biology, every individual system capable of reproduction is referred by the term *organism*. All the mechanisms contained in an organism participate in several regulatory systems. They may thus have several functions simultaneously. One of these functions may be to belong to a particular dense network that organizes itself around a

particular adaptive function of the organism. There are no clear limits between one dimension and the other mechanisms of regulation of an organism (HELLER, 2012:4). Each entity is a system onto itself, and systems are hierarchically organized. The molecule is a system made up of atoms that organize themselves in a particular fashion; the cell is a system composed of molecules that also organize themselves in a particular fashion. In a similar way, the organism is an organization of organs; a group is an organization of organism in interactions. This hierarchical organization is known as the levels of organization of matter. It is important to understand that the dynamics of a particular system typically has such multiple sources.

IV.B - DEFINITION OF PSYCHOLOGY:

Psychology is defined as: *“The scientific study of the human mind and its functions, especially those affecting behavior in a given context”* (New English Oxford Dictionary, 1998:1497).

IV.B.1 - Regarding regulation’s mechanism of Psychology & Body:

The only thing that can be affirmed is that psychological and behavioral dynamics are situated somewhere at the intersection between the mechanisms of regulation of an organism, and the mechanisms that regulate the interaction between several organisms. The organismic models in psychology are mostly interested in how the psyche participates in the dynamics of organisms (HELLER, 2012:10).

IV.B.2 - Classical psychotherapy:

Classical psychotherapy preoccupies itself with psychological functions what is the ways a person perceives and experiences what is happening. A first characterization of body psychotherapy is to include in this category all forms of psychotherapy that explicitly use body techniques to strengthen the developing dialogue between patient and psychotherapist about what is being experienced and perceived. In most schools of body psychotherapy, the body is considered a means of communication and exploration that is just as complex and rich as verbal communication (HELLER, 2012:12). *“The body is no longer experienced as an object of awareness but as an aspect of awareness”* (SALVESON, 1997:35, HELLER, 2012:13).

Heller postulates that the body psychotherapeutic approach integrated two dimensions associated with the body:

1. The psychotherapist serves as a mirror and describes the way he/she perceives client’s behavior. He/she also asks the client to explore what is happening when they try to behave differently.
2. The psychotherapist utilizes body techniques in the field of physical therapy, dance and sports. The focus is first on the interaction between muscle tone, respiration, coordination of movements, and the psyche.
 - 2.1. To create a model that integrates bodily and psychological dynamics, body psychotherapists found it necessary to modify classical theories, which had been developed to explain what happens in one of these two domains: “When we take into account the impact of body phenomena on relational dynamics, we quickly notice to

what extent the current theoretical constructs relative to interaction need to be radically reformulated” (RISPOLI, 1995, HELLER, 2012:14).

IV.B.3 - The body as a vehicle for communication and healing:

Body Psychotherapy recognizes the body as a vehicle for communication and healing. It employs touch as an adjunct to verbal psychotherapy or counseling.

Touch, in the context of Somatic Psychology, refers to any *physical* contact occurring between therapists and clients. It means there are several types of touch that are initiated by the therapist as an adjunct to verbal therapy. Therapists can deliberately employ many forms of a touch as part of verbal psychotherapy. These forms of touch are intentionally and strategically used to enhance a sense of connection with the client and/or to soothe, greet, relax, quiet down or reassure the client. These forms of touch can also reduce anxiety, slow down heartbeat, physically and emotionally calm the client, and assist the client in moving out of a dissociative state.

Body Psychotherapy, or Somatic Psychology, assists people in healing and developing, not only through the use of verbal interventions, but also through guiding them to a deeper awareness of their bodily sensations, images, behavior and feelings. There are many approaches to body psychotherapy, just as there are multiple approaches in psychotherapy, and a variety of techniques are employed. “...*by using the direct physical experience of the body as a healing tool. These systems also advocate our continued growth and transformation as humans through reclaiming our integrative being*” (CALDWELL, 1997:26). Techniques common to most body-centered psychotherapies include attention to somatic awareness, breath, movement, imagery,

and touch, which can vary from deep manipulation used to release body blocks, to supportive hugs or holding (ZUR, O., 2004). Humanistic, Existential and Gestalt psychology, as well as dance and movement therapy, family therapy, systems theory, biology, and Far Eastern philosophy, have all contributed to body psychotherapy approaches. All attempt to integrate the body and mind and take into account when problems began and how they affect a person's development over the years.

IV.B.4 - Different approaches of Body psychotherapies:

There are many different approaches to touch in therapy. Body psychotherapies include schools, such as Reichian (REICH, 1972; ZUR O., 2004:52) and its numerous branches, Bioenergetics (LOWEN, 1976; ZUR 2004:52), Somatic (CALDWELL: 1997 ZUR O., 2004:52) or Hakomi, (KURTZ, 1990; ZUR O., 2004:52). Those approaches focus on harnessing the healing power of touch. There are numerous other psychotherapeutic orientations that have embraced touch. These orientations formalized the use of touch in therapy as an adjunct to verbal therapy. They include Gestalt therapy (PERLS, 1973; ZUR O., 2004), several variations of humanistic psychology (Rogers, 1970; ZUR O., 2004) and group therapy (EDWARDS, 1984; ZUR O., 2004:52). They also include some parts of feminist, child, family therapy and dance and movement therapy (SMITH et. al, 1998; SATIR, 1972; ZUR O., 2004:52).

IV.B.5 - History of Somatic Psychology:

The term *somatic* is often credited to Thomas Hanna, who had been very active in advancing the notion of the term to refer to educational processes designed to

reawaken- by methods of *functional integration* - the mind's potential to control movement flexibility and health. Thomas Hanna, along with Eleanor C. Hanna, founded the Novato Institute for Somatic Research and Training at Esalen Institute in California. In the late 1970s or early 1980s, they generated a diverse group of practitioners, psychologists and philosophers and theorists whom initiated the developing Somatic Psychology approaches. This institute, directly or indirectly, provided a focus for seminal influential figures of our current panorama including such eminent personalities as: Frederick Matthias Alexander, who innovated his own technique for overcoming reactive, habitual limitations in movement and thinking (ALEXANDER & BARLOW, 201; McGOWAN, 1997; BARRAT, 2010:63-70); Alexander Lowen, known for his bioenergetic work (e.g. LOWEN, 1976, 2003; BARRAT, 2010:63-70); Moshe Feldenkrais, who studied the work of Alexander, Gindler, Hacoby, as well the Armenian mystic George I. Gurdjieff (cf. CRAVIATO, 2007; BARRAT, 2010:63-70) and later developed his own method of awareness through movement (FELDENKRAIS, 1981, 1991, 2002, 2005; BARRAT, 2010:63-70); Ida Pauline Rolf, who founded the structural integration method Rolfing – Structural Integration of deep soft tissue manipulation to achieve postural release (ROLF, 1989, 1990; BARRAT, 2010:63-70); and Ilana Rubinfeld, who developed her own *synergy* method of combining talk and touch in a healing process (RUBENFELD, 2001, RUBENFELD & BORYSENKO, 2001; CHARLOTE SELVER; LITTEWOOD & ROCH 2004; 2007; BARRAT, 2010:63-70). Each of these individuals has had a major impact on the expansion of wisdom within their particular domains, and this list is far from exhaustive of Somatic Psychology and Bodymind therapy. We might make a special note of the work of Charlotte Selver, who taught at the Esalen Institute from 1963 onwards and, despite the fact that she published very little, had a very extensive influence on the development of

the *Human Potential Movement* (cf. LITTLEWOOD & ROCH, 2004). Selver believed in the importance of trusting organic processes and was an ardent advocate of what she called “sensory awareness.” She had trained with Elsa Gindler and Heinrich Jacoby in Berlin in the 1920s, coming to the United States in 1938 and establishing the *Sensory Awareness Foundation* in 1971. The list of people whom she taught or influenced in other ways is large, and includes such eminent figures as: Erich Fromm, Fritz Perls, Alan Watts, Moshe Feldenkrais, Ida Rolf, and a personal favorite, the mentor of this doctoral candidate, Peter Levine (BARRAT, 2010: 63-70; FOGEL, 2009:240), who developed the approach called *Somatic Experiencing*.

The prestigious Esalen Institute was founded in 1962 by Michael Murphy and Dick Price in order to support innovative and multidisciplinary education in areas often neglected by traditional academic programs. It continues to provide initiatives in Somatic Psychology and Bodymind therapy (ANDERSON, 1983; BARRAT, 2010:63-70). Today, many (but not all) of the themes and threads of Bodymind therapy are affiliated with either the European Association for Body Psychotherapy (EABP) or the United States Association for Body Psychotherapy (USABP).

IV.C- NEURO-AFFECTIVE DEVELOPMENT PSYCHOLOGY:

Developmental psychology has much to offer neuroscience, because it describes the relationship between interpersonal dynamics and the processes of personality formation. Neuro-affective development psychology focuses on the brain structures that are essential for the formation of relationships, personality development and emotions. There is a strong correspondence between neuro-affective development, posture and behavior of mis-regulated children and the somatic expression structures for which that

age is considered a formative stage. The behavior of one person has an automatic impact on the physiology of those who are around. The gesture of person A influences the senses of person B. The sensory system of person B can subsequently activate physiological, affective, and cognitive mechanisms, as well as modes of automatic reactivity. Most of these activations unfold nonconsciously, outside of the conscious intentions of the interacting organisms (HELLER, 2012:14-15). According to Margaret Mead and Gregory Bateson, it demonstrates a typical automatic dynamic of the mother-child relationship. Children learn to regulate their behavior by anticipating their caregivers' responses to them (SCHORE, 1994; VAN DER KOLK, 2005:402). This interaction allows them to construct what Bowlby called "internal working models" (BOWLBY, 1990-vol.3, VAN DER KOLK, 2005:402). A child's internal working model is defined by the internalization of the affective and cognitive characteristics of their primary relationships. Because early experiences occur in the context of a developing brain, neural development and social interaction are inextricably intertwined (VAN DER KOLK, 2005:402). *"For the human brain, the most important information for successful development is conveyed by the social rather than the physical environment. The baby's brain must begin participating effectively in the process of social information transmission that offers entry into the culture"* (TUCKER, 1992:75-128; VAN DER KOLK, 2005:408).

Edward Z. Tronick is a developmental and clinical experimental psychologist who studies the dysfunctions between mothers and young children by using research tools of nonverbal communication. He is, in effect, attentive to the fact that when an infant is anxious in front of his mother, it is not only the relational behavior that deregulates but also, often, the whole of the mechanisms of affective and homeostatic regulation of each organism. Tronick prefers to use the expression "individual system" instead organism

(TRONICK, 2007:2f). For Tronick, an individual system is mostly regulated by the nonconscious mechanisms that organize themselves in time, in function of practices set in action. He also says that the individual system is never coherent because the contour of the subsystems of the organism is fuzzy (regarded its mode of adaptation at every moment). Tronick also presumes that there is not one mind only or one consciousness, one memory, or one perception but a conglomeration of mechanisms that are designated by these terms (TRONICK, 2007; 493; HELLER, 2012:620-621). Tronick affirms that the human individual system is sufficiently flexible and powerful to calibrate itself in the function of interactions that it establishes with its immediate environment. Further, the most elementary survival functions have need of this mutual calibration, which constructs itself between the newborn and its family circle. The flexibility of the human organism has important constraints and limitations that guarantee its survival and a minimum of coherence to its development.

John Bowlby's epigenetic⁷² understanding of attachment and development psychology was according to Susan Hart, who pointed out that children's psychological development takes place in a dynamic interaction between genetic predispositions and the environment, which shape each other in a mutual process that begins at a conception. According to Tronick, a person born a million years ago is almost the same genetically as one born today. It is possible that individuals who were particularly adapted to survival in a wild natural environment are less well adapted today, while those that could not survive a million years ago can do so in our modern cities. In over a million years, humans were able to acquire a greater variety of survival and reproductive behaviors and create numerous adaptive devices (buildings, medication, etc.). One important point Tronick describes is an association

⁷² Epigenetic is the study of heritable changes in gene activity that are not caused by changes in the DNA sequence: the changes in genes expression (Wikipedia).

between regulators of the organism and a style of interaction that is set in place in the newborn at birth and probably even before. There would then be a physiologic memory of a state of reference for the systems of regulation of the organism. This state of reference would be felt, from the point of view of consciousness, as a profound affective link that mobilizes a feeling of loyalty (TRONICK, 2007-493-495; HELLER, 2012:62-624). There is established attachment to parents in one's early childhood through this typical, dynamic relationship between parents and child. Each phase manifests itself through a repertoire of various conducts that increase with the age of the child. Our potential capacities are expressed through the basic structures of the brain, i.e., through heredity; but those environmental factors mobilize these latent capacities by altering the efficiency of the existing neural pathways and causing new behavioral patterns to emerge. Our life experiences are critical for the differentiation of brain issues (GARDNER, H., 1996; HART, 2008:2). The neural structure determines the potential, but experience gives it its specific form. The structure that the nervous system has from birth determines the opportunities and the changes that environmental influences can lead to. Some genes only express themselves under certain life circumstances, and individuals who are particularly genetically vulnerable are also more receptive to psychological damage from environmental factors. We respond differently to similar stress stimuli, and environmental factors affect our personalities in different ways (GARDNER, 1996; RUTTER & RUTTER, 1997; HART, 2008:3).

IV.C.1 - The human biological capacity for social engagement:

Humans are social beings, and our psychological functions depend on interactions and transactions with the social environment during our lives, especially in childhood.

The human brain is the most complex and plastic natural system in the known universe. Humans and mammals have many instinctual operational brain systems, but in the mature adult human brain the instinctive processes are difficult to observe, because they are no longer expressed directly but are filtered and modified by higher cognitive activity. These processes are controlled by chemical substances and molecules that foster optimal neuronal growth patterns. Our genes enable us to effectively utilize these abilities and navigate in a complex world. These trends are combined in motor skills, sensory perception affect, motivation, emotion, thinking, behaviors, etc. – all aspects that we define as personality (HART, 2008:4).

Body psychotherapists assume that central parts of the personal narrative are accessible only in the inner sensory field, and that they are existentially grounded in the person's motor patterns and habits (BENTZEN, 2004:1).

IV.C.2 - Emotional System Regulation:

The emotional system probably holds a key position in the imprint of many higher and lower brain activities. Owing to the interactions of the limbic systems with higher brain regions, no emotion is unaccompanied by thought, and many thoughts produce emotions. The innate emotional system interacts so intensively with higher brain systems, that the normal animal brain is probably incapable of having an emotional condition without cognitive processes (PANKESPP, 1998, HART 2008:13). Owing to the interaction of the limbic system with lower brain regions, there are no emotions without physiological or behavioral consequences, and many of the resulting bodily changes might also regulate the tone of the emotional system in a feedback loop.

John Bowlby pointed out this hierarchical structure makes the brain more adaptable and efficient, but it also renders the developing nervous system more vulnerable and susceptible to the risk of actually losing efficiency. As development progresses, ever more brain structures can be activated simultaneously in support of each other, but there is also a risk of brain structures dissociating or competing against each other (MORTENSEN, 2001; HART, 2008:14).

All behavioral changes are reflected in the nervous system, and all major changes in the nervous systems are reflected on all neural and behavioral levels. Everyday sensory experiences, sensory deprivation, and learning may weaken certain synaptic connections under certain circumstances, or strengthen them under a different set of circumstances (KANDEL, 2005; HART, 2008:14). External stimuli influence the brain's affect-regulating systems in which in turn affects hormones and neurotransmitters. The social environment changes during infancy, lead to the disorganization and reorganization of brain structures. The range of interactions between caregiver and infant is imprinted on the infant's developing nervous system. Various types of stimulation triggers affective interactions and are embedded in certain physiological and psychological patterns in the infant's nervous system. Early affective exchanges between infant and caregiver form the basis for the self-regulating mechanism that remains an important organizing principle throughout life (KRYSTAL, 1988; SCHORE, 1994; HART, 2008:14).

IV.C.3 - Affect, Caregivers and Tolerance:

Early patterns of attachment affect the quality of information processing throughout life (CRITTENDEN, 1992:575-602, VAN DER KOLK, 2005:403). Secure infants learn to trust both: what they feel and how they understand the world. This allows them to rely

on both their emotions and their thoughts to react to any given situation. Their experience of feeling understood provides them with the confidence that they are capable of making good things happen and that, if they do not know how to deal with difficult situations, they can find people who can help them find a solution.

Secure children learn a complex vocabulary to describe their emotions such as love, hate, pleasure, disgust, and anger. This allows them to communicate how they feel and to formulate efficient response strategies. They spend more time describing physiological states, such as hunger and thirst, as well as emotional states, than do maltreated children (CICCHETTI, 1990:359-382; VAN DER KOLK, 2005:403).

IV.C.4 - Trauma and neuroaffective developing relationship:

Under most conditions, parents are able to help their distressed children restore a sense of safety and control. The security of the attachment bond mitigates against trauma-induced terror. When trauma occurs in the presence of a supportive, if helpless, caregiver, the child's response is likely to mimic that of the parent – the more disorganized the parent, the more disorganized the child (BROWNE, FINKELHOR, 1986:66-77; VAN DER KOLK, 2005:403). However, if the distress is overwhelming, or when the caregivers themselves are the source of the distress, children are unable to modulate their arousal. This causes a breakdown in their capacity to process, integrate and categorize what is happening. At the core of traumatic stress is a breakdown in the capacity to regulate internal states. If the distress does not ease, the relevant sensations, affects, and cognitions cannot be associated – they are dissociated into sensory fragments (VAN DER KOLK, 1995: 505-525), and, as a result, these children cannot comprehend what is happening or devise and execute appropriate plans of action.

IV.C.5 - Neural Emotional Dysregulation:

Dysregulation that occurs during a particular critical phase for the development of neural circuits is not always evident until the symptoms emerge. For example, Varela and Maturana (1992) write that if a newborn lamb is separated from its mother for a few hours and then reunited with her, the lamb will appear to develop normally until it begins to interact with other lambs. A lamb that had been separated from its mother does not know how to play, and it becomes isolated. This animal's reaction patterns and nervous system clearly differ from those of other lambs, due to its brief separation from its mother, perhaps because the mother licks the newborn lamb incessantly during the first few hours after birth. Because it was separated from its mother, the newborn lamb was deprived of this tactile stimulation and, possibly, the release of certain neurotransmitters that would have been triggered by this interaction. The lamb's interaction with the mother immediately after birth appears to have substantial impact on the development of the nervous system, and the consequences are evident in the lamb's behavior in areas that are far removed from the licking behavior.

The magnificence of the nervous system lies in its plasticity in relation to the environment, and neural circuits can develop only when they receive optimum levels of arousal and stimulation. Both the nature and the timing of experiences are important for development. Children and parents reflect the world they have been born into, and the human brain has immense capacity for developing in a user-friendly manner. The brain grows, organizes, and functions in relation to unique life experiences, and experience modifies all human behavior. But the complexity of the brain also makes it a vulnerable and fragile structure (VARELA & MATURANA, 1992; HART, 2008:16-17).

Parenting plays an important role in the emotional and cognitive development of the offspring. Children who have been exposed to abuse or neglect are more likely to develop numerous psychopathologies, while good parent-infant bonding is associated with improved resiliency to stress (KAFFMAN & MEANEY, 2007:224-244). Childhood abuse or neglect is associated with increased vulnerability for several psychopathologies, such as anxiety, mood disorders, poor impulse control, and psychosis that persists throughout life (BEBBINGTON ET AL., 2004; FREYD ET AL., 2005 HEIM & NEMEROFF, 2002; MULLEN, MARTIN, ANDERSON, ROMANS, & HERBISON, 1996; KAFFMAN & MEANEY, 2007:224-244). Importantly, the sequences of early-life stress are not restricted to psychiatric vulnerabilities, but are also associated with increased risk for several other medical morbidities such as obesity and cardiovascular diseases (FELITTI ET AL., 1998; KAFFMAN & MEANEY, 2007:224-244). Several observations suggest that at least some of the long-term effects of early life stress, are mediated by poor levels of parent-infant bonding and decreased parental investment during early life. For example, poor parental bonding, not considered as abuse or neglect, is also associated with increased risk for several psychological vulnerabilities (CANETTI, BACHAR, GALILI-WEISSTUB, De-NOUR, & SHALEV, 1997; KAFFMAN & MEANEY, 2007:224-244), and randomized control interventions, aimed at improving parental care, demonstrate improved behavioral outcomes and cognitive performance that persist for years (D.OLDS ET AL., 1998: D.L. OLDS, KITZMAN et.al., 2004, D.L.OLDS ,ROBISON ET AL., 2004; KAFFMAN & MEANEY, 2007:224-244).

When caregivers are emotionally absent, inconsistent, frustrating, violent, intrusive, or neglectful, children are likely to become intolerably distressed and unlikely to develop a sense that the external environment is able to provide relief.

Children with insecure attachment patterns have trouble relying on others to help them and are unable to regulate their emotional states by themselves. As a result, they experience excessive anxiety, anger, and longing to be taken care of; these feelings may become so extreme as to precipitate dissociative states or self –defeating aggression. *Spaced outer* hyper-aroused children learn to ignore either what they feel (their emotions), or what they perceive (their cognitions). When children are unable to achieve a sense of control and stability, they become helpless (VAN DER KOLK, 2005:403).

IV.D - THE SOMATOMOTOR COMPONENTS INCLUDE NEURAL STRUCTURES IN SOCIAL AND EMOTIONAL BEHAVIOR:

Special, visceral, efferent nerves innervate striated muscles, which regulate the structures derived during embryology from the ancient gill arches (Truex & Carpenter, 1969). The social engagement system has a control component in the cortex (i.e., upper motor neurons) that regulates brainstem nuclei (i.e., lower neurons) to control eyelid opening (e.g., looking), facial muscles (e.g., emotional expression), middle ear muscles (e.g., extracting human voice from background noise), muscles of mastication (e.g., ingestion), laryngeal and pharyngeal muscles (e.g., prosody of vocalization), and head-turning muscles (e.g., social gesture and orientation). Collectively, these muscles function as neural gatekeepers, detecting and expressing features of safety (e.g., prosody, facial expression, head gestures, eye gaze) that cue others of intention and control social engagement with the environment. The phylogenic origin of the behaviors associated with the social engagement system is intertwined with the phylogeny of the ANS. As the muscles of the face and head emerged as social engagement structures, a new component of the ANS (i.e., a myelinated vagus) evolved that was regulated by

nucleus ambiguus, a medullary nucleus ventral to the dorsal motor nucleus of the vagus. This convergence of neural mechanisms produced an integrated social engagement system, with synergistic behavioral and visceral voice, facial expression, head gesture, and prosody is a common feature of individuals with autism and other psychiatric disorders in which the social engagement system is compromised. Thus, it infers from the functioning of the face and the prosody of the voice, difficulties in both social engagement behaviors and physiological state regulation. There are interneuronal connections between the source nuclei (i.e., lower motor neurons) of special visceral efferent pathways and the source nucleus of the myelinated vagus. These neurophysiological circuits provide an inhibitory pathway to slow heart rate and lower blood pressure, which, by actively reducing autonomic arousal, promote the calm states necessary to express social engagement behaviors and to support health, growth and restoration. The brainstem source nuclei of this system are influenced by higher brain structures and by visceral afferents. Direct corticobulbar pathways reflect the influence of frontal areas of the cortex (i.e., upper motor neurons) on the medullary source nuclei of this system. Porges says that feedback through the afferent vagus (e.g., tractus solitarius) to medullary areas (e.g., nucleus of the solitary tract) influences both the source nuclei of this system and the forebrain areas that are assumed to be involved in several psychiatric disorders (CRAIG, 2005; THAYER&LANE, 2000). Also, the anatomical structures involved in the social engagement system have neurophysiological interactions with the HPA axis, the social neuropeptides (e.g., oxytocin and vasopressin) and the immune system (CARTER, 1998; PORGES 2001b; PORGES, 2011:270-271). Afferents from the target organs of the social engagement system, including the muscles of the face and head, provide potent afferent input to the source nuclei regulating both the visceral and somatic components of the social

engagement system. Thus, activation of the behavioral component (e.g., listening, ingesting, looking) could trigger visceral changes that would support social engagement, while modulation of visceral state, depending on whether there is an increase or decrease in the influence of the efferents on the sinoatrial node (i.e., increasing or decreasing the influence of the vagal brake) would either promote or impede social engagement behaviors. For example, stimulation of visceral states that would promote mobilization (i.e., fight-or-flight behaviors) would impede the ability to express social engagement behaviors (PORGES, 2011:271).

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

IV.E- SELF-REGULATION:

Self-regulation is characterized physiological systems. Weiner (1948) proposed a model of self-regulation of the nervous system to explain homeostasis. According to Weiner, homeostasis is an emergent property of a system that, through bidirectional communication, monitors and regulates the status of a body in order to maintain a level of performance within a specific functional level (PORGES, 2011:101). The system would include a central regulator that would determine performance motor for an organ after interpreting information from a sensor (e.g., afferent feedback) that monitors the status of the organ. To maintain physiological homeostasis, sensory pathways originating in

peripheral organs transmit information related to the physiological status, and motor pathways (e.g., vagal pathways and cardiac sympathetic system), change the performance of peripheral organs. The sensory pathways from the visceral organs originate in the periphery and usually end in the brainstem; however, many of the pathways originate in the brainstem and terminate in the periphery (PORGES 2011, 99-102).

Physiological systems could be described as being composed of sensors that input information about external and internal environments (outside the body), and (within the body) motor systems that control visceral and behavioral activity and an integrating mechanism which evaluates the input from sensors and determines specific aspects of motor performance (PORGES, 2012:102). The human nervous system operates as a collection of various interactive, self-regulatory, negative feedback systems, each with its specific role. Sensors or receivers are located on the body surface and to evaluate the environmental changes within the body, as well as internal conditions. The motor systems control the movements of the body and visceral organs. The feedback from the internal structures are interpreted by the brainstem sensors that contribute to the regulation of the autonomic state (e.g., solitary tract nucleus, motor nucleus of the vagus, Arrhythmia Sinus Respiratory (ASR) ambiguous nucleus). The nervous system promotes infrastructure for all levels of self-regulation. The regulation of these processes depends on motor fibers emerging from a medullary core known as the *nucleus ambiguus*. These myelinated motor fibers originate in the nucleus ambiguus, transiting through the tenth cranial nerve, the vagus. The vagus contributes additional sensory and motor fibers for self-regulation of physiological systems. The vagus contains fibers that provide sensory feedback and motor fibers that originate in the motor nucleus of the vagus ASR. Sensory fibers comprise approximately 80% of vagal fibers. Vagal sensory fibers originate in various organs (e.g., heart, lung, stomach,

pancreas, liver, intestines) and end at an area of the brainstem known as *solitary tract nucleus*. Vagal motor fibers originating in the motor nucleus of the vagus ASR different myelinated motor fibers originating in the nucleus ambiguus, the motor fibers unmyelinated generate a primary motor control of the digestive system which protects the bronchi and heart: the afferent and efferent pathways that transmit bidirectional communication between peripheral organs and the brain stem, wandering through the vagus. Neurophysiological studies suggest that the frequency of breathing is determined by the brainstem system that also activates the respiratory rhythm to the heart and bronchi. The agreement between these rhythmic processes can functionally enhance oxygen diffusion and coordinate breathing and heart rate with other processes, dependent on motor fibers of the nucleus ambiguus, such as sucking, swallowing and vocalization. The model assumes that behavior with organized motor activity associated with feeding and emotion regulation during social interaction, depend on a more related primary physiological substrate systematic regulation of the autonomous state (PORGES, 2011:103).

IV.E.1 - Physiological Homeostasis:

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

oxytocin, vasopressin, gastrin, somatostatin. When there are no environmental demands, the autonomic nervous system meets the needs of internal viscera (internal organs such as heart, lungs and intestines) to enhance growth and restoration. When there *are* environmental demands, homeostatic processes are compromised and the autonomic nervous system facilitates increased metabolic production, down regulating the functions of "growth and restoration" to deal with these external challenges (PORGES 2011, 104-111). The nervous system receptors of sensory response receive notice that conditions within the body (interoceptors) to facilitate homeostasis, and receivers outside the body realize conditions (exteroceptors) to deal with environmental challenges. The vagal cardiac performance is associated with both. In general, cardiac vagal tone is increased to facilitate homeostatic functions, and there is a decreased to increased cardiac performance and facilitate specific motor behaviors in response to environmental challenges. The vagal system regulates the metabolic performance (ROWELL, 1993; PORGES, 2012:120) to promote psychological and motor processes associated with appropriate engagements and disengagements to the environment. To interact with the environment, the priorities of the visceral response system change visceral state optimization, to promote growth and restoration (i.e, homeostasis) to a metabolic performance optimization to facilitate motor behavior required by external challenges. The central nervous system mediates the distribution of resources to handle internal and external demands and can be monitored via the dynamic regulation of the heart by the vagus (PORGES, 2011:121).

IV–E.3 - Recent neuroscience’s perspective for Self-regulation:

The focus, up to this point, has been on bottom-up phenomena – the transition from sub-cortical – implicit to cortical – explicit processing.

The neuronal pathways in question are bidirectional, indicating that top-down processes must be considered as well. To the extent that we are dealing with conscious processing, the question may be asked how conscious processing of emotional information alters the functioning of subcortical structures, and how top-down and bottom-up processes equilibrate. This is an area in which relatively little work has been done.

One approach is to consider cortical influences on autonomic regulation. The dorsal ACC (*anterior cingulate cortex*) and dorsomedial prefrontal cortex have autonomic regulatory functions that are mediated by direct neural connections with subcortical *visceromotor centers* (PRICE, CARMICHAEL & DREVETS, 1996 - 1999; BEAUREGARD, 2011:107-109) has observed in PET (positron emission tomography) research that blood flow in medial prefrontal cortex is inversely related to heart rate (Drevets, 1999). Stimulation of *the* medial prefrontal cortex is also known to produce increased heart rate and blood pressure in rabbits (BUCHANAN, VALENTINE, & POWELL, 1985). Critchley and colleagues observed in an fMRI study of physical and mental stress that heart rate variability (HRV) correlated positively with activity in the dorsal ACC (CRITCHELY et al. 2002). We have similarly observed a positive correlation between the high frequency, vagal, component of HRV (Heart Rate Variability) and activity in the medial prefrontal cortex (LANE et al. 1999). Thus, these centers, when activated in conjunction with conscious emotional experience, have a tonic inhibition effect mediated through the *vagus* nerve.

The positive correlation between medial prefrontal activity and vagal tone is interesting in two respects. First, one aspect of the correlation is that higher levels of vagal tone are associated with greater activity in the medial prefrontal cortex. Based on the findings reviewed above, it would appear that a freer degree of conscious processing of emotion is associated with greater vagal tone. This can be understood in terms of parallel levels

of complexity in the patterning of autonomic responses. Greater emotional awareness is associated with greater differentiation and complexity of experience. Support for the association between the two comes from studies of anxiety disorders, in which less and differentiated emotional experience is associated with lower levels of vagal tone (THAYER & LANE, 2000; BEAUREGARD, 2010:107-109).

Second, in the case of lower level of vagal tone, the positive correlation means that when vagal tone is low, activity in the medial prefrontal cortex is diminished. One way of understanding this is that in a state of emergency associated with high arousal (and reduced vagal tone), the more evolutionarily advanced *frontal lobe* mechanisms go off-line (i.e., their activity becomes attenuated), leaving behavioral control to more automatic, evolutionarily more primitive, neural centers. Put in another way, in an emergency situation implicit processes take over as explicit, deliberative mechanisms go off-line. This may be an automatic mechanism that ensures that in a life-threatening crisis, mechanisms perfected during the course of evolution take over.

Various subsectors of the frontal lobe in association with arousal can exist: At very high states of arousal and at very low states of arousal, reflection upon or attention to one's own emotional state may be minimal or non-existent. One might hypothesize that a hierarchy of *dissolution* may exist, whereby reflection, focal attention and background feelings are successively eliminated from conscious awareness, as arousal gets progressively more or progressively less intense. It therefore appears that when emotional experience is consciously attended to, a feedback process occurs whereby vagal tone is facilitated and emotional arousal is modulated. In contrast to a generalized state of arousal, in which a diffuse network of neural structures is mobilized to process sensory information, attention is selective for certain inputs and not others, and involves

selecting certain actions while others are inhibited (THAYER & LANE, 2000; PAUS, 2000; BEAUREGARD, 2010:107-109).

Thus, through a process of equilibration of bottom-up and top-down interactions, bodily state is altered as diffuse arousal mechanisms become modulated and differentiated. One implication of this model is that becoming consciously aware of one's own emotional responses in itself has a physiological effect that is self-regulatory. It is entirely consistent with the clinical notion that to get through an episode of emotional distress, one must first allow oneself to experience the distress fully, as this will then lead to a process of recovery (GREENBERG, 2002, BEAUREGARD, 2010:107-109).

Phenomenal awareness can be differentiated into background feelings and feelings that are the focus of attention. When focal attention is directed to the experience of emotion, the dorsal anterior cingulate is activated and interacts with the other structures at this level and below. In the absence of focal attention, participation of *paralimbic structures*, *somatosensory cortex* and *right parietal cortex* are associated with background emotions. These structures may well be sufficient to mediate experience. These experiences constitute phenomenal awareness, which is mediated by the addition of paralimbic structures to the network of structures that mediate implicit emotion. The paralimbic structures include the anterior cingulate cortex, *insula temporal pole* and orbitofrontal cortex. The orbitofrontal cortex activity appears to be associated with the perception of somatic sensations in context, biasing behavior either toward or away from a stimulus (Damasio, 1994), overriding automatic processes in the amygdala and participating in extinction, among other functions (EMERY & AMARAL, 2000: BEAUREGARD, 2010:107-109).

The highest level of the neuroanatomical model is prefrontal cortex. The *para-cingulate* region of the medial prefrontal cortex is necessary for reflective awareness. The *para-cingulate* region includes the rostral anterior cingulate cortex and the medial prefrontal cortex, per se (BEAUREGARD, 2010: 106).

IV.F - SOMATIC EXPERIENCING™ - A MAP IN THE TRAUMA RESOLUTION

Peter A. Levine created the SE - Somatic Experiencing™ method, the fruit of many years of multidisciplinary study. The method offers a clinical map for accessing the physiological states in which the person is “trapped” in the responses of fight, flight, freezing, or in the collapse⁷³ state. This method facilitates the completion of the self-protective motor response and relieves the survival energy accumulated in the body, intervening in the root that causes the symptoms of the trauma. It is a method that removes the traumatic shock in order to transform and prevent the symptoms of PTSD, adult emotional wounds or those of early psychological development. Levine states that his clinical work with thousands of patients confirms the fact that immobility may exist *with or without fear*, and that one powerful tool in transforming the trauma is to help the patient access the state of immobility without fear. He believes that “Only when the immobility becomes inextricably and simultaneously coupled to an intense fear and other strong negative emotions, do we have the trauma feedback loop rooted in the form

⁷³ “When any organism perceives an imminent mortal danger (with a reduced or non-existent possibility of flight), the biological reaction is paralysis and shutdown. Ethologists call this innate response *tonic immobility* (LEVINE, 2012:36. 2) “*Of the three basic instinctive defense systems – fight, flight, or freezing-immobility, the latter is controlled by the most primitive part of the physiological sub-systems. This neural system (mediated by the un-myelinated part of the vagus nerve) controls the conservation of energy and is triggered only when the person perceives that death is imminent (or by intense and continuous stress) – whether the threat comes from outside, in the form of a mortal threat, or inside, such as a disease or a serious injury*” LEVINE, (2012:105) 3) “*This resource (system of immobilization) aims to act sharply and only for brief periods*”; LEVINE, 2012:105).

of persistent PTSD” (LEVINE, 2012:63). Levine, with his clinical observations over decades of work, states: “The ‘physiological’ capacity of entering and later leaving the innate (inherent) response of immobility is the key both to avoiding the debilitating and prolonged effects of the trauma and to curing even the most deeply-rooted symptoms.⁷⁴ For a person who is traumatized, having the capacity to touch their feelings of immobility, even for a brief moment, restores the completion at their own pace and allows the ‘unraveling’ of the fear and freezing to begin” (LEVINE, 2010:88). This therapeutic method, observing the nervous system of traumatized people within a state of relative relational security, has the primary objective of resolving the trauma, “...having the capacity to unlink and separate the fear from the immobility” (LEVINE, 2010:63). Dr. Levine, one of the few psychologists who work with tonic immobility as a model for trauma, agrees that when an intense fear (and other strong negative emotions) is associated with the immobility response, it becomes imprisoning and consequently traumatic. *“This difference indicates a clear logical foundation for a therapy model that separates the fear and other strong negative emotions from the biological response of immobility (normally of limited duration). The separation of the two components breaks the feedback loop that feeds the trauma response”* (LEVINE, 2010:64).

IV.F.1 - SE – Contemporary innovation for trauma therapy:

Levine’s main idea, in his wonderful, creative genius, is to enable the person to touch the sensations of immobilization, or freezing, in small doses – *titrated*, as he calls it. This challenges the physiology, through the biological pendulum of movement, to move the noxious stress or irritation that stress causes in the organism. Thus, with the help of

⁷⁴ Chronic and complex traumas

the therapist maintaining his or her own presence and the patient's felt-sense,⁷⁵ a new adaptation, a new organization can emerge, so that homeostasis may be reestablished.

The manner proposed by Levine to increase awareness of integral health is to identify and use the trauma indicators that are available through the felt-sense. The felt-sense process, as you track sensation from bottom to head will only work if you have a relationship to the feeling tones held within the body space. "This is the embodied realm of the felt-sense" (SILLS, 2001:373).

Helping the patient develop the felt-sense of the internal sensations, the tensions, the relaxation, the respiratory cycle, and other responses of the autonomic nervous system, etc., is a powerful resource for the recovery of resilience. If we remain in this state of consciousness for some time, we begin to develop the felt-sense of the movement of energy flow that is vital and alive. This is pleasurable; it's a good feeling, a resource that can help us obtain a non-verbal knowledge of who we are. Healing the psychological effects of trauma require us to cultivate the awareness of these sensations, because through this process of gaining awareness, we can allow the physiological impulses to be fulfilled (SILLS, 2001:372). Levine, with his tracking model from bottom to head, inspired by Yakovlev and by Paul McLean's map of the triune brain, classified a dynamic order for the felt-sense. This dynamic of self-observation favors a constant flow in the relationships among the three hierarchical functions of the brain. What happens in the brain is represented on the sub-cortical level, involving all the tissues of the bodily systems.⁷⁶ This classification, based on the sensory and perceptive information that is part

⁷⁵ "Felt-sense" Term created by Eugene Gendlin. It is the result of what we perceive through our sensing organs and what we perceive through the information that we receive from within the body.

⁷⁶ Bodily systems, is regarded by Myers (2009) as the truly holistic systems and they are a inter-relationship between neural, fluid and fibrous's network. All this three system of communication between systems happen all the time in any intervention or any impact from inner and or outer environment.

of the functions of the parietal lobes, which process this information of internal experience, that is, what the human experiences, Levine called **SIBAM**:

This five-element model is the essence of “bottom-up,” sensorimotor processing aimed at guiding the client through different “language” and brain systems, from the most primitive to the most complex; from physical sensations to feelings, perceptions and, finally, to



thoughts. The sensation, image, affect and meaning are tracked by the client, while behavior is directly observed by the therapist. This approach allows for an intimate tracking of the multiple layers and textures of the totality of experience (LEVINE, 2010:139).

This model of communication channels shows a dynamic relationship of what happens inside and outside that can only be perceived by sensing and by perception facilities that are constantly changing. The perception-sense is so essential to the human experience that we almost do not perceive it, and to continue this journey, attention is required. Levine refers to *physical sensations that arise from within the body*, such as receptors lying in the interior of organisms.

The Sensation Channel: These sensations are also known in the literature as *interoceptive*.⁷⁷ They ascend via nerve impulses from the interior of the body to the thalamus in the upper brainstem, where they are transferred to many, if not most, regions of the brain. Four subsystems, or categories, make up the sensation channel in

⁷⁷See more about interoception at the chapter V.

order of increasing depth: the kinesthetic, the proprioceptive, the vestibular and the visceral receptors.⁷⁸

The Image Channel: Levine uses it more generally to refer to *all* types of external sense impressions, which originally come from *stimuli that arise from outside the body* and that have also incorporated into the brain as sense memory. These external senses include sight, taste, smell, hearing and the tactile sense. According to Levine, the largest portion of the sensory brain is dedicated to vision. There are, however, other therapeutically oriented reasons for including all of the external senses in the Image channel. At the moment a trauma takes place, all of a person's senses automatically focus on the most salient aspect of the threat. This is usually a visual image, though it could also be sound, touch, taste or smell. Many times it is a combination of several, or even all, of the above sense impressions simultaneously. When a traumatized individual is able to expand his or her sensorial impressions, associated hyper-arousal begins to ease, allowing that widened perceptual field to return to its pre-threat status, thus enhancing the capacity of self-regulation (LEVINE, 2010:139-142).

The Behavior Channel: Although the therapist is able to surmise much about a client's inner life from a resonance with their own sensations and feelings, such inferences cannot take the place of the client also accessing and communicating his/her own sensations, feelings and images to the therapist. The therapist can *infer*⁷⁹ *a client's inner states from reading his/her body language,*⁸⁰ *the unspoken language of his/her actions/inactions or tension patterns.* Behavior occurs on different levels of awareness, ranging from the most

⁷⁸See more about Kinesthetic/exteroceptive, the proprioceptive, the vestibular and the visceral receptors at the chapter V.

⁷⁹Infers, not projecting therapist's sensations.

⁸⁰For more about body's language, see the chapter V.

conscious, voluntary movements to the most unconscious, involuntary patterns. These levels are similar to the gradations of consciousness Levine has examined in the sensation category (LEVINE, 2010:143-144). Behaviors examined on SE's Map are: gestures, emotion and posture, autonomic, visceral and archetypal behaviors.

The Affect Channel: Levine organized his affect channel around two subtypes of feeling: The categorical emotions described in Charles Darwin's evolutionary theory and the felt sense or contours of sensation- based feeling.

Emotions: These distinct emotions include fear, anger, sadness, joy and disgust. These are feelings that the client is experiencing internally and that a therapist can deduce from the client's face and posture, even when the client is unaware of them.

Contours of Feeling: Contours of feeling is, perhaps, even more important to the quality and conduct of life than are the categorical emotions. Eugene Gendlin extensively studied and described these softer affects when he coined the term felt-sense. Contours are the sensation-based feelings of attraction and avoidance, of "goodness" and "badness." Ones experience these nuances countless times throughout the day. While it's easy to imagine a day without perceiving any of the categorical emotions, try for a moment to conjure up a day without any felt-sense affects. On such a day one would be as lost as a ship at sea with no rudder or bearings. These contours guide ones throughout the day, giving them orientation and direction in life (LEVINE, 2010:150).

The Meaning Channel: Meanings are the labels one attaches to the totality of experience – that is, to the combined elements of sensation, image, behavior and affect. Everyone has fixed beliefs or meanings that they take to be the unequivocal truth. When a person is traumatized, his/her beliefs become excessively narrow and restrictive. Some examples are: "The world is a dangerous place," "I won't ever make enough money to

support myself,” or “I’m unlovable.” These beliefs are often connected to primal fears and are, by and large, negative and limiting. Unfortunately, when one has been traumatized or deeply conditioned through fear while young and impressionable, such meanings become pervasive and rigidly fixed. Later in life, rather than a client freely accessing the full spectrum of developing sensations and feelings, conclusions are drawn based on meanings born out of past trauma or early conditioning (LEVINE, 2010:151). Using the SIBAM model, the therapist can help the client work through the first four channels of awareness in order to reach *new* meanings. When cognition is suspended long enough, it is possible to move through and experience flow via these different channels (and subsystems) of Sensation, Image, Behavior and Affect. Then it is probable for *fresh new Meaning* to emerge out of this unfolding tapestry of body/mind consciousness (LEVINE, 2010:151).

Levine's SIBAM model includes the neurophysiologic, behavioral and somatic aspects of an individual's experience. When there is a successful outcome, or a corrective experience occurs during therapy, the elements of SIBAM form a fluid, continuous and coherent response that is appropriate to the immediate situation. When individuals suffer from unresolved trauma, these various aspects of traumatic association and disassociation continue in fixed, now-maladaptive patterns that are distortions of current reality (LEVINE, 2010:152). It means that the biological elements of Levine's model fit together to create a web of either fixity or flow. In nature, when one feels an internal sensation, frequently an image appears simultaneously or shortly afterward. If a client is bothered by an image, a sensation may accompany it that he or she is not aware of. With the therapist's guidance, when the client becomes conscious of both elements, a behavior, affect or new meaning generally follows. Once ones understand the process and do not interfere with it, biology works to move it along. The sensation-based

brainstem has the job of bringing homeostasis and, thus, goodness back to the body. Therefore, it *naturally* follows that when the client's body's behavior becomes conscious in the safety of the present moment, the thwarted movements come to an intrinsic resolution or a corrective experience (LEVINE, 2010:153). This resolution leads to a discharge of energy, resulting in a fresh *new affect* that brings with it brand-new options or meanings. If the client is unaware of behavior or sensation, the fixed image generally leads to fixed affects and/or thoughts that were troubling the client to begin with. When a fixed behavior does not complete in a new way, the result is a habitual or (over) coupled affect. Because behavior reflects preparatory, protective and defensive orienting responses, assisting clients to follow their sensorimotor impulses to completion, as they come out of freeze, is a key to unlocking the constrictive and limiting prison of posttraumatic stress disorder. The therapist's task as healer is to notice which SIBAM elements a client presents with are hold, conditioned, ineffectual patterns and which are missing completely because they are unconsciously hidden. In SE, following the process of the client is called *tracking*.

SE's process is the use of tracking by paying attention to the physical sensations and monitoring the internal movement of physiological reactions by the present consciousness of the patient, with the aim of diminishing the neural activation so that the therapeutic process proceeds. The therapist assists, at the appropriate time, in titrating⁸¹ the experience – helping the client neutralize the intense sensations of “energy” and the primitive, undirected emotional states of fight or flight, without unleashing an explosive abreaction using internal or external resources available in

⁸¹Levine uses this term titration “to indicate the gradual step-by-step process of renegotiating the trauma. This process is similar to certain chemical reactions such as hydrochloric acid (HCl) and caustic soda (NaOH), extremely corrosive if they are used together. But neutralizing them, one drop at a time, there would be a small effervescence without damage to health. This is the effect that we want to attain in the resolution of the trauma” (LEVINE, 2010:85).

order to access self-regulation.⁸² For example: If the patient's heart rate is accelerated, the therapist may ask the patient to observe their heartbeat but also to pay attention to the rest of their body, especially which part of their body feels good. The therapist also increases the bond and can suggest, if necessary, other support. When the patient perceives that his/her heart rate slows with the intervention of the therapist, he/she relaxes. When he/she relaxes, he/she is better able to orient him/herself in the present moment and recognize where he/she is in the external environment, and thus gains more energy and confidence for the task of paying attention to internal sensations. The idea is to begin with the assistance of the nervous system, which is entwined with the traumatic circuit, making the patient interpret what is happening to him/her as frightening. The therapist should encourage the patient to take interest in paying attention and develop an introspective interest in his/her internal experience made available through instincts, motor reactions, emotional and cognitive reactions, and learn to dis-identify the Self from the neural activation. SE follows the tracking, anchoring the sensations in the body and the elements of the internal experience (SIBAM). The patient thus learns to tolerate the experience through *containment* and begins to be responsible for his/her own physiological system, as the relationship between patient and therapist becomes safer. The patient involved in this process will develop the confidence that he/she is capable of feeling sensations and emotions without getting disoriented.

With the Tracking process in which the patient pays attention to their physical sensations, now with more confidence in the process, the therapist begins to pay more

⁸²See more about *self-regulation* in the chapter IV.

attention to the physiological signs during the process of *pendulation*;⁸³ until the moment in which the patient begins to perceive their tone, their charge or lack of charge – that is, he/she must recognize the start of the emotional impulse that emerges from this activity. There, in that moment, the record of what the body, mind, and brain did to protect themselves appears. “The ability to pendulate develops confidence” (LEVINE, 2010:82). The therapist must be quite attuned in order to help the patient access a new physiological response available to restore the defense system. “A surprisingly effective strategy for dealing with difficult sensations consists of helping the person find an ‘opposite’ sensation: a sensation located in a certain area of the body, in a specific posture, or in a small movement; or even a sensation associated with the feeling of being less frozen, less vulnerable, stronger, and/or more fluid. If the patient’s discomfort changes, even if just for a moment, the therapist can encourage him to concentrate on this fleeting physical sensation, bringing a new perception; a perception in which he discovers and installs an ‘island of safety’ that is at least good” (LEVINE, 2010:82). The objective is to make the client *discharge* the energy of the emotional trauma and absorb more vital energy in the system to restore the limits that were broken in the trauma. For this, the patient must discover this *island* because it informs them that their body is not the enemy; “It can actually be considered an ally in the process of recovery” (LEVINE, 2010:82). “Little by little, the person learns to alter their perception between the regions of relative comfort and those of discomfort and anguish” (LEVINE, 2010:82). *Pendulation* is essential for healing the trauma and also for relieving the suffering. “The constant ebb and flow of this rhythm, as bad as it may feel (in the contraction phase), the expansion will survive, bringing with it a feeling of

⁸³ “Whereas trauma implies being frozen or imprisoned, pendulation is the innate organismic rhythm of contraction and expansion.” (LEVINE, 2010:82). “Pendulation is the primitive rhythm expressed as a movement that goes from constriction to expansion – and back to contraction – but gradually opens into an increasingly large expansion.” (LEVINE, 2010:82).

opening and fluidity" (LEVINE, 2010:83). It is a very important moment in the session. As this doctoral candidate tells her patients:⁸⁴ "Now, get on a surfboard and let's ride this wave, perceiving every detail of what is happening inside and outside of you. Feel how much precision there is in your feet that support you, in the movement of your body, experience the quality of this moment and know that it will make a difference. I am here to help you in this process." The therapist must accompany the patient and help them perceive *the innate biological rhythm* and gradually *contain* the good and bad experiences that occur within the internal experience, the SIBAM. The therapist will need to have psychological language so that the patient can recognize what he/she knows and feels.

When a person is traumatized, one becomes disoriented and confused. The brain becomes disorganized and increasingly incapable of seeing or feeling the situation as a whole. The person's mental records interpret erroneous beliefs, and this can be even more real if the person was neglected and exposed to abuse as a child. Therefore, the communication must be authentic because the patient has already spent a long time locked inside him/herself without being able to find language for his/her internal experience.

It is in the pendulation process that the therapist has the opportunity to help the patient undo the non-reciprocal links between a sensory and/or emotional and/or mental experience that impedes the free flow – the reciprocity among the physiological systems; as a last resort, the coherence with the optional resource of touch. It is in this phase the practitioner has a chance for the vagal brake of the heart to reorganize and stabilize itself, by observing the pause between inhalation and exhalation and its reverberation in the rest of the body. Peter

⁸⁴ Example for therapeutic guidance by this doctoral student

Levine calls this phase of the process *Coupling Dynamics*.⁸⁵ It is a moment in which the therapist must be attentive to perceive when there is more constriction of the elements of the experience, and/or when they are dispersed and lost in the *dissociation*. It is the dynamic phase of perceiving the index of the Porges *vagal tone*⁸⁶ and it helps the patient dis-identify the hyperactivation of the traumatized body of his Being.⁸⁷ The respiration is the variable with which we operate. It gives the practitioner a sense of the variability of the heartbeats,⁸⁸ which gives them a sign that the physiological systems are operating in harmony, or not. If the person makes a very deep or shallow inhalation or exhalation, the therapist must point it out for the patient to perceive, and thus to proceed this process of coming and going with present attention.⁸⁹ The vagal brake is a mechanism of the vagal nerve that makes the heart decelerate, or drastically slow its beats, in order to deal with stress and/or with emergency situations. The therapist intervenes by pointing out and helping the patient distinguish and separate each element that is engaged with each other – *over-coupling* (feelings of headache, nausea, cold feet, anxiety, image of a revolver); and if the elements of the experience are separated – *under-coupling* (he does not remember the gun pointed at his head, or his legs become weak when he talks about the experience). The therapist gives necessary support for each person, at their own *pace*,⁹⁰ to put together what was lost in the

⁸⁵ Coupling dynamics refers to the relationship that different aspects of SIBAM have with one another. It also refers to the response of the nervous system to a stimulus that it perceives as similar to a prior trauma experience. Elements of SIBAM may link together. Healthy coupling dynamics do not produce trauma, since they can be uncoupled, deactivated and discharged. (Manual of SE, Copyright, 2007:B3.17)

⁸⁶ Observe changes in the affective expression. The vagal tone mediates the expression and regulation of emotion (PORGES, 2011:159)

⁸⁷ Dis-identify the Self. The therapist helps the patient to pre start their attention in self-observation. The activation is the activation and he (patient) is himself.

⁸⁸ Practitioner wants to observe if there is coherence, if the body finds itself in a state of well-being, if it is accessing the self-regulation.

⁸⁹ Paying attention to the physiological signals and which system the client is engaged in and if there is greater predominance of the sympathetic, parasympathetic of the ventral *vagus* or of the dorsal *vagus*. The therapist must be aware of the patient's responses the entire time.

⁹⁰ Time is perceived and is given within the therapeutic resonance. If the therapist is not totally present *synergetically*, he or she will go out of rhythm and dissociates.

trauma. The objective is to pendulate the internal experience, moving the traumatic energy *back and forth* between the sympathetic system and the parasympathetic system; thus, the vagal brake will simultaneously be in constant action *going up and down* with the present attention, with its *pre-frontal* area “*on*” and in synchrony with the external environment. In this process, the neurotransmitters⁹¹ migrate from one side to another, and within the natural biochemistry, the process begins to settle. The art and ability of the therapist is to perceive which autonomous defense system the patient is *engaged in*.⁹²The patient could be engaged in the old system of dorsal vagus predominance (in which the vagal brake may be off, or chronically low), or they could be engaged in the sympathetic system predominance or the system could be the social engagement predominance - the ventral vagus. This provides very important information for the therapist to know the appropriate *resource*⁹³ to use in reaching self-regulation, which will lead to stabilization and equilibrium of the body, mind, and brain, and finally, the resolution of the trauma. It takes a long time for the therapist to attain this level of ability and art in conducting this process.

Since the internal flow is energetic and continuous, as the relationship between the therapist and patient becomes more synergistic, the velocity of the neuronal information

⁹¹ When the movement approaches to the traumatic vortex, the neurotransmitter becomes excited, increases the sympathetic charge, and when the movement approaches the counter-vortex the neurotransmitter of the parasympathetic activates and diminishes the charge. This is the to and from movement until finding the nucleus between the two, the place of self-regulation, where the physiological renegotiation occurs.

⁹²If it is in the ventral vagus, in the sympathetic or in the dorsal vagus. By the posture, by the tone of voice, by the level of presence or dissociation, the therapist will perceive whether or not the patient is ready for the next step.

⁹³*Resource* can be anything that gives strength and ground to the ability to move through life in ways that are fulfilling and satisfying. Helping people recognize how they already resource themselves can be very empowering. Bringing a person’s attention to these kinds of things, and to the sensations that are associated with them, can help ones get in touch with inner resources. Resources allow a person to meet the experiences of life in ways that are appropriate and skillful (SILLS, 2001:122-123). If a patient experiences the arising of a trauma affect during a session, like emotional flooding, which can be very upsetting or sometimes terrifying, a perceptual shift to more resourced sensations can help contain and slow down the process. A great resource can be used is to help client to use the breath to anchor the awareness within the sensation of the body. Resource can be internal or external and it has to be used in order to take clients to approach the edges of difficult or easier sensations without being overwhelmed.

accelerates, especially if the therapist is very conscious, balanced, and well-engaged socially and spiritually. Within this safe resonance with the patient, he/she can access a safe regulatory emotional state at any time. This state is observed when the variability of the cardiac frequency becomes balanced. His/her heartbeats enter into unison with other physiological systems and the emotional, psychological, and neurological states stabilize. The SE therapist follows each *Energy Well*,⁹⁴ monitoring the change in energetic levels where the nervous system can rest, restore itself and become balanced. Levine reminds one that the therapist must take advantage of this time and extend it as long as possible so that the brain can recognize and benefit from this restorative state. Levine says that the longer the person remains in this state, the greater their increase in resilience and restoration of the state of well-being, goodness, and wholeness of the Self. This map developed by Dr. Peter A. Levine can be useful for any type of trauma. Especially because when a therapist works with a complaint of high-impact trauma, by tracking at the moment of *renegotiation*, it is the procedural memory that is in command. It can bring out emotional content from the early childhood days, and the therapist must have the appropriate language and tools to repair the damage to the body, mind, and brain. Memory is not static or linear; it is dynamic and non-linear. In the process of curing trauma, it swings between the records of explicit memory (conscious and rational) and the records of implicit memory (innate and unconscious). The implicit memory retains very strong emotional content, and when the person feels that they are in a safe environment, it may be evoked and the therapist must have the ability to help reinterpret and integrate the patient's experience. Helping clients cultivate and regulate the capacity for tolerating extreme sensations, through reflective self-awareness, while

⁹⁴ Term coined by Dr. Levine for the basic line of resting state the nervous system. When the patient is in a high state of activation, he is in a high trough and his pattern of energetic level and as it stabilizes, the basic resting line widens, increasing his resilience.

supporting self-acceptance, allows them to modulate any uncomfortable sensations and feelings. They can now touch into intense sensations and emotions for longer periods of time, as they learn how to contain their arousal. Once a client has the experience of, *“going within and coming back out,”* without falling apart, his or her window of tolerance builds upon itself. This happens through achieving a subtle interplay between sensations, feelings, perceptions and thoughts. Levine believes that *the people who are most resilient, and find the greatest peace in their lives, have learned to tolerate extreme sensations, while gaining the capacity for reflective self-awareness.* Although this capacity develops normally when ones are very young, one can learn it at any time in life (LEVINE, 2010:137). The map left by Peter Levine will always be useful and remembered by those who honor his inspiration, knowledge, and creativity.

IV.F.2 - Somatic Experiencing™ and its clinical practice:

This clinical practice occurs in the relationship between the therapist and the patient in order to help him/her navigate safely through traumatic sensations. The SE therapist must be conscious of his/her own body, of his/her biological resonance with his/her patient, a fundamental attitude to guide him/her through the tracking of physical sensations. The physical sensations guide the actions and are the vehicle of direct knowledge of the instinctive self. Levine states that, "By learning to track their own sensations, the therapists can avoid absorbing the fear, anger, and helplessness of their patients" (LEVINE, 2010:51). He continues by stating that, "The therapists must learn from successful encounters with their own traumas, to be present with their patients. This is the reason that curing trauma must necessarily involve the awareness of the live, sensible, "knowing" body, both in the patient and in the therapist" (LEVINE, 2010:51).

The SE therapist, "...will only, truly be able to help the patients to contain disturbing emotions and sensations if he/she has the self-awareness that as bad as he/she may be feeling (he/she or the client), this will not last forever." The observing presence, the capacity for self-observation, at the same time as experiencing the internal experience, develops the ability to deal with the deepest feelings and sensations, without being swept away or overwhelmed (emotional catharsis – hysterical) or without dissociating from the experience (mental catharsis).

This psychotherapeutic process occurs through an education in perception on the part of both the therapist and the patient. It is an experiential process of education. This is the legacy that our master (Levine) leaves us.

IV.G. SOMATIC EXPERIENCING™ & THE POLYVAGAL THEORY:

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

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

Porges' theory understands that the physical body must be engaged. Biologically, if a mammal is isolated, its neurophysiology and psychological experiences change. The perception of the world also changes and generally becomes distorted.

We understand with this theory that being engaged, being kind, sociable, using the face and heart connection demonstrated by studies and research, that behaviors and feelings have an adaptive function. And if animals and/or humans do not use this system of engagement they may be eaten by a tiger or by culture or by society. This theory of social engagement refers to a newer neural system of certain cranial pairs, especially the Ventral Vagus in which is an environmental system that manipulates our sensation of safety. SE, within modern therapies, is a pioneer in using the system of social engagement in its therapeutic intervention in order to resolve Trauma.

In trauma therapy, we must remember that for mammals, immobilization is lethal. Although reptiles use this as a defense system, mammals use immobilization when they are safe (without fear), and if they use immobilization as a defense system – that is, when they *are* afraid – they generally extend a high percentage of their vital energy.

The use of the social engagement system, as used in therapy, helps mammals to access immobilization without fear, which for Porges is the objective of civilization, and creates the opportunity to discard hyper-vigilance and be safe in the arms of someone significant.

The therapist, through their work of face-to-face and face-heart approximation, aims to turn off the system of hyper-vigilance or surrounding reactions, allowing the patient to awaken visceral sensations of “not fear.” It teaches the patient to negotiate his/her safety, in the hopes that he/she begins to show behaviors of social engagement.⁹⁵ And

⁹⁵ Doctoral candidate

from that sense of safety, also obtained through touch,⁹⁶ the patient even further incorporates the sense of guidance and feels safer to leave the symptomatic, restricted space and expand in movement towards life.

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

Feeling secure is the gateway to developing a healthy relationship.

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

The theory defines three neural circuits that form a phylogenetically-ordered hierarchy of response. It means that one uses the new and evolved circuits first (Social Engagement) with the intention of disengaging from the state of immobility with fear – and when those do not work, as in they do not help one to navigate to a safe state, they

⁹⁶ Probing where the therapist touches and is touched at the same time. Touch to bring the sensation of weight, of embodiment, of awareness of the live presence of the body.

use their older, less-evolved neural circuits, such as the systems of defense. The theory makes a very important distinction: it says that one has two defense systems, that are known by all, associated with behaviors of fight or flight (the sympathetic system) and freezing, playing dead (the Dorsal Vagus system) and these systems influence the organism how to move in dangerous environments.

Perception involves consciousness, and neuroception⁹⁷ does not have consciousness – it simply occurs. The model of neuroception is like a traffic light: each light representing a different physiological system, and each physiological system serves as a neural platform for different behaviors. If ones are in the safe state (green), individuals can interpret the environment in a certain way. In the immobilized form, ones will interpret this stimulus in a different way. For example, when looking at a person whose facial expression is neutral if they are in the green state, then ones perceive the person as having little emotion, little affect. But if they are in the dangerous immobilized state (yellow), ones will adaptively interpret an expression less face as dangerous, and they will ask, “Why doesn't this person like me?” In the closed psychological state (red), due to a life-threatening situation, ones can dissociate completely and be incapable of reading any expression. These are tips for the SEP⁹⁸ to identify the signs and their physiological states of engagement or disengagement. In this way, the SEP can choose an intervention strategy using one of the SE tools proposed by Levine.

Mammals seek safety. Neuroception will evaluate the situation as safe or dangerous; if it is safe, one will spontaneously engage with others. They will make eye contact, physical contact, facial expressions mainly with the upper part of the face, and speak with a melodic and *non-monotonous* voice. Their words will call to people, engaging

⁹⁷Neurons specializing in detecting the presence or absence of danger in the environment.

⁹⁸Somatic Experiencing Practitioner.

them. The theory and its observations say that verbalization is linked to visceral connections with the heart. So there is no distinction, the face (and voice) is a window to the person's neural physiology, that is, to their physio-neurology.

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

Chapter V

LANGUAGE OF BODY & TRAUMA RESOLUTION

V.A - PHENOMENOLOGY OF PERCEPTION:

The term *perception* refers to the act by which ones become aware of a cognizable object (knowable). Perception grasps the objective situation based on sensations that come accompanied by representations and often judgments. The Latin derivative, *percipio*, refers to a harvesting or reaping of the senses (BALLONE, NETO, ORTOLANI, 1996:11-15). Perception, and the meaning given it, is where one perceives, and ideally blends, the intelligent whisperings of heart, mind, and belly. The perception of a subject reveals that there *is* something, and the sensation alerts what that something is (BALLONE, NETO, ORTOLANI, 1996:11-15).

The language of the body is a circular network of sensation, touch, movement and perception, which informs every aspect of physical existence. Sensation is the language of the body and the deep centers of the brain. Sensation informs perception on the meaning of what one is sensing (AGNEESSENS C., 2001:86). So, perception is formed on the basis of movement, just as surely and completely as movement is initiated and guided by perception (JUHAN, 1987:187). Movement emerges from the core of the being and carries life forward in its uniquely formative process. From sensation, movement is generated, and the sense of “I” can be perceived. Joining attention and sensation opens new pathways of perception. How one holds their attention, internally and externally, shapes the form, the world interaction, movement and perceptions. Movement cannot expand beyond the rigidity of our perceptual bases. Perception

emerges in concert with shifts in gravity, relationship, structure, motility, coordination, expression, breath, movement and vision. The process of expanding the perceptual sense of something demands awareness of how the sensation of the body is attended (AGNEESSENS C., 2001:87: 210). The felt-sense, can be considered the gateway to the world's conscience (cognition), and is elementary in perceiving the world and adjusting to the requirement of reality. The adjustment to reality must always be realistic, demanding more than simple physiology of sensory systems. The representation of reality significantly transcends the felt-sense of the world and reality will mean, in essence, what the world is for the person who comprehends it. Therefore, one can say that while the felt-sense has as its starting point at the five senses, the presentation is built on a subjective level, using the particular emotional tone of the subject having an emotional-psychological character (BALLONE, NETO, ORTOLANI, 1996:11-15).

Caspari affirms: "The perception is not sensation and does not identify the outside world as it is, in fact, but with appropriate limitations and features that allow one's sense organs to recognize it. However, perception relates to the senses, especially with regard to how ones orient themselves in relation to incoming information from felt-sense, touch, sight and hearing and smell and taste" (CASPARI, 2006). The senses can be focused into or out of the body. The *intra-sensoriality* refers to the dynamics of the senses to orient within him/herself or outward to the environment that surrounds individuals.

The *inter-sensoriality*, in turn, refers to a phenomenon of one of the senses supporting another sense (CASPARI, 2006). In a healthy person there is an inter-sensoriality, where the senses are mutually supportive and communicate to each other and complement each other in seeking information from the environment to create moment-by-moment opportunities for self-regulation, identity and expression. When there is a trauma, in other words a breakdown in the regulatory process, there is a

decoupling and disintegration of senses. They can no longer support each other, and the way to capture information from the senses changes and modifies self- perception, as well as the world around the person who goes through a traumatic experience.

V.A.1 Change the sensations:

Sensations can be changed in intensity and quality. If they are increased, it is referred to as *hyperesthesia*, if they are reduced it is called *hypoesthesia* and if they are abolished it is *anesthesia* (hyper: much, hypo: little). According to Bleuler, illusion is a misleading perception of a real object. Hallucinations are altered sensations, the result of impact between sensation and perception (BALLONE, NETO, ORTOLANI, 1996:33-34).

V.B – EXTEROCEPTION – INTEROCEPTION AND PROPRIOCEPTION:

V.B.1 - A Neurobiology of sensorial language:

The brain reaches out to the environment via sense organs, which respond to various stimuli such as light, sound waves, and pressure (CARTER, 2009:76). The information is transmitted as electrical signals to certain areas of the cerebral cortex that are specialized to process specific types of sensory information into sensations, such as sound, vision, taste, smell, touch, and pain. Some of this data is then “forwarded” to areas of the brain that make it conscious (CARTER, 2009:76). When the brain makes a sense conscious, it's called perception. For example, sight: Seeing seems to be instantaneous and effortless, and visual images always appear fully formed.

Unconsciously, however, the brain is constantly undertaking a major feat of construction to present one with a view of the world (CARTER, 2009:76).

All neural information that flows from the body toward the brain is referred to as afferent information, the body **affecting** the brain. Nerve cells have long fibers that extend outward from their compact cell bodies. These fibers connect, via synapses⁹⁹, to the fibers from other nerve cells, from the receptor at the periphery of the body all the way to the spinal cord. The afferent nerve cell fibers are small and unmyelinated¹⁰⁰ (FOGEL, 2009:46).

From the brainstem centers, there is efferent information that is referred from the brain and sent back to the body. Some fibers are myelinated (cranial nerves)¹⁰¹ and some are unmyelinated (sympathetic and dorsal vagus of Parasympathetic N.S.). The skin has receptors for movement at the base of the hair follicle (mechanoreceptors), for pressure on the skin, for vibration (vibrotactile receptors), for heat and cold (thermoreceptors) and for pain (nociceptors). Muscles have receptors for stretching (mechanoreceptors) and for fatigue (chemoreceptors). The circulatory system has receptors for pressure (baroreceptors) and blood nutrients (metaboreceptors). These receptors are designed to convert different forms of chemical and physical stimulation into neural (electrical signals) for transmission to the spinal cord and brain (CRAIG, 2002; CRITCHLEY, WIENS, ROTSHTEIN, OHMAN, & DOLAN, 2004; DAMASIO, 2000; FOGEL, 2009:45-46).

Perception is the integration of information received from senses processed by our Nervous system. The stimulation comes from the outside world from exteroceptive

⁹⁹Synapses are junctions between nerve cells.

¹⁰⁰ Myelin is a protective coating around nerve cell fibers that speeds transmission. Unmyelinated fibers, conduct more slowly which partly explains why it often takes several minutes or even longer to feel particular embodied sensations and sense their source within the body.

¹⁰¹ See chapter about Polyvagal theory.

mechanoreceptors in combination with impressions received internally from proprioceptive and interoceptive mechanoreceptors.

V.B.2 There are three types of neurons of sensorial language –

Exteroception – Interoception& Proprioception:

V.B.2.1 - Exteroception sensations:

Exteroception are sensations that come from outside the body. The signals specify sensation that impinges on the body, but where it becomes important for the individual to identify the source of information as external to the body. Exteroception includes receptors for sound, light, taste, and smell (CRAIG, 2002; CRITCHLEY, WIENS, ROTSHTEIN, OHMAN, & DOLAN, 2004; DAMASIO, 2000; FOGEL, 2009:46)

Exteroceptors provide the body a set of impressions of the outside world, in which the properties and aspects of everything that is humanly noticeable are reflected in the objective world. To create the external sense we use the mechanoreceptors¹⁰² present in the sense organs: visual, auditory, gustatory, olfactory, and tactile sensations.

Sensory neurons respond to data from specific sense organs. Visual cortical neurons, for example, are most sensitive to signals from the eyes. But this specialization is not rigid. Visual neurons have been found to respond more strongly to weak light signals if accompanied by sound, suggesting that they are activated by data from the ears, as well

¹⁰² Mechanoreceptors are in fact free nerve endings (FNEs), whether or not equipped with specialized end organs. Variation exists as to the micro architecture of the ending. (van der Wal, 2012,81;org.SCHLEIP)

as the eyes. Other studies show that in people who are blind or deaf, some neurons that would normally process visual or auditory stimuli are “hijacked” by the other senses. Hence, blind people hear better, and deaf people see better (CARTER, 2009:82-86).

Visual Sense: One way of thinking about visual perception is to imagine it as the end product emerging from a long and complicated assembly line. The construction process begins in earnest when information from the eyes- the raw material – reaches the primary visual cortex at the back of the brain. This is then sent along two main pathways¹⁰³ through a number of cortical and subcortical areas. Each of these respond by creating neural activity that generates various aspects of vision, such as color, form, location, and movement. Eventually, the various elements are bound together, and one becomes conscious of a meaningful sight (CARTER, 2009: 82-86). Nerve signals from the left and right optic nerves converge at the base of the brain at a cross over junction called the *optic chiasm*, before traveling to the visual cortex or “sight centers” at the near of the brain. At the optic chiasm, fibers carrying signals from the left side of each retina join and proceed at the left optic tract to the left visual cortex. Likewise, fibers from the right sides of both retinas come together at the right optic tract and go to the right visual cortex. Because the two eyes are set apart, each sees a slightly different view of an object. The nearer the object is, the more different these views. In the visual center of the brain, the views are compared to help judge the object’s distance. The combination of the views of both eyes into a single image is called binocular vision (PARKER, 2007:93).

¹⁰³ The dorsal path gathers information about motion and timing that is integrated into the action plan (unconscious). Ventral path that passes into the bottom edge of the temporal lobe, where it matched or compared to visual memories in order to achieve recognition. Some information continues along this pathway to the frontal lobes, where it is assessed for meaning. At this stage, it becomes a conscious perception (CARTER, 2009:82-86).

V.B.2.1.1 Hearing or Sense of Sound:

The ear picks up sound waves in the environment and translates this information into nerve impulses, which are sent to the brain for processing. The ear also senses the motion and position of the body, which allows the brain to regulate balance.

The ear is divided into three sections: the outer ear, middle ear, and inner ear. Sounds start as vibrations entering the ears, and in the inner ear receptor cells transform these vibrations in the form of electrical impulses, traveling along the *cochlear nerve* to the medulla in the brainstem, and then to the *inferior colliculus*. The cochlear nerve fibers divide so that most of the input from each ear can go to both hemispheres. Processing at this stage enables the brain to determine the location of a sound. The signals reach the auditory cortex via the thalamus, where features such as frequency, intensity or volume of a sound quality and meaning are perceived. Sound consists of waves, or vibrations, whose characteristics are determined by the source of the sound. The main characteristics influencing the perception of sound are frequency (number of vibrations per second) and amplitude (the size of the waves “peaks and troughs”). The auditory cortex responds to different qualities in music (CARTER, 2009:88-93). The ears provide the sense of hearing they also detect head position and motion, and are also essential to balance. The parts concerned with hearing and balance are located in different areas of the ear, but the function of both is based on *hair cell* receptors (PARKER, 2007:90). A deeper exploration on the process of balance will be addressed later (V.B.2.3).

Sense of Smell: Although vision has become the dominant sense in humans, the sense of smell (olfaction) remains important to survival, because it can warn one of hazardous

substances in the environment. The senses of smell and taste are closely linked. Like the sense of taste, smell is a chemical sense. Specialized receptors in the nasal cavity detect incoming molecules, which enter the nose on air currents and bind to receptor cells. Sniffing sucks up more odor molecules into the nose, allowing you to *sample* a smell. It is a reflex action that occurs when a smell attracts your attention, and can help warn of danger, such as smoke from a fire or rotting food. Olfactory receptors located high up in the nasal cavity send electrical impulses to the olfactory bulb, in the limbic area of the brain, for processing (CARTER, 2009:94). There is also a *fuzzy coding* component that is less understood, where each odor produces a variable pattern or signature of impulses. Smell information is analyzed by the brain's olfactory cortex, which has close links with limbic areas, including emotional responses. This is why smells can provoke powerful recollections and feelings (ROBERTS, 2010:318). When a bad odor is detected, such as that of rotting meat, it is natural to both feel and express disgust. Avoidance of the source of the odor follows, and it is almost impossible to eat food that smells bad (CARTER, 2009:96). Whether we find a smell nice, nasty or neutral is very subjective and depends upon familiarity, intensity, and perception as pleasant or unpleasant. An event is associated with input from all the senses, coordinated by the hippocampus. Re-experiencing any of sight, smell, or sound inputs may trigger a memory of an event, but smell seems most strongly associated with memory (CARTER, 2009:96-97). Research shows that a memory of a visual image is likely to fade within days, but the memory of a smell may persist for up to a year or even decades. The hippocampus may not even be crucial for the link, because people who sustain damage to this region can still recall scents from their childhood, even though suffering from general memory loss (CARTER, 2009:97).

V.B.2.1.2 Sense of Taste:

Like smell, taste has a survival value – poisonous substances tend to taste bad (usually bitter), while those that are nourishing taste pleasurable (usually sweet or savory). Together, taste and smell allow animals to evaluate and recognize what they eat and drink. All tastes are detected equally across the tongue, according to recent research – it had long been believed that different parts of the tongue are dedicated to detecting specific tastes. The tongue is well supplied with nerves that carry taste-related data to the brain. There are five basic flavors: sweet, sour, salty, bitter and umami (*umami* means “*delicious*” in Japanese). Taste and smell are both chemical senses – receptors in the nose and mouth bind to incoming molecules, generating electrical signals to send to the brain. Both sets of signals pass along the cranial nerves. Smell-related (olfactory) signals travel from the nose to the olfactory bulb, then along the olfactory nerve to the olfactory cortex in the temporal lobe for processing. The pathway of taste-related (gustatory) data travels from the mouth along branches of the trigeminal and glossopharyngeal nerves to the medulla it continues to the thalamus, then to primary gustatory areas in the central cortex (CARTER, 2009:99). When consuming a food is paired with nausea, flavor-aversion learning has a survival value in teaching animals to avoid attractive-looking foods that may be toxic. It is a robust form of learning that can occur after only one episode, but can last for many years (CARTER, 2009:99).

Sense of Touch: Skin plays a vital role in enclosing and protecting the delicate underlying tissues, but it is also important in providing the sense of touch. As an outer layer, skin is a specialized type of epithelium. Epithelial tissues are widespread in the body, providing coverings and linings for almost all major body parts and organs (PARKER, 2007:148).

There are many kinds of touch sensations. These include light touch, pressure, vibration, temperature, pain and awareness of the body's position in space.¹⁰⁴

The sense of touch is based in the lower of the two skin layers, the dermis. Touch operates by means of micro-sensors, the ending of tiny nerve cells that act as receptors for various kinds of physical change, from the lightest contact to heavy, painful pressure. There is a wide array of micro-sensors, the number and density of which vary from one location to another on the body. Different types of receptors respond more readily to certain types of stimulation, but almost all respond to most stimuli. It is thought that the brain runs through what looks like random incoming nerve signals but recognizes, then picks out, repeating patterns to determine if an object touched is hard or soft, hot or cold, rough or smooth, wet, or dry, static or moving (PARKER, 2007:148).

V.B.2.1.3 Types of touch:

- a) Free nerve endings in the skin respond to light-touch stimuli
- b) Touch pressure entailing short-lived skin deformation stimulates Pacinian corpuscles and Ruffini corpuscles, located deep in the skin
- c) Pacinian corpuscles and Meissner's corpuscles (mechanoreceptors, detecting mechanical movements) respond to vibrations
- d) Receptors are sensitive to either hot or cold, not temperature itself. Heat and cold receptors occur in specific spots on the skin.

¹⁰⁴ Proprioception – from proprio, the latin “self”- is sometimes referred to as the sixth sense. It is the sensing of body position, movement, and posture, involving feedback to the brain from the body. However, this information is not always made conscious (CARTER, 2009:102).

- e) Pain signals come from damaged tissue and stimulate nociceptors, which consist of free nerve endings.
- f) Receptor cells located in muscles and joints send information to the brain about the position and movement of the body (CARTER, 2009:100).

When a sense receptor is activated, it sends information about touch stimuli as electrical impulse along a nerve fiber of the sensory nerve network to the nerve root on the spinal cord. The data enters the spinal cord and continues upward to the brain. The processing of sensory data is begun by nuclei in the upper (dorsal) column of the spinal cord. From the brainstem, sensory data enters the thalamus, where processing continues. The data then travels to the post central gyrus of the cerebral cortex, the location of the somatosensory cortex. Touch sensations are turned into perception in the somatosensory cerebral cortex, which curls around the brain like a horseshoe. Data from the left side of the body ends on the right side of the brain, and vice versa (CARTER, 2009:101).

In studies with patients it was concluded that human's skin contains special touch receptors, with a slow conduction velocity, which are part of a neurobiological system for social touch (JÄGER & SCHLEIP, 2012:90). The flesh is the source of the unconsciousness. In touching the body all that is unacknowledged culturally, ancestrally and personally is contacted.

V.B.2.2 Interoception Sensations:

The sensation coming from inside the body is one that takes the response of the central body to muscle or viscera in which will perform the action (efferent or motor neuron). Its receptors are located in the internal organs, and reveal the consciousness within the

body. It is information that reflects the movements of isolated parts of the body and the state of internal organs, such as senses of respiration, blood pressure, digestion, body temperature, blood stream chemicals and sexual activity (AYRES, ROBBINS, 1977:27). While the sense of proprioception is fairly well known to therapists working with fascia, interoception and its inclusion in fascial therapies may be a new concept for many. However, the concept is not so new: in the nineteenth century it was called coenesthesia (*gemeingefuehl* in German) or common sensations; the neurological model of a mostly unconscious sense of the normal functioning of the body and its organs. Schleip (2012) found it in Sherrington's early writings (JÄGER & SCHLEIP, 2012:89). Current concepts describe interoception as a sense of the physiological condition of the body, which includes a much wider range of physiological sensations, including, for example, muscular effort, tickling, or vasomotor sensations (JÄGER, SCHLEIP, 2012:89). The sensory receptors for interoception are free nerve endings, most of which are located in fascial tissues¹⁰⁵ throughout the human body. It is helpful to understand that proprioception and interoception are organized differently in the human brain and that very different afferent pathways are involved in them (CRAIG, 2009; JÄGER, SCHLEIP, 2012:89). These sensations are triggered by stimulation of unmyelinated sensory nerve endings (free nerve endings) that project to the insular cortex rather than to the primary somatosensory cortex, which is usually considered as the main target of proprioceptive sensations (BERLUCCHI & AGLIOTI, 2010; JÄGER, SCHLEIP, 2012:89). The interoceptive system, associated with autonomic motor control, is distinct from the exteroceptive system (cutaneous mechanoreception and proprioception) that guides somatic motor activity. The primary interoceptive representation in the *dorsal*

¹⁰⁵ Fascia surrounds the entire body just under the skin as the superficial fascia, and enwraps all the other tissue and organs of the body as the deep fascia. It is, as observed by Ida P. Rolf, PhD, the "organ of form" (ROLF, 1977). But in addition to its anatomical and physical properties, the fascial system is increasingly recognized for its physiologic properties (LANGEVIN et al. 2004, 2006; MYERS, FINDLEY, COUGHLIN, CHAITOW, 2012:269-270).

posterial insula engenders distinct, highly resolved feeling from the body that includes pain, temperature, itch, sensual touch, muscular and visceral sensations, vasomotor activity, hunger, thirst, and “air hunger” (CRAIG, 2003:500). As Craig says: Interoception is the sense of the physiological condition of the body. Jäger and Schleip add that the feelings from these sensations not only have a sensory, but also an affective, motivational aspect and are always related to the homeostatic needs of the body. They are associated with behavioral motivations that are essential for the maintenance of physiological body integrity (JÄGER, SCHLEIP, 2012:89).

Interoception is the technical term for the ability to feel one’s own body states and emotions. A feeling is any sensation that is experienced as coming from his or her ownbody. Feelings can be tingly, warm, soft, calm, jumpy, butterflies, and so on. Emotion is the embodied evaluation of those feelings, reflecting how good or bad something feels to one, accompanied by a motivation or urge to act in a particular manner in relation to that sensation, thing, or being that seems to be causing the emotion (FOGEL, 2009:39). Feelings and emotions go together. Craig affirms that sensations are usually coupled with an emotional meaning in our awareness. It does not have the pure interoceptive feeling; one relates to the sensation by embracing it or cringing from it. Even if there is not an overt action, emotion is always accompanied by an urge to act, or an action tendency. Emotions are also coupled with body feelings. It is all part of the interoceptive awareness. Recent neurophysiological researches helps one to understand this co-relationship between emotions and sensations. The neural pathways that allow individuals to sense the internal condition of the bodies are intimately linked to neural pathways for the regulation of the body processes that maintain mental and physical health. Interoception is a way of monitoring themselves so that one can ease the felt

pain, expand the felt joy, and make sure that one gets the resources needed in any given moment (CRAIG, 2008:274; FRIJDA, 1986; FOGEL, 2009:39-41).

V.B.2.3 Proprioceptors sensations:

Proprioceptors constitute more than 90% of neurons and have a large influence in data processing because they trigger perception of physical sensations (BALLONE, NETO, ORTOLONI, 1991:12). Proprioception is the felt-sense of the location and relative position of different parts of the body in relation to objects and to individuals. Proprioception relies on proprioceptors at the periphery of the body: the sense of touch, the sense of muscle and tendon stretch, and the sense of balance in the middle ear (FOGEL, 2009:83).

Carter refers to proprioception as one's sense of how one's own body is positioned and moving in space. This “awareness” is produced by part of the somatic sensory system, and involves structures called proprioceptors in the muscles, tendons, joints, and ligaments that monitor changes in their length, tension, and pressure linked to changes in position. Proprioceptors send impulses to the brain. Upon processing this information, a decision can be made to change a position or to stop moving. The brain then sends signals back to the muscles based on the input from the proprioceptors – completing the feedback cycle (CARTER, 2009:102). Proprioceptive information is either made conscious or processed unconsciously. Conscious proprioception uses the *dorsal column-medial lemniscus* pathway, which passes through the thalamus, and ends in the parietal lobe of the cortex. Unconscious proprioception involves *spinocerebellar tracts*, and ends in the cerebellum, the part of the brain at the back of the skull involved with the control of movement (CARTER, 2009:102).

Proprioceptors in the muscles, tendons, and skin work together with hair cells in the *vestibule* and *semicircular canals* of the inner ear to maintain balance. A gymnast will work on all aspects of strength, movement and body coordination to achieve feats involving fine balance (CARTER, 2009:103).

Proprioceptors and balance: Balance is not a single sense, but a process involving a range of sensory inputs, analysis in the brain and motor outputs. Inputs arrive from the eyes, microreceptors in muscles and tendons, and skin pressure sensors, as in the soles of the feet. The inner ear's fluid filled vestibule¹⁰⁶ and semicircular canals¹⁰⁷ also play a key role. They incorporate sensitive hair cells similar to the cochlea's.¹⁰⁸ The vestibule responds mainly to the head's position relative to gravity (static equilibrium), while the canals react chiefly to the speed and direction of head movements (dynamic equilibrium). Both respond to most head positions and movements (PARKER, 2007:91). The vestibular apparatus of the inner ears detects every movement of the head, including micro-kinetic agitations in which are not seen or felt. Simply holding the head up against the pull of gravity generates a stream of vestibular input into the brain. Bending, turning, rising, falling and walking alter this input (AYRES, ROBBIN, 1977:27). Because the vestibular nuclei are interwoven into the *reticular formation*, any vestibular process may affect the entire reticular formation. The mechanoreceptive information needed for the process of proprioception originates not only from fasciae and other connective tissue structures, but also from mechanoreceptive or even tactile information from skin, muscles, joint surfaces

¹⁰⁶ The vestibule's two parts, the *utricle* and *sacculle*, each have a patch, the macula, containing hair cells. The tips of the cells extend into a membrane covered in heavy mineral crystals (*OTOLITHS*). With head level, the *sacculle's* macula is vertical and the *utricle's* horizontal. As the head bends forward, the hair cells monitor the head's position in relation to the ground. (PARKER, 2007:91).

¹⁰⁷ Each semicircular canal has a bulge near one end called *the ampulla*. This houses a low mound of hair cells, their hair ends set into a taller jellylike mound, *the cupula*. As the head move, fluid in the canal lags behind, swirls past *the cupula* and bends it. This pulls the hairs and triggers their cells to fire nerve signals (PARKER, 2007:01).

¹⁰⁸ The coiled structure in *the inner ear* that contains *the organ of Corti*, which converts sound vibrations into nerve impulses for transmission to the brain.

and joint structures. Mechanoreceptors are triggered by mechanical deformation like squeezing, stretching or compression. In order to understand their contribution to the proprioceptive information, it is not only important to know their topography (where and in which elements of the locomotor apparatus they are located), but also how they are spatially and mechanically related with the various (tissue) components of the system. Proprioception in the fascia is not only provided by the mechanoreceptors that are located within or are immediately attached to the fascial structures, but also the architecture of the fascia plays an instrumental role in the process of proprioception. Mechanoreceptors situated within muscles as anatomical units may orient as to their distribution and spatial organization to the fascial layers, to where the muscle fascicles insert and between which muscular tissue is interposed in the process of force transmission (Van der WAL, 2009; 2012: 81-82).

V.B.2.4 Considerations sensorial language:

The brain is bombarded with sensory information, but only a fraction of it reaches consciousness. Most sensory signals fizzle out unnoticed. Sensations ones are not conscious of may still guide their actions. Sensations are triggered externally by an occurrence that impacts on a sense organ, and internally by memory or imagination. The former is known as *bottom-up or top-down*.¹⁰⁹ The two combine to create our experience of reality. Each person's experience of a given event is different. Physiological differences affect bottom-up processing. One person's color-processing area in the brain may be highly sensitive, for example, so that color is more vibrant than

¹⁰⁹ "*Bottom-up*" visual processing presets the brain with information about the whole field of vision; "*top-down*" processes select which parts of the scene to make conscious. When we look at a picture, our eyes typically alight on a few thumbnail-size areas that we scan in sequence repeatedly. The rest of the image remains a blur unless we deliberately turn our attention to it. (CARTER, 2009:85).

average. Also, an individual's own memories, knowledge and expectations affect top-down processing (CARTER, 2009:77). Craig, (2009) in other words, says that primates possess a more direct route between the afferent region for interoceptive sensations in the spinal cord and their insular cortex. Craig provided impressive evidence that the anterior insular cortex is a peculiarly human brain structure that is crucial for integrating all subjective feelings related to the body, and especially to its homeostatic conditions, into emotional experiences and conscious awareness of the environment and the self. He suggests that the human insular cortex and its peculiar *spinothalamic* afferent pathways set the species apart from other mammals by supporting consciousness of the body and the self (CRAIG, 2009; JÄGER & SCHLEIP, 2012:91). This view of Craig 's is congruent with the somatic marker hypothesis of Damasio (1994), which proposes that humans use non-conscious somatic sensations, such as *gut feelings*, to guide their decision- making when facing complex and conflicting choices. This affirmation re-discovers the importance of interoception in human self-regulation (CRAIG, 2009; JÄGER & SCHLEIP, 2012:91).

The reticular formation¹¹⁰ is the most complex and entangled part of the nervous system. It is the central terminal for countless fibers running to and from every sense organ, internal organ, muscles and brain region (AYRES, ROBBINS, 1977:27). The lower parts of the reticular formation control the autonomic functions of breathing, blood pressure, digestion, temperature regulation, sexual activity and chemical homeostasis. The middle areas determine the state of arousal: sleep, drowsiness, awakesness, alertness, vigilance, excitement, etc. The high reticular formation (the reticular neurons of the thalamus) controls the organization of sensory input throughout the nervous system. A. Jean Ayres

¹¹⁰The reticular formation: Nerve cells scattered throughout the brain stem that are concerned with alertness and direction of attention to external events (PARKER, 2007:246).

(1977) says that the reticular formation prepares the organism to deal with sensation and form an adaptive response. This is the process of sensory integration– the organization of sensation for use (AYRES, ROBBINS, 1977:27).

Some of the interoceptive nerve endings in muscle tissues have been classified as *ergoreceptors*; they inform the insula about the work loaded of local muscle portions. Their mechanical stimulation has been shown to result in an increased matrix hydration, via an augmentation of plasma extravasation, i.e., the extrusion of plasma from tiny blood vessels into the interstitial matrix (SCHLEIP, 2003). He says that is extremely useful to pay attention to the autonomic and emotional client's responses at each moment, while monitoring the touch. From the therapist's perspective, subtle changes in the client – such as an increased local tissue hydration, changes in temperature, in skin color, in breathing, micromovements of the limbs, pupil dilation, and facial expression – can serve as valuable signals for physiological effects related to interoceptive processes. Schleip's (2003) advice refers to invite a perceptual refinement and some verbal feedback regarding their interoceptive perception, especially in the trauma healing process. He said that such interoceptive sensations can be triggered by myofascial tissue manipulation.

V.C - EMBRYOLOGICAL DEVELOPMENT AND SPATIAL ORGANIZATION:

Touch is the earliest sense to develop in utero. Touch may be thought of as a basic sense in that most life forms respond to being touched, while only a subset have sight and hearing. The first nerve to myelinate is the vestibular in which movement is registered. Movement and vibration become the baby's first language, and its perception is linked to the mother's movement (BROOK, 2012:54).

Embryology is a portal to witnessing the origin of being or consciousness arising and manifesting in the density of the form. Embryonic growth is pulsing and alive and our bodies are intelligence awakening. The embryo, as an archetype of perfect form and wholeness, serves as a blueprint for the body's ability to heal itself. The formative and regenerative fluid forces that organize embryological development are present throughout the lifespan, available for harnessing their therapeutic potency. In other words, the forces of embryogenesis become the forces of healing after birth (AGNEESSENS & TAHATA, 2012:10-16).

The cell mass, or embryo, that results from fertilization undergoes cell division within 24-36 hours to become two cells, toward more cells, and this phase creates a ball of cells called *morula*. During cell division, the embryo progresses down the fallopian tube to the uterine cavity (ROBERTS, 2007:398). Before one develops neurally, before one develops embryonic layers, the egg must find its support (in the uterine cavity).

The embryonic cells have started to differentiate into specific cell types as genes within its chromosomes are switched on or off. Within the inner cell mass of the blastocyst, an embryonic disk forms, consisting of three primary germ layers: endoderm, mesoderm and ectoderm. The endoderm cells will form linings of systems such as the gastrointestinal, respiratory, and urogenital tracts, as well as some glands and ductal parts of organs, such as the liver; mesoderm cells develop into the skin dermis, the connective tissues of muscle, cartilage and bone, the blood and lymphatic systems, as well as some glands; ectoderm cells form the skin epidermis, teeth, sensory organs receptor cells, and other parts of the nervous system. Development during the final months is mostly a process of consolidation, as the organs of the fetus have all formed but need to mature (ROBERTS, 2007:401-403). The fetus continues to refine its various activities and functions, including movement, breathing, swallowing and urination. The

bowels show rhythmic activity, but contain a plug of sterile contents called *meconium* (comprising of amniotic fluid, skin, cells, lanugo hairs, and vernix) that is not usually passed until delivery. The limbs (and cortex) develop through slow oscillatory movements. The fetus is rapidly gaining fat stores, and its growing will have reached a stage of maturity, at which point they may be able to cope with breathing if premature delivery occurs. Sensations become more acute – the eyes (already detecting simple light levels) will open, the ears pick up familiar sounds – and the fetus displays a sense of its surroundings, also of the state of its mother. Everything is vibrating with resonate intelligence. If the mother relaxes, increasingly the fetus will too; if she is anxious or restless, it will also respond to this (ROBERTS, 2007:401-403).

The motor system starts in the fetus with movement of the entire body, while relatively independent single movements do not appear until after birth (MATHIESEN, 2004, HART, 2010:33-34). The mother's movements stimulate the fetus's vestibular system, and her physical activity may lead to pressure or vibrations on the fetus (HART, 2010:33-34). Around seven weeks, the fetus begins to move, and the grasping reflex appears around twenty-eight weeks (TETZCHER 2002). It starts to kick around four months, especially if the mother drinks cold water, and within fifteen weeks it perceive flavors. In the thirty-second fetal week, the fetus has vision, a capacity that is active from birth (KARR-MORSE & WILEY, 1997; HART 2010:33-34). Anders and Zeanah (1984) describe how the infant responds to the mother's voice from birth, and they conclude that channel of communication was ready from before. Thus, all one's senses are developed and in use even before one is born.

Ayres (1977) says that all creatures are connected to the earth by gravity and inertia. The pull of gravity and the resistance of inertia are constant and unyielding, and yet one does manage to rise up and move. The mastery of gravity has been the central issue in

evolution from fish to human beings. Ayres keeps affirming that the ontogeny recapitulates phylogeny, so the development of the individual follows essentially the same path as the evolution of the species. From the moment of conception, one unfolds that wisdom within their own nervous system. Babies need to find support in utero; it means they need to orient relative to gravity even at the primary stage of the embryo's development, in order to organize itself towards gravity too (AYRES, 1977:28).

Primary yield initiates the development of the embryonic membrane as container or envelope. Initially, the skin boundary of the embryo is just one cell thick; however, its continuity cultivates the feeling sense of wholeness and security. One experiences the first orientation to gravity through one's mother's relationship to gravity. The mother's sense of orientation becomes the orienting imprint for the embryo's body mass in gravity. In utero, nourishment flows or is thwarted in the exchange from her body to the embryonic body. Autonomic tonus is set through this primary relationship. The membranous continuity of this envelope forms the linings of the viscera, lymph, cranial membranes connective tissues, and more. Internally, this membranous layering feeds internal sensation and the interpretations one gives to those sensations (interoception). Externally, the skin forms a boundary of self, and other, and the world. The skin envelope offers a sense of protection and safety. Yet, this boundary is porous and affords a dynamic exchange between ourselves, another, and the environment (AGNEESSENS & TAHATA, 2012:10-16).

Moment by moment, the study of embryological development illustrates the action of primary yield which helps to develop spatial organization. There is no neurological differentiation, because the human infant in utero is a completely integrated unit, but a stimulus to any part of the body elicits a total body response. The fetus builds up his tonic activity by touch, movement and feeling the uterine wall. All these responses will

form a limit, a structure of weight, boundary and what gives the sense of space inside the belly and from outer inputs.

When the child is born, when they emerge from the womb, they get into the individual process of heaviness, so they need something to support them again, and development then progresses from there in the mother's arms. The new sensory-motor patterns play a key role in the subsequent development of motor, sensory, perceptual, emotional and mental functions. From the moment of birth, newborn infants have a sense of their own existence.

V.D - TOUCH - A LANGUAGE OF ENGAGEMENT:

The flesh is the source of one's unconsciousness. In touching the body, all that is unacknowledged culturally, ancestrally and personally is contacted.

Touch is the earliest sensory function to develop in all animal species (ATKINSON & BRADDICK, 1982; BERNHARDT, 1987), including humans (McGRATH, 2004), and it is the most developed sensory modality among human newborns (HERTENSTEIN, VERKAMP, KERESTES&HOLMES, 2006). When a human embryo is under an inch long and less than two months old, the skin is already highly developed. After two months of gestation, the fingers will grasp when the palm is touched. The finger and palm will close at three months. In the embryo, the ectodermal layer forms not only the skin and sense of touch, but the brain and central nervous system, as well, giving rise to the other senses and sense organs – ears/hearing, nose/smell, tongue/taste, and eyes/vision (Field, 2001). One could even consider the skin as an exposed portion of the nervous system or as an external nervous system. The skin and its embedded receptors make up the largest of the sense organs.

Touch is the first sense and sometimes called the *mother of the senses*.

The fetus is touched constantly in the womb by the amniotic fluid and later, if delivered vaginally, by the walls of the mother's birth canal. As the newborn emerges, they are picked up and held and – if fortunate – immediately placed on their mother's body so that they can feel the security of their being through touch. Whereas their sense of vision is not organized enough yet to assist them in interpreting reality, touch immediately and directly lets the newborn know that their world is secure. The dictionary of the Russian language defines touch as: “In reality, all five senses can be reduced to one – the senses of touch. The tongue and the palate sense the food; the ear, sound waves; the nose, emanations; the eyes, rays of light”.

Babies depend on touch to make contact with the world. Expanding their contacts as they move around and touch things, young children absorb other's commentaries on what they are doing. Like feelings, words become associated with actions, body parts, objects, places and people. Children learn verbs, nouns, names, prepositions, adjectives, adverbs and labels for emotions in this way. Touch is one of the sensory building blocks that helps one recognize the world, create inner representations of the external world in their own brains and nervous systems, and it tells them when one is touching something or something is touching them. As infants, the brains and nervous systems are genetically programmed to grow and develop with the influence of interaction with caregivers. The brain is literally structured through the relationship between the right brain and the caregiver's right brain. In other words, the brain builds almost exclusively through the influence of the nonverbal relationship, including touch, with caregivers from birth until around two years (SCHORE, 2003). Touch is essential in body awareness and proprioception. It is intimately connected with motor planning or learning to move in prescribed ways, such as learning to pump one's legs to swing

farther or in getting dressed. The tactile sense is also involved in fine motor control as well as hand-eye coordination (KRANOWITZ, 2005). But touch can also affect the development in negative ways. Pinching, slapping, punching, restraining, and pushing are all forms of touch that can be used to inhibit certain forms of expression or behavior by the child, to send messages of power and dominance to the child, or to express the caregiver's anger and rage at the child. Both abusive touch and neglect can arrest a child's emotional development.

Tactile contact serves to intensify involvement between two people. Touch usually suggests intimate physical contact between people and carries contextual associations with several archetypal scenarios: a sexual relationship, an adult-child relationship, or a *making better* relationship (Totton 1998; GOODRICH-DUNN & GREENE, 2004:235-237). Touch and tactile contact in the therapeutic relationship provides rich opportunities to explore psyche-soma phenomena as disruptions or disturbances within a two-person system. By yielding and listening to the symphonies of mutual exchange, one can be curious about the internal adaptations, psychic and bodily, in oneself and in the other; seeing body and psyche into relatedness, both with each other and in relationship. Touch in psychotherapy becomes particularly potent and formative in situations when fragmented aspects of a client's psyche and soma are bridged by the therapist's embodiment. Psyche and soma become enthralled and captivated by the gravitational tug of involuntary bodily identifications with un-integrated or disembodied aspects of the client's inner world. It is necessary to rely on one's own sensory self-experience, to keep one sufficiently anchored within his/her own body and personality in order to navigate the depths stirred by touch.

V.E - GESTURE & MOVEMENT

At birth, if the baby is lucky, he or she is placed on the mother's belly and literally wiggles up her torso in search of her nourishing breast. The capacity to creep up the mother's belly is dependent on the innate neurology of the vestibular system, informing the infant which way is up (or down) in the field of gravity. The infant finds the nipple, roots, and sucks by yielding through the throat and tongue; in order to swallow and breathe all requires the underlying action of yielding. Yield, push, reach, grasp, pull, and release are movement behaviors that continue throughout a lifetime. As an infant matures, coordination grows through these gestures. A sense of safety underlies the flow of expression (AGNEESSENS & TAHATA, 2012:10-16- Rolf Lines).

The gesture and its visual capitulation rely on infinite varieties of phenomena that prevent any identical reproduction. The act contains psychological and distinguished elements, even before any intentionality of movement or expression (LABAN, 1974; STRAUSS: 1966). The gesture is the minimum variation of the part of the body that starts to move, and it can be loaded with different meanings depending on the quality of the *pre-movement*¹¹¹. The pre-movement acts on the gravitational organization, i.e., how the individual organizes his/her posture to respond to the law of gravity. Tonic muscles are the muscles responsible for ensuring posture and balance. Thus, any modification of one's approach will have an impact on the emotional state; conversely every affective change causes a change, even if imperceptible, in one's posture (GODARD, 1995). Tonic muscles in charge of ensuring our balance anticipate each gesture.

¹¹¹Pre-movement is an attitude toward weight to gravity, which arises even before starting the movement. The pre-movement, there is in the simple fact of standing.

For Godard,¹¹² there is a difference between static pre-movement and dynamic pre-movement. Static pre-movement is the movement you put on in the morning and you keep all day. Dynamic pre-movement is the pre-movement that comes when one begins to move. Hubert Godard has found that static pre-movement is the most important language of the body. This pre-moving, invisible and imperceptible to the individual himself, will trigger both the mechanical and affective levels of the organization of a person. And the effect of the affective state that concedes to every gesture cannot be controlled by intention. That's precisely what gives complexity to the role of the therapist when they make themselves available to accompany a process of transformation in their clinic.

The therapist, turning attention to the perception of gestures, will have more tools to help the client feel more secure with the ground beneath them, with his/her support. In theory of Godard's Tonic Function (as we shall see in more detail in the next chapter), before moving, we need to guide in three-dimensional space relative to the earth;¹¹³ i.e., before one pushes off the ground, it is necessary to orient to the space by looking and then moving in the chosen direction.

Gravitational organization flows in what happens before the gesture, and will profoundly change the quality of the gesture and highlight it. One can distinguish movement and gesture.

Movement is understood as a phenomenon that describes the strict displacement of different segments of the body in a space, in the same way a machine produces movement. The gesture, however, is inscribed in the distance between this movement and the tonic-gravitational background screen of the individual; i.e., the pre-movement

¹¹² Lael Keen's transcription by Godard's conference in a training taught only for Structural integrators practitioner (rolfers) in Spain, Sept, 2013 in where this doctoral candidate also was present.

¹¹³In the axis physical plan: Front/back; side-to-side; high/below.

in all its affective and projective dimensions. There in lies the expressiveness of the human gesture, expressiveness that a machine does not have. In trauma, a person loses this quality of expression in life's potentiality, because in a trauma, dissociation steals vital energy and spontaneity.

Wallon (1949) defined the motor act differently. Besides its role in the relationship to the physical world (motor performance), the movement has a key role in affection, also in cognition. One of the unique features of Wallon's perspective is, according to Godard, the emphasis on expressive movement, which is the affective dimension of movement. Wallon links the study of the movement of the muscle responsible for its realization. Besides its role in the relationship to the physical world (motor performance), the movement has a key role in affection, also in cognition. The musculature has two functions: a *kinetic function*, which regulates the stretching and shortening of muscle fibers, and is responsible for the movement itself; and *postural tone function* or regulating the degree of variation in tension (tonus) of the muscles.¹¹⁴ Before acting directly on the physical environment, movement acts on the human as a means of mobilizing people through its expressive content. One can say that the first function of movement in child development is affective.

At the end of just the first year, with the development of *praxis*, gestures like grabbing or pushing open or closed, will intensify the possibilities of movement as a tool for exploration in the physical world; returning to action the child's adaptation to objective reality. The development of the first praxis defines the beginning of the cognitive dimension of motion (WALLON, 1949; GALVÃO, 2005:57-67).

The tonic regulations are responsible for the stability of gestures and body balance.

¹¹⁴ muscle activity can exist without giving body displacement (segments or whole) in space.

Although most evident in the area of expression, as seen by the role-play of the emotions, the tonic function is intimately related to kinetic movement, i.e., the movement itself. It is the kinetic function in running motion, for example, allowing the displacement member to a given direction. Imprinting a force in the opposite direction is the tonic activity that gives stability to the body. In the absence of postural support, the displacement of one of the legs would lead to its direction, the rest of the body, destabilizing it. The zigzag walking and successive tumbles typical of drunk people make the consequences very clear of disruptions in the normal tonic flow. Every movement needs to regulate balance. Although most evident in walking or running, it is also required for displacement of body segments. The simple act of extending the arm to pick up an object on the table with gripper fingers, requires a variation of imprinted tone to the muscles, allowing the gesture of pressure to be sustained in space while the rest of the body is maintained in a proper posture for support (WALLON, 1949; GALVÃO, 2005:69).

V.E.1 Neurobiology of movement:

The brain registers events via the sense organs almost immediately, but it takes up to half a second to become conscious of them. In order to generate effective responses in a fast changing environment, the brain must plan and execute actions unconsciously¹¹⁵ moment by moment. The brain speeds up the physical responses by fast tracking sensory information to the motor planning areas along an unconscious pathway. A

¹¹⁵Actions unconsciously: Reflex actions are motor actions that are programmed into the spinal cord. The brain is not involved, and the actions cannot be controlled consciously. Most reflex actions protect the body by producing rapid reactions to escape from potentially damaging stimuli. In each case, the stimulus causes sensory nerve ending to fire; these signals pass through the nerve fibers to the spine, and trigger firing in the adjacent motor neurons, which then feed back to the relevant area and cause it to move (CARTER, 2009:114).

visual stimulus,¹¹⁶ such as a moving object, prompts neural activity that works out where it is in relation to the body. Various parts of the occipital and parietal cortex, between them, calculate the object's shape, size, relative motion and trajectory. This information is then brought together and used to form an action plan, which might involve hitting (swatting a fly, for example), avoidance (ducking or jumping out of the way of a thrown object), or grabbing (a falling fruit or a stumbling child). The chosen response is largely learned: for example, a skilled athlete is likely to catch or hit a speeding ball, while an unpracticed player might just duck it (CARTER, 2009:118-119). Once a movement has been planned, the responsible brain areas send signals to the muscles¹¹⁷ to execute the action. Some of these signals are sent first to the motor cortex, and then onward through the spinal cord. Others travel by more direct routes. Movement occurs when the signals reach the muscle fibers,¹¹⁸ causing them to contract (CARTER, 2007:116). Action plans generated in the supplementary,¹¹⁹ premotor¹²⁰ and parietal cortices¹²¹ are forwarded to the motor cortex for execution. The motor cortex is made up of about one million neurons, which send long axons¹²² down the spinal cord. These are bundled together, along with axons that come directly from the somatosensory cortex, to form the lateral corticospinal tract. Just before entering the

¹¹⁶Visual stimulus - Dorsal and ventral routes: visual stimuli are processed along parallel pathways. The unconscious dorsal route generates physical responses while the ventral route creates conscious perception.

¹¹⁷ Muscles are the body's "*flesh*" "They bulge and ripple just under the skin, and are arranged in crisscrossing layers down to the bones. Their job is to contract and pull the bones to which they are anchored. Rarely working alone, they usually contract in groups. Moving bones at accurate angles and by precise distances (PARKER, 2007:56)

¹¹⁸Fibers: When stimulated by a motor nerve, electrical changes in the muscle cause the release of calcium ions inside the muscle. This causes the filaments of the muscle to slide against each other and contract.

¹¹⁹Supplementary: An area in the front of the motor cortex involved in planning actions that are under internal control, such as actions done from memory rather than guided by current sensations.

¹²⁰Pre-motor: A part of the *frontal cortex* concerned with planning movements.

¹²¹Parietal cortices: The top back subdivision of the *cerebral cortex*, mainly concerned with spatial computation, body orientation and attention (ROBERTS, 2007:486).

¹²²Axon: The fiber like extension of a neuron that carries electrical signals to other cells. Most neurons have only one axon (CARTER, 2009:246).

spinal cord, the nerves from each hemisphere of the brain separate and cross over, so the fibers from the left hemisphere of the cortex go down the right side of the spinal cord, and vice versa. The rubrospinal tract originates from the red nucleus in the midbrain, and helps to produce fine movements. The vestibulospinal and reticulospinal tracts starts lower in the brainstem and help control balance¹²³ and orientation. The axons of the motor neurons, which receive signals from the spinal tracts, emerge from between the vertebrae and travel to the muscle. The nerve endings infiltrate the muscle fibers at neuromuscular junctions, and when they fire they release the neurotransmitter¹²⁴ acetylcholine.¹²⁵ This diffuses across the narrow synaptic cleft,¹²⁶ connecting the nerve muscle and binding to acetylcholine receptors in the muscle cell membrane; which by a series of reactions makes the specific muscle contract. Muscles required to carry out fine movements have correspondingly higher numbers of neurons than those required to perform gross movements.

The body has three main types of muscle tissue. What one commonly thinks of as muscles are skeletal¹²⁷ muscles. Most join to bone and cause movement of the body. Skeletal muscles are also known as *voluntary* muscles, since one controls their actions at will, and as striated muscles, because of their appearance under a microscope. A second type is the smooth¹²⁸ muscle, in the walls of body parts such as the airways and stomach. This is called *involuntary*, because it works automatically rather than under

¹²³ Control Balance: *The reticulospinal and vestibulospinal tracts* help control balance and orientation, and neutralize the effects of gravity (CARTER, 2009:116).

¹²⁴Neurotransmitter: A chemical secreted by neurons that carries signals between them across *synapses*. (CARTER, 2009:245).

¹²⁵Acetylcholine: A *neurotransmitter* that plays an important role not only in learning and memory but also in sending messages from the motor nerves to the visceral muscles (CARTER, 2009:242)

¹²⁶ Synaptic cleft: A gap between two neurons that is bridged by neurotransmitters.

¹²⁷Skeletal: A microscope view show pronounced stripes, bands, or striations, created by the alignment of muscle fibrils.

¹²⁸Smooth: The light microscope reveals few features, only tapered muscle cells with dark nuclei

conscious control, or smooth muscle, from its magnified appearance. The third type is the cardiac¹²⁹ muscle in the walls of the heart.

How muscles work together: Muscles can only pull, not push, and are arranged in pairs that act in opposition to one another. The movement produced by one muscle can be reversed by its opposing partner. When a muscle contracts to produce movement, it is called the *agonist*, while its opposite partner, the *antagonist*, relaxes and is passively stretched. Few movements are achieved by a single muscle contraction. Whole teams of muscles act as agonists¹³⁰ to give the precisely required degree and direction of motion, while the antagonists¹³¹ tense to prevent the movement from over extending (CARTER, 2009:63). Movement in the body, such as nodding and walking, employs the mechanical principles of applying a force to one part of a rigid lever, which tilts at a pivot point (fulcrum) to move a weight (load) elsewhere on the lever. The muscles apply force, the bones serve as levers, and the joints function as fulcrums. A whole range of lever systems exist in the body, and among them they allow a wide range of movement, as well as providing a means to lift and carry things (CARTER, 2009:63).

Sense of position: Muscles contain many tiny sensors, known as neuromuscular spindles. These are modified muscle fibers with a spindle-shaped sheath or capsule and several types of nerve supplies. The sensory or afferent nerve fibers, which are wrapped around the modified muscle fibers, relay information to the brain about muscle length and tension as the muscle stretches. The motor neurons stimulate the opposite reaction, causing the muscle to contract and shorten, and restoring muscle tension to normal. Similar receptors

¹²⁹Cardiac fibers: Fibers in heart muscle are short and branching, often Y – or V – shaped, with faint banding or striations.

¹³⁰Agonist: Bending the elbow for example: The chief agonist is the biceps *brachii muscle*, which runs from the scapula to the radius bone in the lower arm.

¹³¹Antagonist: Straightening the elbow for example: The biceps *brachii* relaxes and the *triceps brachii* on the opposite side, attached at its lower end to the ulna, contracts. It is aided by *the anconeus muscle*.

are found in ligaments and tendons. Together they provide the body's innate sense of its own position and posture called proprioception. The muscular system produces an endless variety of actions by using muscles as coordinated teams. Muscle tissue creates bodily movements and it also powers internal processes. From the heartbeat, to the movement of food through the intestines, to the adjustment of arterial diameter, to focusing of the eye, the muscular system leads a very physical existence, in which regular use prevents wasting, and injury is more common than disease. However, muscles are helpless without the nervous system to stimulate and integrate their activities (CARTER, 2009:54).

Posture, in other words, is the neuromotor system's expression of emotion, and aptitude about orientation toward or away from the world (CACIOPPO et al., 1993; MAXWELL & DAVUDSON, 2007; WALLBOTTI, 1998; FOGEL, 2009: 198). Muscles are – along with the symptoms of autonomic nervous system function, such as sweat, tears, trembling, body temperature, heart rate and skin color changes – the main avenues that your brain and nervous system uses to express itself in the world. All facial expressions come from the muscles under the face's skin. The way that emotion and stress affects muscle tension, and tension in turn affects feelings of stress and emotional state, creates an attractor that can stabilize into each individual's characteristic postural appearance and aptitude. Posture can be submissive, defiant, depressed, bouncy, open, or relaxed. Posture is one way of expressing the basic bio-behavioral response modes. Posture can be used to take a stance toward (engagement) or against (fight mobilization) or away from (flight mobilization) the world. It makes good sense that the muscles play an essential role in self-protection, since they are potentially under voluntary control (FOGEL, 2009:198).

Among all of the basic principles of treatment for loss of embodiment self-awareness, Somatic Experiencing Practitioners (SEP) are trained to be supportive and to access body memories or blockages in order to restore the biological self-regulation process.

Chapter VI
**HOW TOUCH & MOVEMENT ACTS WITH SE
TO RESTORE THE ONE SELF**

VIA - EMBODIMENT – A PATH TO SELF-REGULATION:

Embodiment is an essential aspect of Touch & Movement's work in trauma healing. Embodiment, for this student is defined as the conscious perception of bodily state through coherence and fluidity of the sensations in the continuous processes of movement, which allows the person to express his/her authentic capacities, respecting their individual limits and other's limits in affective and social relations. Self-regulation promotes a feeling of well being, safety and impulse for life. It is the capacity in which allows restoration of an organism by rhythmic movements between states of comfort and discomfort, pleasure, displeasure of expansion and contraction. Traumatic experiences cannot co-exist in any of these states.

Self-regulation is the curiosity state, the state of playfulness, goodness and a sense of belonging to life. In mammals, this capability of self-regulation is essential. It gives them the capacity to alternate, in a fluid manner, their inner bodily states to adapt to external changes of the environment (LEVINE, 2011:312). This kind of ability allows animals to vary their emotions to properly adjust to environmental challenges. According to Allan Schore, and others, affect regulation is an adaptive function and a basic vital feeling of the Self. Body and movement psychotherapists understand embodiment as much more than just the fact of having or being in a body. They know that inhabiting the body, fully living in it, is not straight forward (Soth, 2006; CAROLL,

2002:250). Embodied self-awareness is the ability to pay attention to oneself; to feel sensations, emotions, and movements online, in the present moment, without the mediating influence of judgmental thoughts. Embodied self-awareness is composed of sensations like warm, tingly, soft, nauseated, dizzy; emotions such as happy, sad, threatened, and body senses like feeling the coordination (or lack of coordination) between the arms and legs while swimming, or sensing the shape and size (fat or thin), and sensing the location of objects and other people (FOGEL, 2009: ix-xiv).

Embodiment may mean what Winnicott (1966) called *indwelling*; it requires an active sensing of bodily sensation, impulse and affect; it implies a sense of ownership of one's body and feelings, and a capacity for inter-subjectivity. All these meanings are gathered in Merleau-Ponty's (1962) term *the lived body*. Merleau-Ponty had a huge influence on re-conceptualizing the body as the locus of experience, and placing phenomenology at the heart of understanding. Schore (2003) chose his words carefully: "Embodiment is a process which fluctuates according to many factors; it is on a continuum with dissociation. The increasing popularity of the term *dissociation* in psychotherapy, as part of the developing understanding of trauma provides a further word in the interdisciplinary vocabulary. Dissociation has widely varying meanings, of course, as does the word *embodiment*. But it is increasingly used by therapists from many orientations to refer to overwhelming affect, dysregulation, disconnection between self-states, or detachment and disengagement from relationships." It describes a state of relative disembodiment (SCHORE, 2003). Embodiment is made possible by neuro-motor and neuro-hormonal pathways between the brain and the rest of the body, pathways that serve the function of using information about body state to maintain optimal health and well being. When these pathways become compromised, primarily as a result of physical injury or psychological stress and trauma, one loses their ability

to monitor and regulate the basic body functions. The many different types of practices that can enhance embodied self-awareness that has been impaired follow some general principles that can be understood in terms of the psychophysiology of self-awareness (FOGEL, 2009: IX-XIV). It is the case of Somatic Experiencing™ created by Peter A. Levine, PhD, as Movement Education, as Dr. Ida Rolf felt the need to include in her method – Rolfing Structural Integration, and later, Hubert Godard developed his studies and his pedagogy on that issue.

The body as a perceptual space, as an organism, as a cultural object, as the site of subjectivity, of transformation and process, is the vehicle for all aspects of live communication (CARROLL, 2010:254).

Embodiment is to be awake about one's self. It is to know what one is doing, while being aware of what is happening inside and outside in a reflective way. Being embodied is to be paying attention to organic, mental and affective processes, and at the same time be aware of external perception as exists in continuum interaction between both states. This kind of perception modifies the alertness state of individuals in which, by their side, will modify their actions in the environment. Being awake requires a certain level of attention, receptivity and certain muscle tonus in the whole organism. To develop and to deepen that, one has to enlarge their perception. Perception can be understood as an integration of the senses, resulting in refined consciousness. For example, consciousness of superficial and profound sensitivity, awareness of sense of body position in time and space, and also consciousness of neuromuscular structure tension in the body. Time after time, one starts to get more confidence in the perception of their own body, also of their psychological processes and in the somatic resonance in relationship to the other. Embodiment is a process of maturing and a precious space in which one can have an opportunity in life to remember who they are. It is the alertness

state of receptivity to the reality of what happens by itself and what happens to each one (and to the other) simultaneously.

The body must, on the one hand, provide enough robustness and stability to act as a foundation for consciousness, and on the other hand, be so exquisitely sensitive, finely tuned and complexly self-organizing that the state of self can change rapidly in response to the relational environment (CARROLL, 2002:247).

A better quality of Embodiment may be achieved by the addition of Touch and Movement Education. This is due to using the procedure proposed in this chapter VI. The practitioner may be able to evoke an internal release of inhibition that will promote a new external configuration. It means when someone has been traumatized, an adaptive body organization establishes; then when an intervention is done it can create a third body or physiological re-organization. If movement re-education is used in SE, a better functionality and new possibilities of expression toward sustaining optimum health can emerge. In order to work using touch and educational movement for clients of the Somatic Experiencing™ process, the therapist will access the child's psychological spatial development stage and what was missing in the sensory-motor level. The pedagogy will use is based on Godard's studies and practice.

According experience of this doctoral student, when an expert practitioner deals with trauma, he or she will start to notice the inherent complexity intertwining between body, mind and brain. These restrictions, which are reflected in a frozen, narrow, inner and outer space, diminish the flow of vital Life Force. Using Godard's movement approach in Somatic Experiencing, someone can be aware of his/her embodiment with much more consistency. Inner sensations are mapped in the orbitofrontal portions of the brain where inputs are received from the senses (exteroceptors), from muscles, joints

(proprioceptors) and viscera (interoceptors). As soon as one shifts body sensations, one also changes the highest function in the brain too. Through emotional regulation it is possible to understand what happens in embodiment.

It is not possible to identify how large the body's intelligence is, but it is throughout embodiment that one can evoke it. The body and the flow exist all the time. The practitioner has to help the client feel it and sense the immobility without fear. Then, by palpation or the gamma touch, the practitioner can facilitate the client's awareness of his/her body presence as the body yields and it can reveal itself. Therefore, embodiment can emerge. This level of experience is able to take someone to feel the live awareness of the body. This state is the result of surrendering in gratitude to the Earth for lending us our bodies. When one accesses this consciousness, it is a refreshing experience that increases vitality, joy and well-being. This state is when our intelligence experiences itself as an embodied spirit noticing its space, sphere, dimension of volume, weight, movement or lack thereof. It is hugely satisfying to experience the live body and integral health.

An embodied therapist, who guides others in reintegrating the brain pathways that became dysfunctional due to trauma, will find it an honour to help their clients recover what was lost and reconnect to life.

VI.A.1 - Tonic Function by Godard's perspective for embodiment:

For Godard, the relationship of body with space is the basis of his work on perception and how tonic function is intimately linked with it. Godard makes a comparison that is very interesting. He says that generally in trauma, for people recovering from injuries, only 20

percent of them actually suffered real injuries. The other 80 percent who come to therapy for their perceived injuries will come to learn that it comes from a lack of perception. His comparison caught the attention of this doctoral student since her very first class with Hubert Godard. This dissertation comes from years of speculation over this Godard's statement, and from practicing Somatic Experiencing™, deepening body perception (of both therapist and client) and its mechanism to deal with a state of shock while at the same time be embodied. This proposal is to bring reflection on the potential of movement education to re-establish embodiment; where a person can access consciousness of their body and how it relates to the space. Working with perception, the practitioner can wake the senses to more sharply respond to the impact of gravity; and facilitate the reconnection of one with the ecological environment and with him/herself.

The gravitational response, the first developed sense, will be invisibly present in anything one does, even when they forget to think about what they do. For Godard, Tonic Function is a dynamic and complex system that reacts to gravity and allows orienting and movement to assume psychobiological postures (FRANK, 2002). The gravity response system can also be affected by a change in perception, impression, or the meaning one may hold for a situation. Acquiring tonal balance enables a person to adapt to life situations with more ease, responsiveness and a fuller range of sensations, feelings, and postural balance. When a person is fixed at one end of a tonal spectrum, which may be broadly described by hypotonic or hypertonic musculature, there is far less adaptive capacity. It is the ability to react to a situation with an effective and appropriate response that is the desired result. Tonic muscles (the muscles of posture) respond to sensation, the language of the brain stem, not the language of the cortex, which may involve the language of will. The command of "stand up straight" may become a momentary overlap of an underlying pattern of collapse or rigid holding.

However, the suggestion of finding two directions within the body, the symbolic Earth and Sky within each muscle accessed through the perception of weight and orientation, engages a felt sense understood by the deep centers of the brain, specifically the cerebellum and the medulla and the gamma motor neuron loop (FRANK, 1995:15). Godard sites two centers of gravity: “*G*”(or *general gravity*) refers to the lower center of gravity, constellating around the third lumbar vertebrae. This lower center relates to a sense of support from the ground, and structurally to the way in which weight transmits through the pelvis and hip joints. And “*G* ’ ” (or *G prime*) refers to the upper center of gravity. It is a moving center. The way in which one reaches, grasps, pulls, pushes, expresses, and welcomes, all have initiatory action in the shoulder joint. This center of gravity “*G*’ ” organizes the head-neck-arm at about the fourth thoracic vertebrae. The upper center of gravity has a direct role in shaping the relationship of the legs and pelvis, as well as a profound effect in expressing personal history and interactions with the surroundings (NEWTON A., 2011:248-273). Godard gives an example: “A lot of people are completely *up* people, who have no ground. People, who are the opposite, are building from the ground up. The tonic muscles will respond not to what one does, but to the way they are oriented to the space” (CARYN McHOSE, 2009:37-42). He affirms that posture has the capacity to go in two directions. It’s very clear that 50% of the action needs to start from the floor, like pushing or pulling, and 50% needs suspension, like pointing and reaching. The space of action will be affected directly by the way the posture is organized (CARYN McHOSE, 2009:37-42). Newton A., (2011) talking about tonic function and Godard, says: "Accessing gravity preferences, (weight/spatial orientation), unique to each individual, affects not only the physiology within the brainstem but directly affects muscle tonus." Tonus is the state of tension in the

muscles of the living organism. Tonus increases when there is excitement or when actively moving about, and is lowered during sleep due to the functioning of the reticular formation in which turns up with incoming sensation or turns down with the lack of sensation. Overstimulation of the reticular system results in hyper-vigilance (NEWTON A., 2011:248-273). There are two motoneurons: alpha (cortical) and gamma (sub-cortical). The spindle muscles responsible for tonus regulation, keeping one vertical in spite of all interference (ankle sprains, uncomfortable shoes, fatigue, etc.) are the tonic muscles. The spindle muscles (stretch receptors) are the intelligent receptors that send and receive signals from the gravity control center in the brain, including the reticular formation, the spine and the cortex in which interprets sensory impressions. These ongoing adjustments in the muscles are registered without or conscious awareness. These muscles burn oxygen more efficiently than the fast-twitching, sugar-loving, phasic muscles (NEWTON, 2011:248-273).

It is throughout the tonic dialogue that a baby builds bonding; they also develop boundaries and the containment provided by the sensation of spatial safeness. Godard explains that if the baby experiences any discomfort, like an intensity of light, he or she will deal with that only by tonic activity. The baby goes into sympathetic activation (fight/flight) before feelings of discomfort, and it takes some time for him/her to analyze the space (kinesphere), become emotionally agitated and to be able to move by him/herself and get free from that discomfort. In this phase of development, the biological regulation comes from the other. The baby finds his/her regulation by the support from the mother or caregiver's self-regulation. Exploring posture and visual sense in young infants, André Bullinger (1991) affirms: "Newborns' visual activity shows orientation and appears readily coordinated with audition." He observed that in this posture, the young infant's gaze is more stable, and the extended hand, facing the

infant sideways, offers a privileged target for visual exploration. Bullinger also noted that when the newborn is seated in a symmetrical posture, head aligned at center, head control is reduced, and the infant appears to huddle up, showing increased oral activity, such as spitting and tongue protrusion. Breathing appears to accelerate and is sometimes blocked for prolonged periods, providing a temporary “pneumatic” tonic state that compensates for the lack of postural support and control. Asymmetrical postures, by contrast, anchor the young infant.” By providing stability and bearing points, which progress in the integration of posture, a visual action can take place. When infants are solicited to change posture as they track a visual target, an interesting development is observed. Immediately after birth, it is the postural state in which infants themselves determine the spatial limits of their tracking. When the object exits the portion of the visual field the infant can attend to, he or she tends to wedge back to the stable and asymmetrical posture he or she was in at the beginning of the tracking motion. Once stabilized in this original posture, the infant appears to engage in intense visual scanning, although no objects are present in the visual field (EARLBAUM, 1999:18-19). By three months, visual tracking by the infant appears to mobilize essentially head movements only, the stabilized trunk becoming the bearing point of the overall visual pursuit. The interaction between posture and vision in early development is evident in observations demonstrating that changes in the head posture of the young infant has a significant impact on the mapping of his or her visual space. According to the procedure that was used, in each posture the infants fixated one point at the center of their visual field, for each particular posture in which they were placed. Once the baby was staring at the central fixation point, a mobile was moved from either the right or the left periphery of the visual field starting at about 135°, and moving toward the center. The dependent measure used to assess peripheral detection was the moment the infants

stopped fixating at the center point and made the first saccade in the direction of the mobile (EARLBAUM, 1994:17-18). The sensorimotor systems newborns are equipped with -- including visual, auditory, haptic, and vestibular systems -- are functioning and attuned to particular features of the environment. Neonatal behavior is best described as a global engagement, in the sense that from the start of development the various sensorimotor systems are organized to function in synergy (Bullinger, 1981, EARLBAUM, 1994:26-27).

The ability to create a previous psychological activity is when the baby gets to sit in an upright position, while sustaining his/her head. It appears that with growing control over self-sitting ability, infants become *one-handed reachers*, regardless of posture. From a developmental perspective, these results also suggest that postural development might play an important role in breaking the original symmetrical and synergistic use of the hands in reaching, contributing to the emergence of a more differentiated functioning of the hands (Rochat, 1989; Rochat & Senders, 1991; EARLBAUM, 1994:25). When the baby starts to have a separation between left and right, he begins to have contralateral movement, which comes from meeting the other. And it is only after this that the baby begins to have tonus in the spine and is able to uncouple the short and long flexors of arms and legs. The baby is sitting on both ischial tuberosity (sitz bones), and has asymmetrical postures; then he sits on one sitz bone and the other appears and he has torsional movement (GODARD, 2013). This action, which is accurately oriented in space, provides the infant with a complex co-variation in the environment: a particular sound with a particular address in space. Suppose that a sound the baby heard came from a novel, colorful music box that was placed on the right side of the bassinet. This co-variation would result in a reinforcing visual consequence, eventually enhancing the probability of its repetition. This simple example illustrates that the original synergistic

nature of sensorimotor functioning, when combined with the rudimentary attunement of this organization to particular features of the environment, is a sufficient condition for providing the infant with regularities, invariants, and information about addresses in space (EARLBAUM, 1994:19). Infancy research has revealed that from birth, infants are capable of performing actions of remarkable complexity and organization. Such early behaviors include head orientation to sound (Muir & Field, 1979), visual tracking of moving targets (BULLINGER, 1977), and hand extension toward visible moving object (von Hofsten, 1982: 1999: EARLBAUM, 1994: 17-18). From birth, posture is dynamic and an integral part of the perception-action cycle. Postural development and postural constraints attached to the infancy period have to be understood within this context. Infants manifest, from an early age, remarkable perceptual and cognitive abilities (E.J GIBSON & SPELKE, 1983; SPELKE, 1991), but future development of these abilities, and the development of functional action in particular, is linked to progress in the development of posture.

Considering that human infants have a relatively extended period of postural immaturity, and that postural development parallels progress in the skilled control of action, the question of how posture and action interact in development is how progress in the control of posture relates to the development of functional action in infancy. Functional action is defined here as goal-oriented behavior (e.g., sucking to ingest food; transporting an object to the mouth for feeding or for oral/haptic exploration; reaching for an object to grasp it; and moving eyes, head, and trunk to track a visual target (EARLBAUM, 1994:16-17).

Stern (1985) said: “There is a primitive sense of self – an embodied self-awareness that has the capacity to expand its awareness of itself – at the very core of the psychophysiological being.” The newborn at the breast is adequately equipped to be self-

aware of how to move and sense in a way that facilitates feelings of pleasure and reduces the feeling of displeasure from the mouth and gut. There is learning to feel and regulate the self-to-self coordination of sucking, swallowing, and head turning in relation to mild flow. There is an emerging awareness of strong and powerful emotions related to those actions and to the success and failure of those actions (Stern, 1985; FOGEL, 2009: 01-13). The lack of self-reference in the immature brain would in fact engender an autistic state of being overwhelmed by the world without a clear sense of what is important or useful. An autistic child is not able to create a triangulation relationship with caregiver to reach the desired object, so it is impossible for them to have body schema self-awareness. Without self-embodiment in traumatic experience, the nervous system cannot cope with what is overwhelming. Memory, movement, and sensation become impaired and the boundaries of the self shrinks to a small sphere of perceived control. As a result, individuals can no longer monitor their internal states. The baby can no longer tell when they are actually hungry or tired, happy or sad. The reason the body needs the other to be self-aware is in order to maintain homeostasis, that is, a state of mental and physical health in which one's cells are sufficiently nourished to maintain normal metabolism to preserve and grow body function. The neural pathways for embodied self-awareness are directly linked to the pathways for homeostasis. Only when there is a sense of safety can one access the bio-behavioral responses related to safety; restoration, engagement and normal absorption. Restoration involves an awareness and acceptance of the need to recover, and occurs in extended periods of licking, rest, sleep, and the comfort of other warm bodies (FOGEL, 2009:13-14).

Tonic Function commands every biological and psychological function, making it possible for any form of verbal or non-verbal communication, characterizing it as a dependent process of learning. The lack of postural control is a major constraint of early

development. In general, any movement pattern is a complex whole that integrates posture and action. The postural aspect of movement refers to the integrity of the whole body while a specific action is carried out. Observation tells us that movement and posture are not controlled separately, but tightly integrated into what Reed (1990) called *dynamic posture* (EARLBAUM, 1994:, 1999:16-17). Virtually from birth, infants learn to overcome, and also to use, gravitational force to perform movements that are part of functional action patterns. With growing control over posture, they free themselves from external body supports, opening up new possibilities of action and exploration (EARLBAUM 1999:17-18).

VI.A.2 – How to create a dynamic balance between inner and outer space:

Bonnie Bainbridge Cohensays: “Vestibular nerves are the first to be myelinated before all other senses, even before being oriented to nourishment, one first needs to orient to the gravitational field." When a baby develops there is no tonus in the head, but there is in the limbs. The gravitational response becomes linked with the mother. After a time, the baby starts to twist when it is time to start bonding with the other. If the baby gets scared¹³², they come back to the symmetrical posture of flexion and extension in the same posture. But the baby begins to be able to go to the encounter with the other, and is able to surrender to the arms and detaches from his/her spine as the baby is letting go from arms and legs. Ultimately, ontological information of touch and movement begins

¹³²Wallon, 1949:126). He speaks that there is a relationship between reaction of equilibrium and fear. When there is any disturbance in the equilibrium, there is a sudden uncertainty of what aptitude to take. When a newborn is left by own in the bath or at the flufly sofa without support, or in particular after a fall, the newborn reacts with a sudden immobilization with fear that could be seen by gestures, eyes reflexes, trembling. These are immobilization reflexes and newborn can get frozen on his or her posture that means is his or her way to express their “susto”, horror that produce more fear and muscles contraction or hypotonia. Theictusof fear (PREYER & STERN; WALLON, 1949).

from the moment of conception, and through the embryological development process and its spatial organization.

Another concept emerges which Godard calls *Phoric*¹³³ *System*, which is the need to stay with oneself and be grounded in one's own gravity before they can be with another. One stays with the Self, the part of the body that we regard as the spine and front, and then goes to relate to the other. It is not the fascia that organizes this, according to Godard, it's the relationship with the inner and outer space that organizes muscles and motricity.

There are two gravities that are thoroughly explained in Tonic Function from Godard's perspective. There is the gravity of the ground, and there is the gravity of the head, the *otoliths*. When the head moves it activates the otoliths and then they have a sense of the ground. Individuals have gravity from above and below. They have two ways to feel gravity and weight. They are: the baroreceptors of the feet, and the otoliths of the head. When Godard says *vestibular system*, it comes before the eyes. The first attempt to move will bring the necessary separation. One differentiates up and down and has a line. The line gives one the capacity to differentiate front and back, which then gives the capacity to differentiate left and right. There is a left body and a right body. The line doesn't exist in and of itself. When the baby starts to have a separation between left and right, he begins to have contralateral movement, which comes from meeting the other (GODARD, 2013).

¹³³Phoric means – “support” in Greek

VI.A.3 - The core stabilization and an organization space process:

The organizational relationship in which comes from above to below, or from below to above, create a triangle¹³⁴ of support with vision. One orients with a sense of weight in which informs the inner ear¹³⁵ about balance and its relationship with spaces shaping a triangle with vision¹³⁶.

One has two ways of orienting through the head: vestibular system and eyes. But they are very different. When one orients through the eyes, gravity is in the other. It's so important to have the gravity of the inner ear. When one orients through the vestibular system and looks at another, they have the capacity to be close or far. This is *vergence*.¹³⁷ Vergence is mandatory for breathing. One has to be able to expand, to come apart and to reassemble him or herself. If the lens is fixed, one cannot breathe and comes back to the center. Vergence is the capacity to involve you in a kinesphere of one or not. Drivers who struggle with a car don't include the car in their kinesphere; the good driver makes the car part of their body. This is a vergence issue. It's like a zoom lens in a camera. The capacity to have a zoom is a very important part of the relationship to others. It makes a relationship with the other elastic (GODARD, 2013).

According to Godard (2013), the core muscles mostly respond to activity of the feet, hands and head in the way they meet the world. When one triggers the mechanoreceptors of the front of the sole of the feet, it triggers the deep muscles of the back, if one triggers

¹³⁴Triangle means a flux of images. By image is regarded every information received by the five senses. Triangle that is given by tonic activity in relation with gravity and emotion.

¹³⁵ See in this chapter the sense of hearing about balance

¹³⁶ See in this chapter the sense of vision

¹³⁷Vergence as a sensory motor function provides more than just useful information into understanding to someone. Vergence function may answer basic questions by understanding where the patient is in relationship to space (WARSHOWSKY, 2012).

the mechanoreceptors of the back of the sole of the feet, one will have triggered the muscles on the front. The tension in the trunk depends on the way that one transfers weight through the feet. Godard's (2013) studies found that haptic activity is the perception associated with motor activity. Haptic activity can come from the way ones are held as infants. As described in Chapter II, a source of chronic developmental trauma can come from this stage when the child frames passive or loose haptic activity, as sudden or abrupt gestures happen in the relationship between the baby and mother.

In terms of change to the movement pattern, Godard says that adults have to somehow become children again in terms of sensorial organization. Only then can one truly reorganize the movement. Levine (1997) says in order to do trauma healing one has to access the intrinsic movement to discharge the excessive accumulative stress energy, to complete the physiological active defense response. What Godard is saying is that it is necessary to redefine a better pedagogy of core stability. This doctoral student is observing that before one can renegotiate a trauma, the body has to find core stability. This affirmation regards that core stabilization comes from the relationship one has as they move in space. It is a continuum flux on giving and receiving information from inside and outside the environment. Each movement is a moment of adaptation to gravity in which one constantly accesses self-regulation. Core stability is related to integration between haptic activity and balanced movement given by tonic function.

VI.A.4 - Touch & Movement from Godard's Analysis Movement Education:

Touch & Movement from Godard's Analysis Movement Education is used by this doctoral student as an ontological tool to reconnect one with the primary function of life: giving and receiving information to and from the ecological environment. The body is

provided in nature by neural, fluid and fibrous networks¹³⁸ with its specific receptors and systems to perceive the inner and outer world and organize the body within a space. In order to understand the bodily processes and its adaptations, it is necessary to know the mechanism of how the body is organized spatially. When there is trauma, it blocks the primary motricity function of sensory exploration of the inner and outer environment, affirms Godard (2013). To restore the One Self, there needs to be the association of both activities - motricity and sensory. Both must work in collaboration. For Godard (2013), this cooperation is the haptic activity. If one is not on his/her feet, when a therapist is expecting a psychological change, they will be taking a big risk. If the client makes a shift at the psychological level, without presence in his/her feet to support them, he or she will be flying, because there are no grounding roots. A therapist has to bring the client back to his/her feet and track the changes in terms of gravitational organization. If a client, for example, makes a change in the chest area and the person isn't on their feet, then more disorganization will appear. When motricity and the sensory system do not work in collaboration, it leads to dissociation. Dissociation is the physiology of the freeze response in which somehow affects the whole organism. It could come from cultural habit, education, accident, fear of exploration, any nature of trauma or any psychological estimation of the context. What Godard (2013) is saying, is that when there is trauma,

¹³⁸The neural net: Is the brain and the spinal cord which is encased in the vertebrae. All the main trunks of the spinal and cranial nerves would branch out into smaller and smaller twigs until reaches the tiny tendrils which insinuate themselves into every part of the skin, locomotor system, and organs (MYERS, 2001:25).

The Fluid net: Is the vascular system: Centered around the heart's incessant pump its major arteries and veins go to and from the lungs, and out through the aorta and arteries to the organs and every part of the body via the wide network of capillaries (MYERS, 2001:26).

The Fibrous net: It is all elements of the connective tissue or fascial net. Principally collagen, but with some added elastin and reticulin – ones would see the entire body, inside and out, in a fashion similar to the neural and vascular nets, though the areas of density would once again differ. The bones, cartilage, tendons, and ligaments would be sheathed with it, and infused with a cotton-candy net surrounding each muscle cell and bundle of cells. Is not possible have a cubic centimeter without some of meshwork of collagen in the body. With any touch more than feathery light, one contact the tone of this web, registering it whether ones are conscious of it or not, and affecting it, whatever our intention (MYERS, 2001:28).

there is a haptic dissociation of touch & motor activity, because it immediately triggers the core muscles. Then, the mechanoreceptors (spindles) of the hands and feet, occipital, the eyes, the vestibular system are triggered, and the haptic dissociation is extended to any other senses, breathing and whole body. When the haptic function is not working, the sensory-emotional function is also not working. That is why the haptic system is so important in restoring One Self, and it requires body spatial re-organization.

VI.A.4.1 - There are two levels of body organization:

1) The body image. Godard (2013) says that one cannot reinvent an image of him/herself every day. The body image is build up from culture, by surroundings or any stimuli received in which the identity is shaped.

2) The body schemata. The body schemata is more regarded as the sub-cortical order, and it has been discussed in Chapter V, though it will be better understood in the next segment how the body structure is composed.

VI.B – FASCIAL ORIENTED & GRAVITY FIELD RELATED TO TRAUMA:

Structure is the spatial arrangement of all the parts of the body, determined primarily by the fascial net, as it manifests in the absence of any muscle activity in the body and with no outside forces acting on the body. This spatial arrangement can be called the *structural body* (Flury H. 2000). It is evident that one can never see the structural body directly because there always exists muscle activity in the body, and outside forces are always acting on the body.

Bodies are composed mostly of water, and much of their structure consists of hydraulic bags – fascial bags filled with gels or with semi-liquid masses that behave like gels: the mass of the abdominal viscera within the peritoneum, individual visceral organs, such as the liver and kidney within their fibrous capsules, the brain within its meninges, the heart within its fibrous pericardium, and even muscles (in relaxed state) within their endomyseal sheaths (electrogel). Indeed, the entire organism is enclosed within the embrace of the superficial and deep fascia (FLURY H., 2000).

Human beings are indeed *bags inside bags, inside bags*. Some of these bags have hard fillings (the bones enclosed within their periosteum) and some have soft fillings (all the rest).

The structural body is thus just one aspect of material reality – a relatively low level in the somatic organization, overall. Yet, it is a level that has its own set of laws – being responsive in a mechanical and elastic sense. The structural body works with the neuromuscular system; it has to be coordinated and directed. So it is perhaps more accurate to say that the structural body is controlled by the neuromuscular system.

When there is a Nervous system shutdown caused by trauma or extreme stress, the neuromuscular system is affected through co-activation of Sympathetic and Parasympathetic levels in which a non-reciprocal relationship is established. Ultimately, the structural body is affected by disorganization in the muscle tonus of the neuromuscular system.

The functional body is the result of the structural body plus neuromuscular coordination. Then, in trauma, a new adaptive organization between the structural body and the neuromuscular system has to be created. This formula defines the central focus of this paper: that the improvement of physiological function is required in trauma

healing. So, neuromuscular coordination has to be the central focus to re-educate one whom has experienced trauma.

VI.B.1 - The importance of Fascia in trauma: The work of Dr. Ida P. Rolf

The gravity field came to the healing panorama with full credit to Ida Rolf, PhD, American's biochemist –

the pioneer of bringing the concept of the influence of the gravity field to the body in psychotherapy.

Dr.Rolf did research in human tissues, especially fascia tissue, at The Rockefeller Foundation

Figure 11 – Fascia



Source: Myers, 2001

after the Second World War. She looked for knowledge in homeopathy and yoga, and this environment facilitated her creation of the Rolfing¹³⁹ method years later. Her research in fascia:¹⁴⁰ Fascia forms a continuous web throughout the whole body, surrounding all muscles, bones, nerves and organs. Because the fascia associated with any body structure typically lacks an anatomical name, the structure itself is used to

¹³⁹Rolfing Structural Integration, developed by Ida P. Rolf, PhD, organizes the human being in gravity. It enhances structural and functional integrity, as revealed by proper alignment and coordination. Two foundational premises distinguish Rolfing from other somatic practices; first, that physical balance, fluidity, ease and grace, and indeed personal wellbeing, all require appropriate adaptation to the field of gravity; and second, that the fundamental organ of structure is fascia (CASPARI & MASSA, 2012:303-309).

¹⁴⁰The fascia connects the whole body in an “endless web” has steadily gained ground. (Schultz & Feitis, 1996: Myers, 2008:6).

refer to its associated fascia. Through the fascia, the entire body is affected somewhat by any local change. This fascial continuity allows Rolfers to facilitate change in tissues distant from the contact point – even those that cannot be touched directly (CASPARI & MASSA, 2012:303-309). There is evidence for a “crystal memory.” Perhaps it can be said that the bioelectric matrix is what originates and maintains the order of the collagen-fluid matrix. As the collagens and pathway of water form a global network, there will be a certain degree of stability, or resistance to change. This constitutes a memory, which may be further stabilized by cross-linking and other chemical modifications of the collagens. The muscle is thus structurally, inseparably linked with the fascia organ, or to put it more specifically: it is a part of the fascia organ. In the myofascial (myo- muscle – fascial – fascia) system, the contractile elements of the muscles dynamize the fascial network, and thus affect both optimum pretension of the tension elements of the tensegrity structure and the movement of the whole system (MYERS, 2001). Dr. Rolf knew that if the structural body is touched, the connective tissue is modified. As Rolf was studying the tissue, she noticed different lines of tension in it. So she had an insight that these lines could be the result of the impact of gravity's influence on the tissue. It means these lines were the ‘meridians’ of latitude and longitude that girdle the earth. In the same way, these meridians girdle the body, defining geography and geometry within the myofascia (Myers, 2008:4-5). In biology, there is a geometry. It happens from molecules, cells to the macrocosmos’ levels. The fascial web constantly changes shape, chemical composition, and physical properties to adapt to mechanical and other stresses (CASPARI, & MASSA 2012:303-309). Meridian is usually used in the context of the energetic lines of transmission in the domain of acupuncture, but here is not that case, rather, it signifies lines of pull, which transmit strain and movement through the body’s myofascia around the skeleton. According to Myers, these lines have some overlap with

the meridians of acupuncture, but the two are not equivalent. The body organizes itself from its relationship of the physical body with three dimensions. They are: front and back of the body; below and top of the body; and the middle line. Individuals exist at the three-dimensional field and these lines of pull affect the structure and function of the body in which affects the three holistic networks as defined by Myers.¹⁴¹ This configuration creates a tensioning level along the myofascial continuity¹⁴². They are transmission of lines that organizes within a game of attraction and three-dimensional tensions under individual history. Rolf starts to understand how gravity acts at the structural body throughout this geometry, and starts to understand how to bring ones aligned at the vertical axis; recognizing fascia's capacity to self-correct over time. Structural integrators facilitate limited positional and functional changes to which the body can adapt, allowing adequate time between interventions for the adaptations to occur. After each adaptation, new changes become possible (CASPARI, & MASSA, 2012:303-309). Rolf found that as you modify the structural body, deep psychological changes emerge from it. So, by the body process, psychology and biology meet. Rolf concluded that: "As much as the front/back; side to side; inside and outside are organized, the gravity field flows easily in the body."

¹⁴¹ According Myers there are three whole body communicating networks. The neural net: nervous system; the fluid net: vascular system or every part of the body via the wide network of capillaries and the fibrous net: the fascial system (MYERS, 2008:24-27). Coppieters (chapter 7.19) notes the nerves have a large component of connective tissue as part of their make-up, as well as being potentially influenced by the mechanical interfaces of all tissues through and past, which they travel, and which they supply, including fascia/connective tissue. (Chaitow, 2012:295 –Schleip).

¹⁴²The term 'myofascial continuity' describes the connections between two longitudinally adjacent and aligned structures within the structural webbing.

VI.B.2 - Trauma vortex and memory of traumatized fascia:

The control of motor function is an integrative sensorimotor provision and the sensory input in which comes from the myofascial unit is important in the generation of motor function output. A changed sensory impulse flow, therefore, changes control of the muscles, which leads to muscular strain and can favor the origin and the activation of muscle fibers.

According to Gautschi (2012), dysfunctional fascia structures can, in this manner provoke or maintain dysfunctions of the muscle fibers, just as muscular pathology in the form of tissue. It is important to know that it always has a fascial component, as well, and can be the cause of fascia dysfunction.

Fascia has an important task as a receptor organ, and fascia dysfunctions always lead to a changed flow of impulses from the fascial mechanoreceptors also. Fascia disorders, therefore, change sensory function of the interoception and /or the proprioception.

Stiffness is defined as the actual change in force for a given change in length.

Compliance is the inverse of stiffness. Increased compliance of fascia yielding hypermobility occurs in various inherited connective tissue disorders.

These multisystem disorders are characterized by varying involvement of vessels, skin, joints, bones, internal organs, eyes, muscle, and the peripheral and central nervous system (VOERMAN, HUIJING, 2012:245).

There is evidence that a changed muscle activation pattern is a result of trigger point activity (LUCAS et al. 2004; GAUTSCHI, 2012:237-238).

When traumatic forces are introduced into the body, the potency of the breath of life will condense or collapse in order to protect the organism within its unified field of action. For Rolf, when there is restriction that impedes gravity to flow, adaptive impediments will appear. She is indicating that there is a traumatic structure that needs to be re-organized.

As inertial forces enter the field, the potencies that make it up naturally track the motion and force of the traumatic impact. Fluids will densify under stress, and tissues will contract and compress; they will contract to protect their integrity. Tissue memory is not about the past, that the tissue is remembering a past experience. It is more that the forces around which they had organized during trauma or environmental insults have not been resolved. It is about unresolved forces that are maintaining the disturbance in the present.

The whole tissue system will express and compensate for any unresolved inertial forces and potencies present. The connective tissues, muscles being tension structures in which are all continuous. Strains will be expressed throughout this unified field as a whole. There is a history, a context, but the forces originating the disturbances within the field are still present. When the inertial forces resolve, tissues are again free to reorient to their natural fulcrum and the primal midline. They can return to their original and natural motility (SILLS, 2001).

VI.C - TOUCH & MOVEMENT ACTING IN ORDER TO HEAL BODY – LEVINE
& GODARD’S APPROACHES:

The very nature of the body field is to be responsive. For this reason the process of early learning and psychological development is so intrinsically embedded within somatic process, the use of touch and movement in psychotherapy can offer a potent entry into the realms of non-verbal experience. In Chapter IV, section E, the reader can understand the practice of SE. This proposal is to respect the SE process as it is, but giving more attention to the tonic function; bringing more awareness to the focus and peripheral vision helping the client to sense the weight and not starting to renegotiate before the body feels stability with the earth. The awareness of the weight sensation is what gives reconnection with the inner ear and through body stability can be restored. Without the presence of awareness of the body weight, consciousness cannot be present. This happens because human bodies are part of the earth, part of a gravitational and electromagnetic field that occurs all the time. A traumatized person gets dysregulated because they lost the connection with his/her weight and need to self-regulate to get it back. Tonic function is the reference to any step ahead in the SE process, as movement education is added to it. In that way, it is possible to guarantee the efficiency of integration of the senses. In order to add Movement education to the SE process, afferent touch has to be placed in a three-dimensional way in sitting, standing and laying down position. Practitioner, before palpating the client's body, has to be spatially embodied him/herself first, and bring a sense of the weight, having breathing as the indicator of coherence to observe client's shift. A therapist can help clients to find their inhibition from any order anytime. First, the therapist has to support the client to accept the inhibition (uncomfortable sensation or in any element of SIBAM). Secondly, within resonance the therapist has to educate the client in what is needed. Among the educating

process, he or she can also use tools as resources (like using thera-band, stick, tuning board, balls, salute the sun and embodiment exercises) to access the center of gravity and locate any of the five senses (images); by playing with focal or peripheral vision and inviting the client to do what, within resonance is needed. These approaches have the goal for uncouple the fixed image. The client has to be able to address the imaginary state in which exists only in the flow. The practitioner can use a wealth of creative exercises to support the stages of spatial organization that were missing in the sensory motor level development. It is very important to bring awareness of spatial organization to the client. It is common during the process that the client finds inner inhibition in the form of uncomfortable sensations and/ or underneath emotions stuck in the pre movement.¹⁴³ Feeling is a continuous process involving varying degrees of pleasantness and unpleasantness. Feeling tones (based on physical sensation) are unique registrars of experience. They are the way that one becomes aware of the concerns and how they can go about satisfying them. These contour of feelings affirms Levine (2010), however, are often unnoticed. This is in large part because of the lack of sensitivity to inner experiencing or because sensations are often hidden in the shadow of the more intense emotions. Most people are unaware of these nuances that are overshadowed by the periodic upheaval of discontinuous intense emotions that appear to come from nowhere. They may seem wholly irrational and even “dangerous”, leading to suppression. This only further deadens the subtlety of the continuous feeling tones ...which in turn leads to the eruption of more over bearing emotional states punctuating those by increasing flattening and deadness... and so on. This is how various feeling tones become stifled before they are born into awareness (LEVINE, 2011:301-302). That is why it is so crucial to go slow and titrate physical sensation, as the practitioner helps clients to find

¹⁴³Before a “voluntary” movement is made, there is an unconscious pre-movement (LEVINE, 2010:318).

their weight and their inner and outer space. The therapist needs to help clients to find their foundation articulation in which separates up/down; front/back and midline. The job of the therapist is to track the client using somatic education to re-educate them to bring back more proprioception in which is missed through traumatic experiences. The awareness of three-dimensionality is the base of orienting in space. With Godard's proposal, he says that the practitioner has to work a stage before orienting response. They have to work to restore the haptic system first. That is not either motor or sensory system rather both have to be restored together. He says that in trauma, or in any extreme threat, there is dissociation in both systems and they lose their collaboration between each other. The haptic system, according him, has to be the first system to be rescued. It refers to the quality of relationship with the world that is expressed by the haptic system, which is primary, overall. He says that it is a psychobiologic learning process of adaptability of human kind that is dissociated with trauma experiences and needs to be reorganized. The motricity and sensoriality has to work in collaboration. In trauma, palpating or tactile (sensory) system and movement system ruptures and it happens before the orientation.

The contribution of movement education from Hubert Godard to Somatic Experiencing™ is to add the basic elements of safety, in the haptic level. In the encounter of therapist and client, the primary action is to rescue the spatial organization and its dynamic balance in gravity.

In psychological terms, when there is dissociation, one has the tendency to go directly to the trauma vortex or to the counter vortex (resourceful state). Too much excitement, or not enough excitement, causes one to lose contact with their experience. So, the therapist has to be the container of the client's process and help the client to learn how

to contain their experiences. When one allows him/herself to experience embodiment, he or she creates a field in which allows resonance.

When one immediately goes into emotion, the autonomic nervous system has a reduction of oscillation between sympathetic and parasympathetic, and they will discharge constantly. If the practitioner can titrate it, this system can reach the optimum awareness or tonus system. When one stays at the optimal point an enormous capacity for discharge will be available and new possibilities will emerge. The autonomic nervous system is completely linked to gravity through the gamma system and the *guy* who has his hand on the pulse of both is the cerebellum. The cerebellum is the one who integrates alpha and gamma activity and it depends on the level of awareness/consciousness it is given by the awareness of the senses and emotions. Emotions play a central role in how they conduct ones lives. As people learn to master their emotions, they also begin to harness the underlying impulses to action (LEVINE, 2011:313). However, emotion has to be expressed, discharged and contained in the precise amount of emotional state to evoke up the impulse for the cortex to process it and re-define the experience.

The tonic function that is the bottom plan of emotional process has blockages inhibiting human expression. In trauma, emotional expression and its border alter. It alters the border that the person gives to himself, the border that person gives to the other and the border that the other gives to the person. All of this flows all the time. It means that the movement process reveals at an unconscious level mostly, once the words have come after the gesture. In gesture one senses the Self; through the gesture ones are able to feel the Spirit of one and resonate with it.

Somatic Experiencing™ looks for discharge of excessive, accumulative stress energy in the body. As the therapist does body sensation tracking, there is a continuum dynamic between the brainstem/limbic system and neo-cortex. As the practitioner asks client to pay attention to the present moment in what is going on inside and outside at the same time, the prefrontal cortex is triggered to amplify the experience in which brings huge capacity to embodiment. The quality of palpation, or tactile is powered for people with low or inadequate proprioception. By touching where one is missing the tactile sense in the skin, or at perception zone, this kind of touch restores the proprioception lost by trauma and also restores the possibility of empowering other senses. The quality of touch, the level of the practitioner's embodiment, will trigger the spindle's activity in both therapist and client. The level of activity at the spindle is what makes the link between emotion/reticular formation/limbic system/autonomics and gravity. So, in order to work with traumatic ones, the practitioner has to take clients to a place of alertness. When they move or if they stand up, they will be present.

Somatic Experiencing™ seeks to touch while engaging fully in the cyclical flow of information between the triune brain dynamic involving the perceptual system. Somatic Experiencing™ does not have any intention to fix body structure, but intends to help clients learn how to contain high levels of activation and help the client's body to access the self-regulatory process in order to experience coherence. Somatic Experiencing trauma therapy trusts the body knows exactly what it needs for its healing. Once the body is experiencing its biological *pendulation*, naturally the body attracts the inner integration among and between the physiological systems. Then, the body, mind and emotions regulate in order to find stability and homeostasis.

The intention of disengagement is to help access the space within which the inertial potencies can be accessed. As the forces within the inertial fulcrum are resolved, the

affected tissue structures will uncouple and disengage. In this uncoupling process, a reorganization and reorientation to natural fulcrums and a more ideal motility and motion dynamic may result.

In the Somatic Experiencing approach, the therapist takes the client to the table work only when client has done previous sessions and has learned how to manage with the activation, to know how to use resources to find relative stability. From many years of experience, this doctoral student starts the work combining Somatic Experiencing & Godard's movement education with the client in the seat or stand position as usual in SE. The therapist creates an environment in which the client feels safe enough to challenge them to deal with the impact of gravity, and helps them to orient to the space. It is very important to observe how one can coordinate breathing with movement while staying in contact with inner and outer space. If there is anything blocking, the practitioner supports the client through three-dimensional touch in order to help with yielding, surrendering the spine and the sense of the weight of the body to the ground.

All touch and movement is used within the resonance created between the client and practitioner.

The multidirectional flow of information between the nervous, endocrine, immune, and neuropeptide cell systems are also sent to the brain via the various channels of the psychosomatic network. If the cells of the body are stressed, or if they are comforted by touch and relaxation, different kinds of information will be sent to the brain. When one is traumatized, there is an imprint inside the autonomic nervous system, but that is also because of an expressive repression. Often, one does a posture to keep themselves safe. If one refrains from expressing something, he or she will have a missing gesture, and that will have an effect on the posture. Individuals don't have to express all the gestures,

but trauma healers have to have the capacity to potentialize the expression of them. That is why posture regarded trauma is so complex to change (Godard, 2013). In fact, it is a repression of impressivity in which leads to a repression of expressivity. When one changes the status of the posture, impressivity changes. Depending on the posture, one perceives the world in different ways. The expressivity also changes according to posture. If one has hapticity, he or she can express more freely because they are supported by the hapticity. Touch and movement invite dialogue between consciousness and the unconscious through movement, body awareness, touch and dialogue. This is just a starting point where this doctoral student is exposing herself to bring the idea of combining Levine's work with Hubert Godard's work in order to achieve trauma resolution. It may also be used to integrate into consciousness experiences accessed through the body. The process of giving language to somatic experience reflects the development of the sense of a verbal self.

Godard's Movement work gives this doctoral student a bridge to access the ontological understanding of being in Life. She has gotten an understanding about how to help trauma victims to reconnect with a sense of belonging, because Godard's work is helping her to embody herself. She has in her own flesh that experience. Therefore, she started to lose her fear of sensing the fear of her own separation in order to move ahead in life. She understood the new concepts that Godard is bringing with his wide ecological perception of space and the existential mechanism of giving and receiving information through the haptic system. The new concepts Godard is bringing to the bodywork environment, this doctoral student is bringing to the Somatic Experiencing approach through her own experience.

VI.C.1. How to evoke the intelligence of the body toward self-regulation:

Godard's central work is to teach how to reorganize the movement pattern of perceiving how the body relates to space. He creates pedagogic skills of touch and movement exercises to address core stability in what can be a bridge for psychological shifts. The very important concept in psychology is when Godard brings *The Phoric System*. The Phoric function is about the envelope body. It comes before gravity, before orientation. It is about how the Self is separated in the body, how the mass is divided, because one cannot move if there is no division first.

The question of moving is not really about what moves, it is about what doesn't move. A Movement educator has to spend a lot of time building what doesn't move. For example: in Godard's words: "I can't move my leg if I am in my leg. I have to build a place where I am not my leg so that I can move my leg. I can't see a branch off a tree if I am sitting on the branch--I have to first get on another branch, and then I can see the branch" (Godard, 2013). Godard thinks that to take a step ahead in movement or to change the movement pattern, one (in the sensorial organization) need to somehow become a child again. Only in this way will adults be able to reorganize blocked movement. It is in becoming children again, a person can experience the flow of life. Through posture the baby starts to create images, which gives the power of anticipated action. As Godard says, the baby gets posture from static to pre movement.¹⁴⁴ As the baby recognizes that he or she does not confront the environment anymore, they perceive that emotion is diminished, so the baby can detour in the movement. On the

¹⁴⁴There is a difference between static pre-movement and dynamic pre-movement. Static pre-movement is the movement you put on in the morning and you keep all day. Dynamic pre-movement is the pre-movement that comes when you begin to move (Lael Keen's transcription's of Godard's lecture in 2013, Spain).

other hand, the baby can get new sensory-motors and again open to the continuum flux of images. But if it does not happen, the baby will project and the new won't be possible to happen and the known path will repeat.

When the baby is seated on the bottom of the chair, the up and down appears; so after is front and back, followed by the separation of left from the right. This is the start of walking. One can support one leg and take a step with the other. It is when one side stabilizes the other, and one can go to the outer space, to the other. When a baby can separate left and right, then she or he can start core activity. But this happens in relationship with the other. The way one is in their own core organization is about their capacity to receive impressions and to express. The core muscles are completely embedded in social engagement. When one has inhibition of expression, it inhibits core activity. This is what Porges says that behaviors and feelings have an adaptive function. Porges' theory of social engagement refers to a newer neural system of certain cranial pairs, especially the ventral vagus, an environmental system that manipulates the sensation of safety in chapter IV. One can't change core activity if he or she doesn't change the capacity to engage with people. A Therapist's function is to work with the client, giving time for the expression of the little emotion, not too much emotion or not too much of any other stimulus. The therapist, through face-to-face and face-heart approximation, aims to turn off the system of hyper-vigilance or surrounding reactions, allowing the patient to awaken visceral sensations (interoception) of "not fear." The polyvagal theory associates immobilization without fear as confidence, safety and love. When people are interacting in safety, that state of vagal regulation of human hearts has elevated levels of oxytocin. When people are separated, feeling isolated, they lose the vagal heart regulation and become more hyper-vigilant and have cardiac arrhythmia. The suggestion of this doctoral student is from a sense of safety, by the therapist

palpating the client's body, incorporates even further the sense of guidance increasing the containment and coherence. Client and therapist are beyond the paradigm of touch experiencing, being touched as touch. Palpation brings the sensation of weight in a three-dimensional plan, brings a better quality of embodiment, awareness of the live presence of the body. As clients feel safer, the body “knows” how to leave the symptomatic restricted space and expand in movement towards life.

When there is core stability and haptic activity, the person rescues the natural flow, as a child relating to the outside world through a nice gesture, with the optimum tonus. So, it becomes easier to access the self-regulatory process.

As one gets more organization in relation with the gravity force or with the earth's strong attraction, he/she can start a dialogue with the functional adaptability that is an unconscious factor (CARYN McHOSE, 2009:37-42). The therapist has to look for the client to be in a place of *alertness* in order that they can move and will be present, grounded (in their feet). The embodiment exercises or any intervention proposed by Godard (2013) has to be modulated at the midpoint between excitation and relaxation, as he calls the alertness state.

What makes one afraid of a space is that potential for movement. This is often, in fact, what is also limited in the potential for action and imagination. Because in this potential for action or subjective space, there are some movements that are completely repressed, some are really there, some are not possible, and some are working with people in dance or in therapy about the question of space to help them understand their potential of action, their subjective space. The action system needs a very clear presence and orientation. The Haptic System has the function of tonic dialogue. Several parts of the

body can be or not be open to touch or to be touched. Through touch the response that was missing can be evoked, and so it can access the natural intelligence of the body.

VI.D – TRANSFORMING FIXATIONS TO NEW POSSIBILITIES:

Fixations can occur on several levels, and the interest here is the fixation patterns that impede, distorting natural biological intrinsic movement. So it directly involves perception and spatial orientation. Structure fixation is called *lesion* and functional fixation is called *inhibition*. Most of the time, in psychological trauma, it is spoken of as an inhibition. Lesion manifests as myofascia restrictions. Lesion has a better response when used as manipulative or biomechanical touch, however, inhibitions need to be treated from perception's perspective and coordination. Perception is related to the senses, and coordination is related to neuromotor activities. Lesion is a restriction on a bone, a ligament, viscera in which can be worked on directly by the hands as a practitioner works. Inhibition lasts through the child's development. It is something that the person can release if they bring their attention to it. Inhibitions don't go away when they are worked on manually. This type of holding is held by the *gamma* loop system. It is the tonus of presentation. If one has a holding for a long time, it will provoke a lesion, if one doesn't work through perception systems. Inhibition and lesion cannot work the same way. Working with trauma healing, the practitioner will meet both modes, and they need to know how to differentiate one from the other. If an inhibition is touched in an *alpha* cortical way, technically, it will not let go. When a practitioner introduces even gentle traction into the tissue system, he or she is initiating a conversation with the tensile forces that organize the inertial pattern. As the tissue is palpated one may perceive that there is a place of inertia, a distortion within the tissue strain or pull. The inertial fulcrum may or

may not be located directly around or within the tissue, fluid, or potency field, or as a membranous or connective tissue strain or pull (SILLS, 2001). Also, as the practitioner touches there is a neural mobilization, as Chaitow and Coppeters (2012) noted that the nerves have a large component of connective tissue as part of their make-up, as well as being potentially influenced by the mechanical interfaces of all tissues through and past which they travel, and which they supply, including fascia/connective tissue (CHAITOW, 2012:295). In another words, the inner bodily space can be reduced as well as the perception of outer space once shock affects the ending nerves of the senses.

When someone is engaged in the dorsal vagus system, or as in Godard's words, *when the envelope body is not secure*, the practitioner will waste their time working on agency. Agency will only emerge when the envelope body is secure. Those bodily states can be observed as inhibition developed by stress or trauma. The therapist has to follow the movement as it emerges. There comes a time when the therapist has to move in a precise way and then it needs agency.

To articulate two parts of the body, one needs to have a separation between these two parts with a different status for each. One will be the continuity and security of the self, through a good sense of gravity; the other, secured by the first one, will go freely in the world. If one says *hello* to someone, the security of the trunk and head with gravity will allow them to give their hand completely to the other. But in another situation, it could be his/her arm in which become the point of security, and the rest of the body in which is going in the world, like if one stands up from a chair by pushing on the arm chair with their hands. Very often, difficulty in movement will come from not to be able to change the seat of presence (the part which stays in gravity) and to offer the other part. This constant activity of grounding a part of the body and then offering another part, Godard calls *phoric activity*, and it is the prelude to articulation. Individuals should be

able to move constantly from the seat of presence, and then to constantly move the part in which is going out to the world. This phenomenon is so important when practitioners work on someone. The more one is able to have a good seat of presence, the more the practitioner will offer their hands to the client without any confusion and with good listening. According to Godard (2013), there are three people. There is me, there is the client, and there is a third entity in which is the practitioner's hand in which they have given to the client and the part of the client's body which they have given to me.

In order to evoke a phoric separation, for example, if there is a lack of proprioception or a gap between two parts or an overcouple in the left upper body of a client, a practitioner cannot be in an alpha voluntary mode. To have a left-right separation the "I" needs to first have an up-down separation, and second a front-back separation (GODARD, 2013).

What this doctoral student has learned from Godard's studies is that the therapist has to work on him/herself first. Godard use to say that if the practitioner is not able to evoke a natural movement in a client, the problem is not in the client. The problem is in the therapist, who is not able to go where the client is. It is necessary that the practitioner find that separation inside of him/herself first before evoking an intrinsic movement from the client. The practitioner's work is not about to "do"; it is about *non-doing*. When he or she makes a subtle movement, he or she is working only from *gamma* touch. A gamma impulse receives feedback as it works. In trauma healing, the practitioner wants to calm down from the nervous system (brain) to the muscles or from the muscles to the brain.

If they are frozen, when a traumatized person comes to the Somatic Experiencing process, the practitioner has to start with a simple intervention; he or she has to go in

with very small doses, using gentleness. If someone cannot notice a body sensation, the practitioner's task is to help the client to find the sensorial vocabulary. If the difficulty persists, one can use other sensorial channels, like vision, hearing or tactile to address the missing sensation. In general, when someone gets fixated on these kind of processes and are linked with existential losses, memories that can paralyze them through the language, emotions etc., the therapist has to be very tender and clear with boundaries.

To work combining Movement Education & Somatic Experiencing™ it is tremendously necessary to titrate the system and work step-by-step; first, by bringing stability to the body before renegotiating the trauma. Somatic Experiencing is used to help clients resolve relational issues, reenactment patterns, reengage socially, any kind of traumatic experience, to tolerate increased intimacy, take risks, and mediate change. By utilizing body states, touch resource and movement along with highlighting increasing tolerance of positive affect and capacity for pleasure to create a template for the client to practice new ways of being more aware. As the practitioner tracks physical sensations, they check in all the time on how the body is dealing with tonic function. For touch and movement it is suggested to use three-dimension base with the therapist being the one who is stable and open to the haptic system.

Some hallmarks suggested by Levine (LEVINE, 2012:74-75) to work with security on the Somatic Experiencing process with traumatized clients are:

- a) Establish an environment of *relative safety*; offer support to explore and accept their body sensations;
- b) Establish *pendulation* and containment: the innate power of rhythm;
- c) Use *titration* to increase stability, resilience and organization;

- d) Provide a corrective experience by supplanting passive responses of collapse and helplessness with active, empowered, defensive responses;
- e) Separate or uncouple the conditioned association of fear and helplessness from the biological immobility response;
- f) Resolve hyper-arousal states by gently guiding the discharge and redistribution of the survival energy mobilized for life-preserving action while freeing that energy to support higher-level brain functioning;
- g) Engage self-regulation to restore dynamic equilibrium and relaxed alertness;
- h) Orient to the here and now, contact the environment and reestablish the capacity for social engagement.

What is looked for in Somatic Experiencing is to find the intrinsic relationship between visceral sensation and motor expression. Inhibition is the signal the body shows where disconnection lies between the experience and its expression. By tracking physical sensations, the interoceptive state is manifested by emotions. The practitioner has to help the client titrate emotion or any stimulus to be able to be processed by the CNS. So, emotion moves out from sensation to action. The basic proposal is when the therapist works with dissociative states the most difficult thing is to bring the client to stay in the present moment, to find their consciousness, which is a state at the right point of readiness for action.

There are several types of trauma. For Peter Levine, in order to work to trauma resolution, one has to restore the defense active response. In the most of trauma is easy to find symptoms of inescapable attack, in which SE include as main features symptoms:

- High activation.
- Distortion in the orienting response:

- Hypervigilance or inability to realize the danger
- Also a specific freeze tends to be generalized. For example:

Active Response are eliminated or frustrated and one stay:

- **Stuck in the escape**, developing avoidance pattern (not exposed, not participating, not committed).
- **Stuck in the fight**, developing attack pattern compulsive disorder (uncontrolled anger, seeking confrontation and danger).
- **Trapped in the dilemma / conflict** between two impulses of survival: fight or submission? Freezes the conflict. Then, delayed reactions are the rule.
- **Stuck in the freezing**, developing pattern of powerlessness, not realizing (without healthy aggression without defenses).

As therapist work to unfreeze or to disengage from where one are stuck with, observing what already is discussed on the chapter IV, Item E using the Polyvagal theory to modulate the Nervous system, is necessary first to bring client to the ground before to orient and complete the physiology active defense responses. Not because they are not there. Usually instinctive nature and physics is there for example: biting, punching, kicking, scratching, screaming, running etc. Some impulse are accessed others not. Survival responses are basic and primitives: shout out, threaten, pretend to be dead, scratch, bite.

- ❖ Impulse can be accessed, but prevented **by the control**.
- ❖ Impulse can be accessed, but prevented by the **control of the perpetrator**.
- ❖ Some of impulse of active defense **is not accessed** (dissociation / collapse of freezing).

Therapist to come from freezing to the Active Response needs to recognize in the freezing, an efficient response. Working the dilemma / conflict involve good psychological or good common sense background and in many cases has to access the developmental early issues. Go easy and slow and deal between inhibition and freezing. Operate at the point using SE tools, where the active defense responses are present, encouraging surfacing and complete.

Resources are the fundamental SE tool to modulate the Nervous System and bring one back to the main stream. It is important that the therapist makes sure that the person can remain safe and monitored. Part of the process is for the therapist to use his/her imagination to find alternative answers and possible outputs. Activate mirror neurons. Mobilize the body along with the image. Recovering **Energy Red (healthy aggression)** is likely to titrate the natural strength of one to conquer, to achieve things in life. It is important in the trauma healing process that one feels and expresses natural aggression, defends him/her space, and their boundaries. The motion isometric / isotonic is useful. It can bring a sense of right tonus and help one to notice or to orient their boundaries. The therapist has to help client to maintain contact with the periphery, where the discharge and completeness of active responses happens.

There is no way to work with trauma healing without touching on one's emotions. By lack of emotional support trauma was installed in the system. Then it is crucial working **helplessness and frustration**, valuing the incipient and incomplete active responses and providing resources for its completion. On the same line, working **shame**, validating the natural feeling, sensations associated welcoming, supporting, accepting and searching for affective alliances. The **fear** arises **murderous rage**, defensive primitive impulses that focus on annihilation. It needs to be titrated and to explore the physical impulses (biting, growling, scratching, punching, and kicking) without being

flooded with cognitive interpretations, without having to act. It will be very positive to enlarge the space to feel before taking action, creating content.

The posture is the potential for action. Each movement starts by postural anticipatory activity or pre-movement, in general, the unconscious that shapes the potential for actions and coordination. So, inhibition is an aptitude of the pre-movement. The difficulty to make a movement is often associated with an inhibition at the perception level, or lack of adequate information.

Godard's re-education work, that is the proposal for this paper, is to start from the tonic center, where the person holds and creates inhibitions. The therapist has to analyze the client in three dimensions, and also in a static and movement position, because in this way the practitioner will focus his or her touch, movement and perception.

In the Somatic Experiencing approach, the therapist only takes the client for table work when the client has done previous sessions and has learned how to manage with the activation; to know how to use resources to find a relative stability. Start the work in the seated or standing position; it is safer and it challenges the client to deal with the impact of gravity and helps them to orient to the space. It is very important to observe how one can coordinate breathing with movement. If there is anything holding, the practitioner supports the client through the three-dimensional touch in order to help yielding, to surrender the spine and the sense of weight of the body to the ground.

Where is the person holding his or her structure related to the space orientation? Which are the lines front/back; side to side or in the midline is the person holding? How is the pattern of the gaze? Peripheral or focus vision?¹⁴⁵ The objective at this time is to make

¹⁴⁵Vision provides rich information for self-motion in the environment and is therefore of overarching importance in motor control, often overriding other sources of information (Schmidt & Lee, 1999). In

the person pay attention for where she or he is holding in relation to gravity, because it is connected with his or her defense mechanism process. The practitioner analyzes in standing, seated and walking position, to notice the relationship with all three-dimension levels of the body in relation to the vertical line.

The therapist is looking for a change in the pattern so staying in the action system is something that would come up, because he or she wants to get separation from fixation points.

Working in order to transform fixation (trauma) into new possibilities, first the trauma therapist will work in the seated or standing position.

From many years of experience in body-oriented trauma therapy, this doctoral student developed a set of theory and protocols combining movement education from Godard's embodiment exercises using Somatic Experiencing trauma therapy approach. One of her students, Sarah Zorica Mitic, M.D., PhD¹⁴⁶, starts to use SOMA EMBODIMENT's protocols with cancer's patients who presents ANS hyperactivity in the bladder¹⁴⁷. She

motor control, two kinds of vision, focal and peripheral, are distinguishable that have different functional and information processing characteristics. Focal vision is assumed to be responsible for detecting the physical characteristics of environmental objects, while peripheral or ambient vision is concerned with detecting the spatial characteristics of the surrounding visual world (Schmidt & Lee, 1999; Sekuler & Blake, 2000). Focal vision is mediated by visual information from the central retinal weld, while ambient vision is mediated primarily by peripheral vision. These different features of focal and peripheral vision have previously been examined in various motor actions, such as hand movements (Sivak & MacKenzie, 1990), long jumping (Eves, 1995) and postural control (Amblard & Carblanc, 1980).

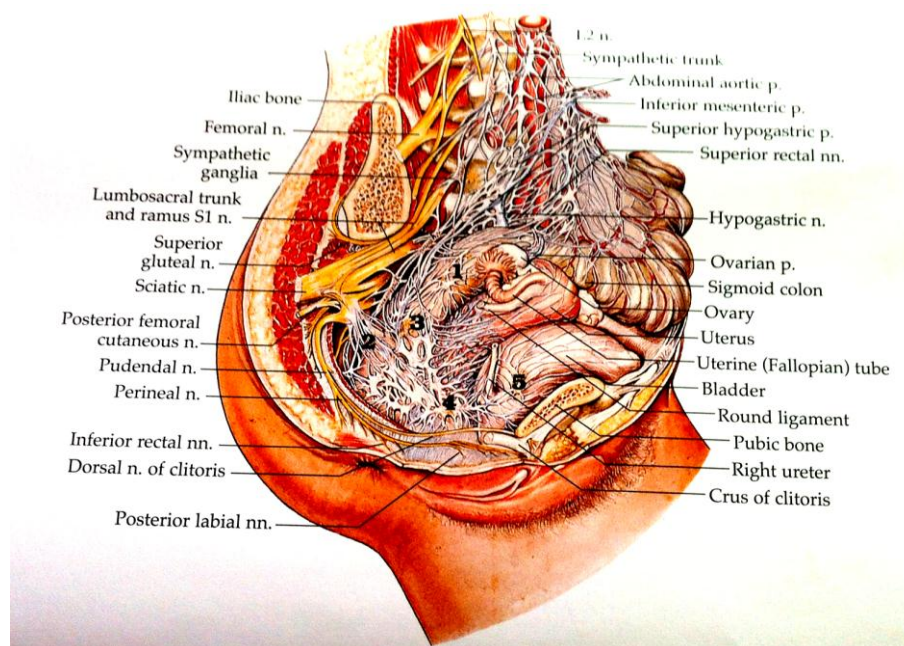
¹⁴⁶ Dr. Sarah is an anesthesiologist also psychophysiologist, and works at Oslo (Norway) University Hospital with cancer patients and very traumatizes ones. Her email's address for contact and more information is: zormitic@gmail.com

¹⁴⁷**The micturition reflex requires interplay between the parasympathetic and sympathetic divisions of the autonomic system.** When bladder volume is low, urinary outflow is inhibited because activity in sympathetic pathway is greater than activity in parasympathetic pathway. Mild distension of the detrusor (storage portion of the bladder) initiates a low level of sensory activity, which reflexively activates spinal preganglionic neurons. The resulting low level of preganglionic activity is effectively transmitted and amplified by the sympathetic inferior mesenteric ganglion but filtered out by the parasympathetic bladder ganglion because of differences in patterns of synaptic convergence in the two ganglia. The resulting predominance of sympathetic tone keeps the detrusor relaxed and the urethra constricted. Sympathetic postganglionic fibers also reduce parasympathetic activity by inhibiting preganglionic release of acetylcholine. In addition to their effects on the autonomic outflow, the sensory signals are sufficient to keep

decided to place her hand using gamma touch in the seated position at sacrum in a lady who used to come several times per day to the toilet because of bladder dysfunction. The practitioner touched in the back/front of the client's solar plexus in order to awake the sense of weight, volume, bringing sense of root and perception of three dimension of physical body. After three sessions with Dr. Sarah Mitic (the practitioner), the client started to comment that her frequent need to go to the toilet was diminished. After two months of treatment, she just goes two or three times per day.

Sarah was wondering how this kind of amazing touch was so effective to change the trauma register. She started to understand deeply how Autonomic and Endocrine Functions are coordinated by Central Autonomic Network centered in the Hypothalamus.

Figure 12 – Sagittal Section of Female Pelvis



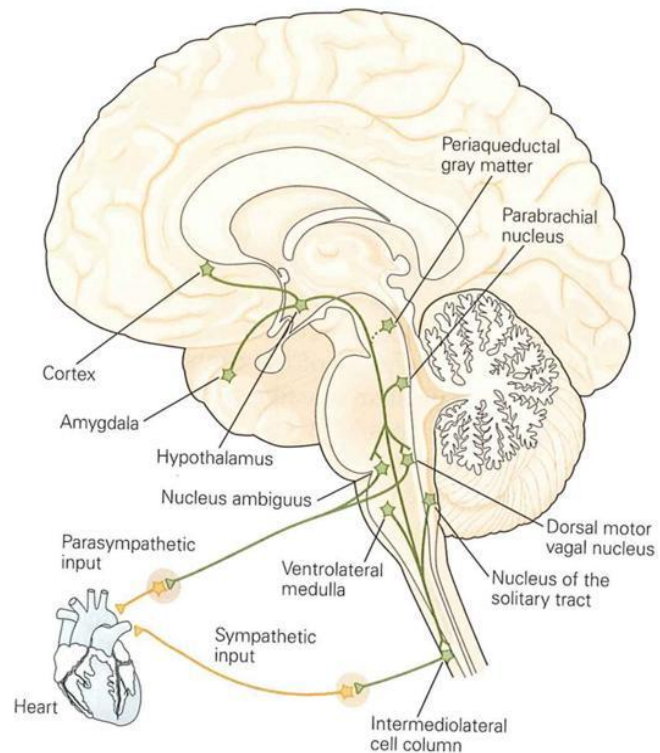
Source: Torigian & Hammell, 2008

the external urinary sphincter closed. When filling causes the bladder to reach a critical volume, the associated increase in sensory activity reaches a threshold that allows for impulses to pass through the pontine micturition center (Barrington's nucleus). Descending activity from this nucleus then further excites the parasympathetic outflow. The resulting increase in parasympathetic preganglionic firing promotes summation of fast EPSPs and initiation of postsynaptic action potentials in the bladder ganglion as it switches to its "on" state. During the emptying process descending pathways also inhibit the sympathetic and somatic outflows through inhibitory spinal interneurons. Inhibition of somatic motor neurons in Onuf's nucleus causes relaxation and opening of the external sphincter KANDEL E., et al., 2013 pp: 1068).

As Sarah started to place her hand on patient's sacrum, in seconds the patient referred some peristaltic movement in the belly. Sarah asked for the patient to place her own hand in front of her belly. Internally, between the Sympathetic ganglia nervous and parasympathetic ganglia nervous start to balance (inner motility). As the patient starts to feel safer and contained, some discharge came up like warm visceral sensations. And at the same time, the patient also was feeling warmth from Sarah's hand. Sympathetic ganglia nervous and parasympathetic ganglia nervous in the hipogastric nervous system is very important for all the plexus pelvic because it reaches pelvic motor nervous dorsal ganglia, which comes from tract spinothalamic direct to the hypothalamus. This phenomenon also happens in the solar plexus. It means that if one is in freeze, the hyperactivity triggered in the pelvis, or in the solar plexus, can be balanced as it is contained, and the sympathetic and parasympathetic trunk nerves can get up through the spinal cord from the tract spinothalamic straight to the hypothalamic area in the medulla oblongata. There is a direct

route without any crossing opposition side for other synapsis. For instance, a simple embodiment exercise can bring one toward awakening their perception of space and of the ground! And amazingly rooting them, from bottom to up in seconds!!!

Figure 13 - Efferent pathways



Source: KANDEL, et al., 2013

As practitioner works in order to address intrinsic movement to complete the physiological active response, especially to access movement for running or walking, the *psoas muscle* is activated. This muscle is also involved with stability, grounding. So, when we are thinking in core stability the psoas muscles and the sacral region represent important areas for body-orientation in

Figure 14 - The crossing of Sympathetic and Parasympathetic Nervous.



Source: Gray, 1918/2000

trauma therapy. The same can be true for the part of the thorax, just between the scapulae, because one has to be spatially organized toward gravity in order to address the emotional neural regulation and self-regulation.

Researchers interested in motor activity and emotional regulation are very aware of the fact that these regions coincide with the crossings of nerve fibers belonging to the sympathetic and parasympathetic nervous systems. Furthermore, there is a direct neural connection between these crossings and the limbic system – this connection does not involve tractus spinothalamicus. So, we have a neuroanatomical explanation that these regions represent a switch (trigger) for autoregulation because of the crossings of positive (sympathetic nervous system) and negative electrode (parasympathetic nervous

system). All neurons possess multiple branches distributed throughout the skin so the touch of the therapist could provoke an impulse that could lead directly to the limbic system. That could explain one immediate change of the emotional state of the patient caused by just being stimulated in previously described regions; regions that are just waiting for an awakening of the proprioception receptors.

One very exciting challenge for the future will therefore be to understand in greater detail how the central autonomic network can be manipulated therapeutically to counteract the loss of peripheral autonomic function. This will require closer interaction between the communities of scientists who study peripheral and central autonomic mechanisms. A second exciting challenge will be to unravel the still mysterious links between motivation, emotion, autonomic function, stress, and neuropsychiatric disorders. By combining current advances in molecular biology, genetics, and computational modeling, meeting all of these challenges now seems possible (KANDEL E., et al., 2013).

For Godard (2013), one of the most classic points of fixation is the head. When the head is free, and the otholith is working, the fixed point is in the cervicals, and they pull the ribcage up when the breath is in, instead of pulling the head down.

If the practitioner doesn't have the otholith working (because an inhibition of gaze or face) and are not strong enough to pull the chest, they will recruit two other muscles. It is necessary to work on the head in order to unlock muscles that are attached in the head. This is the work of Rudolph Llinas (The "I" of the Vortex): The brain is like a conductor and it will only work with the part of one that is awake. So if a muscle is awake, that is the one the conductor will call on, and the other muscles will not work.

Hapticity of the head is about engagement in the face. The practitioner has to link the head with the support of the feet. It is only the feet, the grounding that will make him

capable of confronting the new pattern, the new possibilities. If the practitioner tries to bring the client into a new option, without him having his feet first, then it won't work, as there is an order.

What is needed is a connection between the otholith and the feet. There is the order. Godard says that there is ascendant and descendent origin of the problem. Ascendent is more related to biomechanic. For example how feet is functioning up. Descendent problem is more relational or psychological / symbolic. For example how the head is dealing with the line as facing emotion or psychological situations.

The first intervention should be given in the feet, and then the opening of the hapticity of the head. As soon as one gets back the head, the otholith comes on line. If this is not working, the core muscles will not activate. If the head has lead, then only the otholith can do this. One cannot drive the head from the feet.

When one comes together with chin tucked down, one is driving the body from the outside, from the image. If one comes to meet with peripheral awareness, she or he is driving from the inside (GODARD, 2013).

For a new sensory motor acquisition, one has to go beyond the image. In other words, one needs to have an unconditional image of one's own self. For Godard, if one stops the image, they will come back to the baby, to the flow. In his teaching he says to his students: "Don't be a dead fish," and, he wants emphasize, "don't get stuck in the image." For him, any new sensory motor acquisition necessitates a new peripheral quality. Godard follows André Bullinger's suggestion: "For any new sensory motor re-acquisition, you need to have a reinvestment of the peripheral visual function." In the therapy process it is needed to have a moment without image. If one dives very strongly inside one's own self, they are stuck in the image and will lose the context. If one is stuck in the image, they lose

the quality of imagination. The goal of any therapy is to put back the imaginary process that has been stopped by trauma. The imaginary process renews the image constantly. The only way to not get stuck in the image is to be in peripheral awareness, which is necessary to be present in the world. Peripheral attitude of the posture means no image. First, it is the flow; then a new image can appear. The trick is for the therapist to work with the small emotion, and not with the big one, in order to help one get out of their image fixation. If one is more conscious of the small emotion, then one no longer needs the big discharge to modulate the body physiology, and to adapt a new coherence system as a result of more organization of space. Therefore, one will include their own self into the space, challenging for correct breathing.

To create new possibilities, it is important to bring the client to sense continuous flow without fear. For that, the practitioner has to look for a new organization that is open to the ability to receive through the palpation activity of the senses; i.e., opening the peripheral eyes, alternating with vision and focus; also opening the senses from the soles of the feet, from the hands, and from the occipital muscles. The first aptitude is to receive in order to open possibilities to give and receive information from above and below, keeping the support, at the same time, of the relationship between front and back, and in the midline there is a place that one easily holds against the ability to find the ground. It means there is an inhibition of the other, or the other inside. The phrase above is understood as an inner dissociation or a conflict between body image and body schemata.

When a traumatized body compensates, it means hold, shortness, twisted and naturally one does an aptitude with the head, an aptitude of hold the body instead to orient to the space by the senses. So, when one works with Somatic Experiencing in tracking the physical sensations they discharge from peripheral or from the core, the movements

start to re-orient the client, giving other possibilities to the system. Summarizing the movements comes from inside to outside, front/back are elements that start to participate in the whole system. Working on perceiving how the spine is functioning in this process is very important. The function of the spine is to be understood, as the capacity to perceive and respond to two fields, two polarities – in a way -- the spine is understood as a movement (GODARD, 1994). The person does not have a spine, but anti-gravitational muscles. In most of the cases, the spine and areas around it holds a lot of compensation.

The spine is soft and flexible. It allows going from front and back, up and down. The spine can be very mobile. The spine represents the “I” the Self. The sense of weight sustains it. When someone has the perception of the spine as something mobile that allows coming and going, consequently the pelvis also comes and goes. The most important point is also to see the transition of points when working with the spine (GODARD, 2013).

But primarily, one needs to sense the ground, the weight first, before being able to articulate. Before doing the movement *something* has to stay (spine) and at the same time, has to sense what goes toward the space, allowing the arms to take the rest of the body. Part stays, and at the same time the arms expand. The “I” is linked with the sense of support. If one loses the sense of support, he or she loses the sense of integrity. That is why it is so dangerous to move. The main important question in movement is expressivity. The main inhibition (static) that you do in the morning is one of social presentation. This is the reason that it is difficult to change. It is the way to express your own self, or the way to receive impressions from the world. If one stays too open, he or she may be overwhelmed by sense impression, so the Self closes it off. To move in the world is dangerous because one can lose the sense of support. Therefore, the

fundamental fear of falling exists that is a common fear for everyone. When one loses balance, they also lose support. Serious cases of fixations are found in the breathing related to trauma. If three-dimensional touch is used, the lungs, the heart (that are the emotional areas and are related to the social engagement vagal systems) will respond through movement. Also, visceral activity will respond to touch; when one comes and goes towards another the movement comes from the viscera.

In the viscera, there is a high level of Dorsal Vagus activity and this system shutsdown under a vital threat. Regarding viscera inhibitions, Levine suggests a very simple sound to open and give more space in the belly, and to bring afferent impulses from viscera to brainstem. This is the sound Levine calls *VOOO*. This sound vibrates the whole area and Levine asks what the person is noticing after at least three time of making this sound. This intervention is very clever, because it creates a possibility for the emotion to move to an action.

Somatic Experiencing working together with Movement education is looking for grace, pleasure, vigor and coherence in the body. The practitioner always needs to know that they have a personal ecology acting all the time. This new suggestion brought by this doctoral student is to offer new possibilities for amplifying and potentiating the action capacity in a healthy and integrative way for trauma resolution. Through the example above, there are two hapticities running the breath.

When one has up and down hapticity together, she or he will breathe eccentrically. If one doesn't have hapticity at both ends, the breath will be concentric. Godard (2013) warns the practitioner they should never work on breathing itself, rather work on what is necessary to breathe. Otherwise, the practitioner will put the brain in the breath and that is a disaster.

Godard (2013) says that one is only responsible for the pre-movement of breathing, not for the breath. He notes that John Lee said many years ago, that what is called breathing disorders are, very often, postural disorders (Godard, 2013). The best metaphor is that if one is thirsty, and it is raining outside, and he or she goes outside with a glass and turns the glass upside down, and no water goes in. Breathing well is the same as just turning the glass right side up in the rain so that the water flows in, and then turning the glass upside down so that the water can run out (GODARD, 2013). THIS IS NOT CLEAR FOR ME IF IT HAS TO COME. BUT THE ISSUE OF BREATHING COULD BE BETTER EXPLAINED.

Inhibition can also be created from the back; one can hold from the back excessively, losing the capacity to allow for comings and goings. All of these things are related with the manner that you meet the other.

Every inhibition reflects a blockage in the emotional flux of energy. It affects the tissue, awareness and the emotion that is holding in the body. This energy is delivered to where there is action.

Working with inter-sensoriality, there is a moment when vision will open and perception will be expanded. That is why it is so important to pay attention to the support, to create availability to emerge the symbolic to the imaginary level. The practitioner needs to be aware all the time to bring the client's attention to the occipital muscle, because if the head is fixed, the head cannot work like radar to capture information from the environment. It is the function of orienting response. Blockages and unresolved trauma paralyzes, disorganizes and disorients emotionally. The positive result comes when there is a liberation of energetic process in every level. The body can be healed if the emotional energetic blockage system is removed.

Chapter VII – **METHODOLOGY**

VII.A QUALITATIVE STUDY ASSESSMENT:

The preceding chapters draw us to conclude that an effective intervention process aiming at undoing and redressing traumatic organization must include an appropriate composition of touch and movement built in such a fashion as presented in Chapter VI. Nonetheless, one must bear in mind that the optimal introduction of touch and movement occurs through a limited range of unique sub protocols, which include: perception of body weight and volume; visual orientation (e.g., focused or peripheral vision); perception of containment, of restriction and of motion (legs, trunk, arms and neck); orientation (front/back, up/low and medium line) and so forth. These sub protocols are either used in their entirety or are broken into parts according to and following verbal and non-verbal cues provided by the volunteer patients. The sub protocols are inserted into the general approach and protocols of the Somatic Experience and are well attuned within its frameworks.

The author has developed intervention processes and a procedure based upon these fundamentals, and during three years of non-stop clinical practice, has seen patients and has applied the protocols to them. The author has also trained a team of professionals to use the concepts of touch and movement as extensions and complementary paraphernalia and repertoire of Somatic ExperiencingTM interventions in their respective clinical work.

Thus, the unfolding of the registries of the author's daily clinical practice could attest the observations and the evaluation of higher quality of interventions attained, as well as of higher treatment results obtained when compared to other techniques and approaches in which touch and movement were not properly prioritized. Similar assessment was obtained by the observations, collected by a team of professionals that had undergone the author's experiment in their respective clinical work.

VII.A.1 - Selected Processing Mechanism

The dynamics of a validation project involving the collection and observation and processing of measurements produced by accurate advanced technologies could not be designed due to the following constraints:

- Difficulties in obtaining funds and resources to afford the use of functional magnetic resonance imaging.
- The timeframes required to use the laboratory equipped with the apparatus for brain mapping due to scarcity of friendly hours for patient sessions, because the lab was a resource available at the Federal University of Rio de Janeiro, however, it is subjected to tight schedules catered to several Departments and Institutes.
- Difficulties in enlisting a meaningful number of volunteer patients in order to produce measurements of the preceding items.

On the other hand, one must bear in mind that the states of traumatic activation, even when only evoked through recalling past events, are naturally accompanied by

variations in heartbeat, variations in blood pressure levels, as well as by sweating, trembling, shaking, by aches and pains, by variations in the processes that influence perception in general, by attention alterations, by sobbing, etc.

Therefore, the author opted to use a brief qualitative evaluation (all the way through adjectivation) conducted by each volunteer patient. This brief qualitative evaluation followed a standardization to be described below.

VII.A.2 - Sample Population

VII.A.2.1 - Volunteer patients

In order to decrease the possibility of variations that could generate 'noise' in the quality of answers of the experiment, it was determined that the selection of volunteers should comply with a few requirements of large amplitude:

- Ten battered women victims of domestic violence.
- Type of domestic violence to be restricted to verbal and moral abuse, threats, voice alterations, threatening stares, anything short of direct physical violence by any means.
- Age span (25 to 40 years old).
- Time of issue prevalence: between one to three years since the first inception of episode occurrences up to the moment of evaluation.
- Current status: women necessarily no longer sharing home with the aggressors.

- Voluntary women patients necessarily having not been previously submitted to any professional help (in the form of psychological therapies) up to the present moment.

VII.A.2.2 - Team

The team involved in the conduction of the research experiment consisted of one SE accredited therapist with extensive SE practice, and who had been submitted to specific training concerning the aforementioned protocols that include touch and movement.

VII.A.3 - Procedure

VII.A.3.1 - Setting and testing conditions

The experimentation setting was located at the very workplace of the therapist. The area encompassed 40 square meters and was equipped with:

- Both natural and artificial lighting and ventilation and acclimatization.
- Chairs, a cozy and comfortable reclining armchair and a massage table.

As for the general terms and conditions, the main agreements consisted of:

- The volunteer women patients have all signed Terms of Consent whereupon it was formally stated that the therapist shall not use nor reveal names, photographs, videos or any other types of registers of

sessions that could in any way be used as possible identification indicators.

- The volunteer patients picked suitable times themselves (weekday schedule for sessions) when they were freely available to be assessed for the experiment.
- The volunteer patients were divided into two groups: one to be submitted to SEsessions only (five volunteer patients) and another one to be submitted to SEsessions PLUS the protocols of touch and movement (five volunteer patients)

VII.A.3.2 - Data Collection

The experiment's protocol is described below; the important additional observation relates to the activity of adjectivation attribution. By adjectivation we understood the observations and remarks declared by the volunteer patients in specific times of testing:

- In the beginning of Session ("Arrival" , in Table 1 and Table 2)
- Right after concluding her account of her case/episode ("Description", Table 1 and Table 2)
- Right after the end of the oneanda 1/2 half hour therapeutic intervention – either SEonly or SE+ touch and movement protocols ("Final" and "Grading Mark" in Table 1 and Table 2).

For the sake of exemplification, we may state:

- In the beginning of session: relaxed, a bit anxious, serene, well, calm, etc.

- Right after having reported her case: angry, enraged, sad, humiliated, in pain (emotional and physiological pain: arms, shoulders, etc.), in trembling, chills, heat waves, etc.
- Right after closing of SEsession only or SE+ touch and movement protocols session: free, liberated, loosen up, joyful, different, surprised, amazing, fantastic, etc.

For the creation of a dictionary of adjectives, departing from the adjectivation of the first volunteer patient, the process consisted of:

- Increasing count when using the same adjective several times.
- Adding a new adjective when the term was utilized by one volunteer's trauma's victim.
- Requesting details about specific meanings of a new adjective and asking for the disambiguation of already existing adjectives in those cases when the therapist could consider that a similarity might arise between two different terms (e.g., a volunteer victim use the adjective "heavy"; another one used "rigid". When she was requested to further explain what she meant and what exactly "rigid" would represent, the answer was: "deprived of the strength to move myself." She was then asked whether "heavy" would be a proper similar adjective: a positive answer was given. Thus, the adjective "rigid" was not utilized and, instead, the adjective "heavy" got one extra occurrence.

The general protocol was:

1 – Volunteer patient/trauma victim arrives at the setting of the appointment/experiment and she is welcomed by the therapist who escorts her into the room. Then she is interviewed regarding general information concerning who she is and personal data, according to a standard form, within a set timeframe (15 minutes). In this phase the therapist is already applying means to ‘stabilize’ the volunteer patient, deactivating her expectation regarding taking part in an experiment, calming down possible anxieties and / or any discomfort that may have arisen when commuting to the location. Finally, the volunteer then declares a description of her emotional and physiological state at that very moment.

2 – The volunteer patient reports to the therapist details about her ordeals and becomes “activated;” she then declares her emotional and physiological state. This phase timing is managed by the therapist and can vary from case to case (but mostly covers an approximate duration of fifteen minutes).

3 – The volunteer patient is then submitted to the intervention conducted by the therapist (SE session only or SE+ touch and movement protocols session):

Time frame of approximately ninety minutes; the volunteer patient is then invited and encouraged to define or to narrate briefly her current emotional and physiological state, and then must attribute a grading mark - ranging from 0 to 10 – concerning her current state, compared to that of the moment at the end of the description of her case/ordeal; for both groupings (SE session only or SE+ touch and movement protocols session) the session is closed and patient is already moving around in the setting (not on the table nor sitting in the chair) when the process is concluded and the patient is released.

Table 1 - SE sessions only

Case	Arrival	Description	Final	Grading Marks
1	Well	Dizzy	Stable	8
2	Well	Feeling as if chest Is being squeezed	Relieved	9
3	Serene	Humiliated	Well	8
4	Stable	Dizzy	Stable	7
5	Serene	Insecure	Secure	7

Source: Franco, 2014

Table 2 - SE Intervention PLUS Touch and Movement

Case	Arrival	Description	Final	Grading Marks
1	Arrival	Dizzy	6*	9
2	Calm	Nauseated	7*	10
3	Well	Humiliated	Centered	8
4	Calm	Insecure	9*	8
5	Serene	Nauseated	10*	9

Source: Franco, 2014

Observation: 6*: "I feel myself lightened up and well-grounded and well connected to all my surroundings and well integrated with nature."; 7*: "...as if my body could float, however, while keeping and retaining my full attention intact."; 9*: "I feel my body becoming integrated and now I feel sure I can get rid of my past."; 10*: "I feel all the body in total freedom to do anything.".

VII.A.3.3 - Data Analysis

From observing Tables 1.1 and 1.2 the resultant conclusions are direct and self-evident, as below:

- a. All interventions produced positive results.
- b. The grading markings attributed by the volunteers shows higher grading for the Interventions SEPLUS touch and movement: this reflects what was hypothesized, since this modality alters the perception of sensory-motor integration, thus providing more quality to the process of perception as well as to the discharges of the energies blocked by traumatic experience, which is then stored and accumulates in the fasciae, viscera and in big muscle groupings.
- c. The final attribution of adjective in the modality of intervention SE session PLUS touch and movement has a very meaningful feature: in only one case the adjectivation can be summarized into one word. In four cases the volunteers had several remarks to make and observations to point out, considering that:
 - Their perception was expanded
 - More discharging activity was registered
 - More sensory-motor integration took place
 - A more even relationship between cognition, emotions and physiology could be found: embodiment.

VII.A.3.4 - Conclusion

The simplified study carried out for the purpose of this dissertation highlights the pressing need for further testing and measurements to be carried out with proper equipment (functional magnetic resonance imaging, brain mapping, blood pressure measurement and heartbeat measurement) in order to accurately verify the reality and the scope of changes, at the level of physiology, that were surely taking place and altering the whole system throughout the diverse stages of an intervention procedure that uses touch and movement in the body aiming at the restoration of blockades and restrictions generated by traumatic experiences.

For further probing, the author of this dissertation and her mentor are currently organizing a project for measuring experiments that shall include more advanced technologies and the participation of 45 volunteers.

Chapter VIII
CONCLUSION

Trauma affects the whole organism. It's not just muscles, bones, ligaments, blood, or fascia. It includes brain tissue, thoughts, beliefs, ideation, self-image, attitudes, and worldview – body and mind, emotions, intellect, and spirituality (WILLIAM S., 2012). In essence, trauma creates a fracturing of the body coherence in navigating life and leaves one fragmented and disembodied. For whoever has the opportunity to work to transform trauma, there will be new gates open to the hidden potency of Life. The first one who has to pass by this process is the practitioner.

The idea that the Nervous System is malleable and that one can transform the brain and the memory tracking the body from bottom up, is what Somatic Experiencing has effectively demonstrating in the past twenty years.

Somatic Experiencing, the most typically proposed treatment in trauma resolution, believes clients can be helped by being present in their body's sensations, slowing down their activation in order to discharge emotional intrinsic movement held in the body/mind and brain.

The somatic treatment of traumatic disruptions in physiological and emotional regulation is not so simple to do. Although top-down techniques, psychoanalysis, cognitive therapies, etc., offer effective management of dysregulated body states and can provide significant relief, they do not fully address the issues. In the Somatic Experiencing Trauma Resolution approach, the top-down direction is harnessed to

support sensorimotor processing: through mindful tracking (top down) of physical sensations and impulses (bottom-up). This approach further develops the tools to work with the body and mind mutual feedback loops (De ALINE LaPIERRE, 2006; USABPJ. vol 5 pg. 43 – 60;. (OGDEN, MINTO, PAIN, 2006, USABPJ. VOL5: 47-49).

In every trauma there is an emotional component. In Somatic Experiencing™ tracking sensation, one can address the emotion to express completing the physiology, if one brings attention to relate perception with motricity efficiency in order to increase the awareness. But one does not need too much emotion, just a little bit, because with too much excitation integration is lost between the alpha and gamma systems. When there is a threatening, traumatic experience the *haptic* system is the first system to be dysregulated. It means, that sensoriality and motricity are not working together. They are dissociated. The body structure has its tonic function to deal with the impact of the gravity system and it is done by the Nervous system. Then, this adaptability or this psychobiological system is the primary system of self-regulation. In order to achieve trauma healing, the first system that needs to be restored is the haptic system. Somatic Experiencing practitioners need to take the client to experience the optimum tonus in order to have any deep change. There are many studies that have been done that show the capacity for perception. If you get too emotional (excited) or too slow and inside, perception is highlydiminished. This paper explains the importance to reorganize the body related to space, the haptic activity and its dynamic equilibrium in the gravity for trauma resolution. Also in this paper, the author has mapped by chapters all the science related to the phenomenon of trauma; and what is needed to transform old procedure memory into new possibilities of constructing a new circuitry in the brain. The studies presented in Chapter VII, has shown efficient results of a new possibility for body

psychotherapies. If touch & movement are introduced in the process the embodiment is facilitated to renegotiate trauma using SE therapy process.

Using SE combined with Somatic Education from Hubert Godard, one will be able to integrate sensory motor activity, efficiently facilitating healing by applying embodiment exercises within the healing process.

Reviewing the highlighted points in this combination of approaches, any new sensory motor acquisition needs a new peripheral quality. The only way to not get stuck in the image is to be in peripheral awareness, which is necessary to be present in the world. The most difficult for one in process, is to go away from the image. The image, as was written before, is created in the cortex. Each time one lets go of the image it can be painful; one can feel like they are depressed, because it seems one is losing part of themselves. When one surrenders, yielding the sense of weight to gravity, he or she can sense safer and can experience the flow. In trauma, when a person goes to meet someone, they lock their body because they are in doubt, holding part of themselves. It happens because there is inhibition. To heal trauma, one needs a moment of suspension, to experience the flow to a new image coming or the imaginary process to be online. Then, it needs to stay in a postural activity in which allows the person to come out of the fixed image. The therapist is looking to promote a moment for clients to feel themselves without image, experiencing pure presence. Peripheral attitude means there is no image, and in this process one can experience the awakening. The peripheral gaze can connect with the Presence. To make a new sensory motor acquisition one needs to have a blank, and then a new image can appear. To join the implicit memory, one needs a floating attention. Floating attention, like a child, is when things are not already associated. When things are not already associated, one has the possibility of the imaginary. Consequently, new possibilities can emerge, as a new memory in place of the old one that does not serve

anymore. The procedure memory requires a new body procedure. As the practitioner palpating the body adding Embodiment exercises, it challenge the three bodies communication network (previous citation of Meyrs) in which somehow it can influence changes in the brain. Maybe, still we have a lot more to learn in future about glia's cell and reconsolidation memory.

Traumatic events generate some of the most enduring forms of memories. Despite the elevated lifetime prevalence of anxiety disorders, effective strategies to attenuate long-term traumatic memories are scarce. The most efficacious treatments to diminish recent (i.e., day-old) traumata capitalize on memory updating mechanisms during reconsolidation that are initiated upon memory recall (GRÄFF J., et al., 2014).

The consolidation of remote memories relies on both synaptic process on the time scale of minutes to hours, and circuit consolidation over weeks to years (Frankland and Bontempi, 2005; Squire and Bayley, 2007). Pioneering work on the circuitry of memory has shown that the process of long-term contextual fear memory consolidation requires early involvement of the hippocampus, followed by the neocortex. Specifically, these studies showed that hippocampal lesions impair recent memory 1 day after training, but the same lesions have no effect on remote memory several weeks after training (Anagnostaras et al., 1999; Bontempi et al., 1999; Debiec et al., 2002; Frankland et al., 2004; Kim and Fanselow, 1992; Kitamura et al., 2009; Maren et al., 1997; Maviel et al., 2004; Shimizu et al., 2000; Wang et al., 2003; Winocur et al., 2009). Such graded retrograde amnesia is also observed in human patients with medial temporal lobe injuries (Squire and Alvarez, 1995; Squire and Bayley, 2007). However, complete, nongraded amnesia has been reported in animals performing spatial memory tasks (Broadbent et al., 2006; Riedel et al., 2006; Riedel et al., 1999) and in some human subjects. Indeed, studies causing extensive hippocampal damage have reported

nongraded retrograde amnesia for fear conditioning (FC)(Sutherland et al., 2008; Wang et al., 2009; Winocur et al., 2007). This and other work has led to the “multiple trace theory” that the hippocampal memory trace is not replaced by the cortical one, but rather both memories are in continuous interplay, and the effect of hippocampal lesion may depend on both the nature of the task and the nature of the lesion (Cipolotti and Bird, 2006; Moscovitch et al., 2006; Winocur et al., 2010) (GOSHEN I., et al., 2011).

Fear and other anxiety disorders develop after the experience of a traumatic event such as grave physical or psychological harm. Because of a strong emotional underpinning, traumatic memories are extraordinarily robust and difficult to treat, evidenced by an estimated lifetime prevalence of close to 29% (Kessler et al., 2005). Among the most efficacious treatments for anxiety disorders are exposure-based therapies (Cukor et al., 2010; Foa, 2000; Foa and Kozak, 1986), during which a patient repeatedly confronted with the original fear-eliciting stimulus in a safe environment so that the once fearful stimulus can be newly interpreted as neutral or safe (Foa and Kozak, 1986). A fundamental element for successful exposure-based therapies is the reactivation of the traumatic memory (Foa and Kozak, 1986), which initiates a time-limited process called memory reconsolidation, during which a memory becomes susceptible to modification (Misanin et al., 1968; Nader et al., 2000).

In the context of exposure-based therapies, reconsolidation-updating approaches have proven effective to attenuate the response to fearful stimuli in human and rodents alike (Monfils et al., 2009; Schiller et al., 2010), and similar paradigms have been successfully used to prevent drug craving and relapse (Xue et al., 2012). Based

On the assumption of a period of updating or learning during memory reconsolidation (McKenzie & Eichenbaum, 2011; Nader & Hardt, 2009; Tronson and Taylor, 2007),

several other studies have referred to pharmacological means in order to enhance this process (Kaplan & Moore, 2011). Among those, histone deacetylase inhibitors (HDACis) might be a particularly promising candidate to permanently modify fearful memories (Lattal & Wood, 2013) for two reasons: First, by modifying chromatin compaction, epigenetic mechanisms can have potentially stable and long-lasting effects on gene expression (Levenson and Sweatt, 2005), a required feature of long-term memories (Kandel, 2001): second, epigenetic mechanisms per se can target a vast variety of nuclear processes involved in neuronal plasticity (Gräff et al., 2014), such that their effect is not restricted to a particular signaling pathway.

Remarkably, almost all of these either purely behavioral or pharmacologically supported approaches to attenuate fearful responses have exclusively focused on recent, i.e., day-old, memories – leaving it unclear whether they would also be effective for remote, i.e., month-old, memories. As traumatic memories are often times not readily amenable to immediate treatments (Keams et al., 2012) and because remote memories are more stable than recent ones (Frankland et al., 2006; Inda et al., 2011; Milekic and Alberini, 2002; Suzuki et al., 2004), there is a clear need to investigate options to overcome remote fear memories (GRÄFF J., et al., 2014).

To renegotiate trauma involves developing a sense of mastery over the intense feelings, body sensations, and impulses associated with the traumatic memories (OGDEN, MINTO, PAIN, 2006, USABPJ. VOL.5: 47-49). Ones working with trauma resolution need to be aware how memory is safely re-evoked, how resources are retrieved, and how empowering actions are discovered and executed. The focus of treatment shifts to establishing a life beyond trauma.

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