The Neurobiology of Somatic Emotional Learning and Formative Psychology

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Experience is not what happens to you; it's what you do with what happens to you.
— Aldous Huxley

Abstract
This article describes the basic brain structures that are involved in somatic-emotional learning and how neural brain activity and emotional behavior patterns can be influenced and differentiated through the practice of Formative Psychology, a somatic methodology developed by Stanley Keleman.

Keywords
Neurobiology – Formative Psychology – Voluntary Muscular Effort – Somatic-Emotional Exercises

Neural Networks

In the last two decades, neurobiological research has considerably altered our understanding of the brain and its capacity for lifelong emotional growth and learning. The brain responds flexibly to changing internal and external environments by continuously reorganizing itself and the body. There is a constant dialogue between the cortex, the limbic system and other parts of the brain and between the body and the brain. The basic structure of the brain is modular and behavior patterns are organized by neural networks or maps. A neural map represents a specific event or behavior. In a neural map, the information from different areas of the brain is connected to a complex excitation pattern. Frequently used patterns increase their performance by heightening the ability of the involved neurons to fire. With repetition, a pattern can be activated with increasingly less sensory information. Fragments of sensory information may be sufficient to trigger an already established excitation pattern. Neural adaptation, strengthened synaptic connections and the growth of new synapses and neurons stabilize a neural map. Somatic learning requires a neural reorganization. This process is called neural plasticity.

The Cortex

The most complex patterns of brain activity are organized in the cortex. These include learning, remembering, planning, problem solving, awareness and the execution of differentiated responses to the world. On the level of motor behavior, the cortex differentiates voluntary behavior from pulsatory involuntary reflex actions. All these functions culminate in the prefrontal cortex. The prefrontal cortex is located in front of the premotor and motor areas of the frontal lobes and does not reach full maturity until the third decade of life. The orbitofrontal cortex is located above the orbits of the eyes. It is involved in the process of decision making. Another specialized cortical area is the insular cortex. It produces an emotionally relevant context for thoughts and body sensations and plays an important role in the experience of pain.

In the brain, certain functions are partly lateralized. The right cortical hemisphere predominantly processes emotionally related content. In the left cortical hemisphere, linguistic and causal understanding is prevalent. Although the brain has a modular organization, it integrates separate incoming signals into a unified pattern of behavior.

Mirror Neurons

Watching an action and actually performing an action activates corresponding neural networks. This phenomenon is facilitated by so-called mirror neurons, which are motor neurons. They are involved in the planning and in the simulation of an action as a preparation to act. Mirror neurons also participate in the process of imitation learning. They not only respond to another person’s action but also to the intention behind the action. It is assumed that the mirror neurons are the biological basis for direct action understanding and for the ability to read the emotional states of others. Additionally, the capacity to empathize with others is facilitated by the mirror neurons. They establish an empathetic experiential link between agent and observer by creating a similar shared neural state. This has been experientially demonstrated in humans referring to the patterns of disgust and pain. All this implies that having empathy for another person, and understanding his emotions and behavior, is a neural motor process.

The Limbic System

The part of the brain that plays an important role in the organization of memory and in the regulation of emotional behavior is called the limbic system. It is also referred to as the emotional brain and is a ring-like structure surrounding the brainstem. The limbic system includes certain edges of the cortex and structures of the interbrain such as the thalamus, the hippocampus, the amygdala and the basal ganglia. The thalamus acts as a relay and determines which stimuli reach consciousness. The hippocampus is involved in storing and retrieving explicit memories and is therefore a key brain structure in learning. The amygdala is essential for decoding emotions and, in particular, decoding stimuli that are a threat to the organism. Motor memory, located in the basal ganglia and the cerebellum, is the basis of all emotional motor behavior. Emotional limbic circuits have less neural plasticity than the more cognitive cortical patterns. Therefore, the relearning of emotional behavior usually requires more time and practice.

The right orbitofrontal cortex has an important function in the dialogue between the limbic system, the autonomic nervous system and the frontal lobe. This pathway is particularly affected by challenges and high levels of stress. When excitation and stress hormones flood the brain, the prefrontal cortex has difficulty in calming and quieting the limbic system. Additionally, the function of self-perception, which is associated with an activation of the superior frontal gyrus, is lessened. A person who experiences continuous stress may gradually lose his ability to distinctly perceive physical or mental overload. In the case of severe patterns of alarm and helplessness, the consequences often are a diminished cortical-limbic function including cell damage of the hippocampus and the onset of disease.

Cortical-Limbic Dialogue

The cortical-limbic dialogue organizes and differentiates somatic emotional behavior. Within this dialogue, the frontal lobes plan, organize and finally execute motor activities. To complete an action, implicit subcortical structures have to contribute the corresponding motor and emotional behavior. This is shown in figure 1. Therefore, somatic emotional behaviors arise from a mixture of explicit and implicit brain functions.

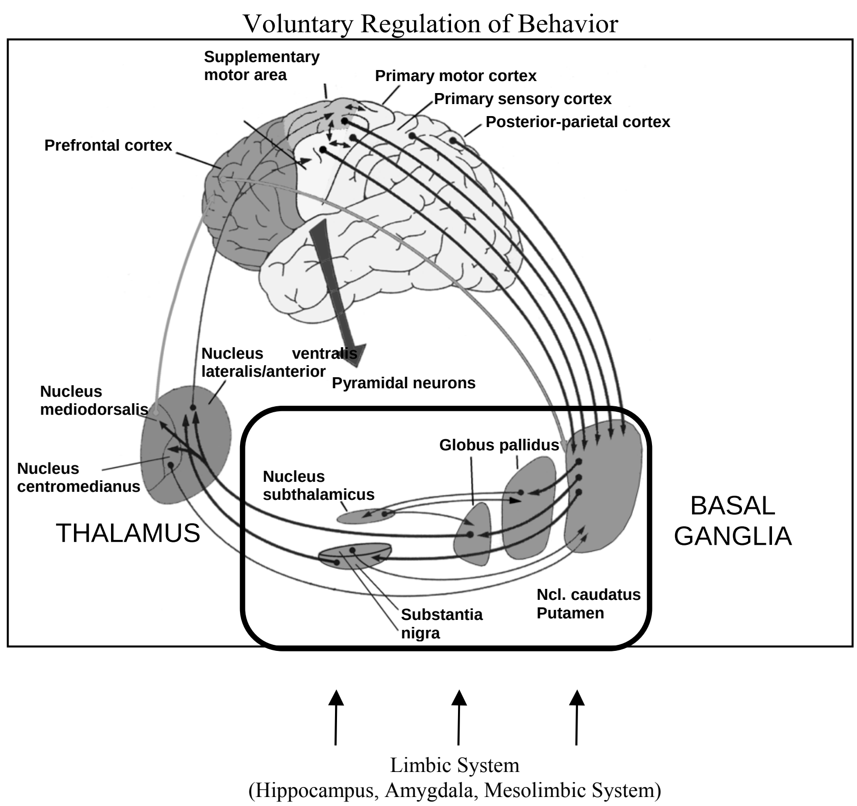

Figure 1: Voluntary regulation of behavior by Gerhard Roth. A complex loop connects the basal ganglia with the thalamus and the frontal lobe. It is in the frontal lobe that movements are planned and coordinated. The basal ganglia seem to act as a filter, blocking the execution of movements that are unsuited to the situation. The limbic system modulates the activity. After the excitement loop has been completed several times, the primary motor cortex is able to carry out the action via the pyramidal neurons. Repeated practice of voluntary motor patterns over time establishes volitional behavior.

Formative Psychology

Behavior patterns are neuromuscular organizations that can be experienced as different stages of somatic motility, porosity, rigidity and density. To learn or maintain behavior patterns requires practice. Patterns that are not used regularly become less available. Through repeated voluntary practice, more stable and complex neural maps grow. These neural maps are a result of neural plasticity, which is especially evident in the prefrontal cortex and in the hippocampus. Focusing attention on how to deal with a given situation somatically is a major Formative concept for influencing the behavioral learning process.

Voluntary Muscular Effort (VME)

Voluntary muscular effort, carried out as micro and macro muscular movements, influences the intensity of a behavior pattern, which in turn results in an altered self-experience. This is the basic Formative principle and protocol for learning and influencing behavior patterns.

Cognitive-emotional experiences are an expression of micro and macro muscular movements. These movements also grow and differentiate kinesthetic and proprioceptive senses, which are involved in the regulation of body posture, muscle tonus and emotional expressions and gestures. VME is a bottom-up dominated dialogue with muscular-cortical influence. In contrast, in a top-down dialogue the organism attempts to calm itself through mental activity. In a bottom-up dialogue, the activity is lateralized to the right prefrontal cortex, while in a top-down dialogue the predominant activity is in the left hemisphere. When visual, auditory and cognitive brain centers, as well as muscular behavior patterns are integrated into the learning process, the corresponding neural-somatic networks gradually acquire more complexity and can be more easily recalled.

VME activates the parasympathetic nervous system, which is connected via the amygdala to the orbitofrontal cortex. VME has a calming effect on the viscera by altering the visceral smooth muscle tonus. A high parasympathetic tonus lessens the intensity of the alarm pattern. Furthermore, parasympathetic activity is correlated with the ability to regulate emotions in social interactions.

VME slows down behavior patterns and makes it possible to elaborate details of the pattern in order to influence experience more distinctly. With VME, it is possible to discriminate between similar somatic emotional patterns. This reduces potential confusion between past and present emotional behavior patterns. Voluntary muscular effort subdivides behavior patterns into manageable units and therefore increases the ability for self-management. Minimal voluntary effort immediately changes the quality of the pattern. It can alter a pattern in such a way that a “personal shape” within the pattern is created. Consequently, helplessness is reduced and the learning of muscular support and containment is encouraged. How to form a shape that is both receptive and firm at the same time is an important practice. In Formative language this is called a porous-rigid shape.

The Formative method improves the capacity to make behavioral adjustments and to deal with negative feelings and experiences. The urge to escape from the present somatic reality is greatly reduced. At the same time the Formative method enhances the ability to persist by reducing the intensity of effort. Persistence is a fundamental component of problem solving. In the case of too much effort, a feeling of “wanting to” but “not being able to” may arise. The result of exaggerated effort is distress and exhaustion of the organism. This may lead further to all kinds of stress related symptoms.

Voluntary muscular behavior has to be developed and is the basis for a unique experience of oneself. Over time, VME is the key to forming a personal body identity.

Somatic-Emotional Exercises

VME is practiced by means of somatic-emotional exercises. They intend to teach the regulation of challenges and stress in social situations in a more managed and differentiated way. Additionally, practicing and differentiating motor behavior alters formerly established emotional behavior patterns. With less or more muscular effort the intensity of the pattern can be influenced.

Somatic-emotional exercises focus primarily on the somatic organization of a behavior pattern. They relate thinking and feeling directly to body posture, gestures and muscle tonus. The accompanying feelings and emotions are part of the somatic organization but not the primary interest of the therapeutic intervention. The most important aim is to reorganize neural motor patterns. If somatic-emotional exercises are practiced over a longer period of time, typical behavior patterns such as compacted rigid states or helplessness can be reorganized.

Conclusion

Formative practice, that is voluntary muscular effort, strengthens the function of the frontal cortex and increases the plasticity of both the cortex and the limbic system as a precondition for learning and differentiating behavior. In addition it promotes communication between the two brain hemispheres. Verbal skills, emotional expressiveness, cognitive functions and muscular behavior patterns form a strong unity through repeated practice.

Voluntary muscular effort cultivates the relationship of oneself as a resource for a personal connection to others and the world. Practicing and differentiating motor behavior alters formerly established behavior patterns. This contributes to a state of well being and an enhanced intrinsic motivation for somatic-emotional growth and learning. As an integrated whole, neurobiology and Formative Psychology provide a unifying scientific framework in understanding, influencing and differentiating human behavior.

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Biography

Gerhard Zimmermann, MD, is a dermatologist working as a psychotherapist in private practice in Mainz, Germany. He also has a degree in Gestalt and Behavioral Medicine and specializes in the treatment of psychosomatic and stress related disorders. For the past 15 years, he came to appreciate Stanley Keleman as a teacher, therapist and friend. In an earlier study Dr. Zimmermann verified that Formative Psychology was very effective in the treatment of severe eczema, a chronic skin condition that is highly stress dependent. Email: dr.g.zimmermann@t-online.de