

Emotions, Muscles, and Repression

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Emotions, Muscles and the Cortex:
A Physiological Basis for Repression

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CONTENTS

| | |
|---|----|
| THE PROCESS OF DISALIGNMENT | 3 |
| Social conditioning. | 3 |
| Trauma. | 4 |
| Psychological tension. | 5 |
| THE FOUR ASSUMPTIONS | 6 |
| TRANSLATION AND VERIFICATION OF ASSUMPTIONS | 6 |
| Assumption (b). | 7 |
| Assumption (c) | 9 |
| Background Information | 10 |
| Physiological Theories of Emotions | 10 |
| The Hypothalamus | 12 |
| The Hypothalamus and the Muscles | 13 |
| The Hypothalamus and the Emotional System | 14 |
| The Hypothalamus and Cortical Activity | 16 |
| Hypothalamus and Repression | 19 |
| The Progression of Repression | 19 |
| Assumption (a) | 22 |
| Specificity of muscle groups | 23 |
| The four steps of regression | 25 |
| Assumption (d). | 26 |
| CONCLUSION | 26 |
| REFERENCES | 28 |

This paper briefly looks at the interactions of the Mind, emotions and the body, (Hereafter referred to as the Body/Mind) as accepted by other cultures and subcultures, and goes on to evaluate the validity of these concepts. Citing material on the physiology of muscles, and the nervous system, as well as some ideas as to the physiological basis of emotions, a learning based model of repression, via these interactions, is constructed. The model, stating clear, hypothesized relationships between the brain, skeletal musculature, and emotions presents itself for empirical analysis, which should help further clarify the interrelationship of the Body/Mind.

The concept that the musculature of the body both reflects and influences emotions has been around for a long time. Various Eastern cultures, such as the Egyptian, Tibetan, and the Chinese have developed very elaborate exercises and disciplines to help bring about harmonious attitudes and feelings via working with the realignment of the physical body. Over the last hundred years or so these types of concepts have begun to appear in the Western hemisphere. The acceptance of these ideas can be broken down into two basic groups; the empiricists and the phenomenologists. On the empiricists side these ideas probably got their best treatment by Freud, who postulated that the muscles of the body aided in repression. Due probably to the lack of sufficiently so-

phisticated equipment at this time/ these ideas soon became part of the history of Psychology. (until recently e.g., Mangan/Murphy) & Farmer, 1980) Other, more experiential people, realized the value of many of the concepts, and the ideas proliferated, developing many parallel systems for the harmonious integration of the Body/Mind. (e.g.} Rolfing, Postural Integration, Alexander Technique, Salutations)

THE PROCESS OF DISALIGNMENT

According to this way of thinking, there are three basic ways in which the Body/Mind comes out of alignment with itself. They are: (a) Through social conditioning! (b) trauma or trauma-like experiences, and (c) general, prolonged tension or anxiety. Examples of each of these processes follow.

Social conditioning. Social conditioning is defined as the direct or subtle forces and rules of the outside or social world which restrict the natural behaviours and expres-

sions of a person. An example of social conditioning imposing tension upon a body is the process that happens as a child comes to believe that "only little babies cry." This child, when he hurts himself in front of his friends will "grin and bear it." Depending on the child, various other responses other than the grin will help him do this. Common ones are the tensing and raising of the shoulders, the clenching of the fists and jaw muscles, or even the general stiffening of the back muscles. After sufficient occurrences of such situations, the child develops a specific muscular response pattern which helps him hold or suppress his feelings, and soon enough, the child can indeed "grin and bear it."

This process is also quite common in the adult world. (e.g., getting mad at your boss and not even being able to punch the wall)

Trauma. Trauma can range from anything as common as a spanking, to extreme violence witnessed or experienced by a person. In any situation of trauma, there is a muscular response, similar to that of social conditioning, which helps the person deal with the situation.

In some cases the actual event rearranges itself in the persons mind, to further buffer the perceptions and/or cog-

nitions which the person can not immediately handle. For example, in the case of extreme violence where a child has witnessed the stabbing of his mother, the child in his limited consciousness, sees the man as a monster which could appear, out of the dark, at any moment. The child becomes trapped in postures of fear or even general withdrawal. He may develop phobias of the dark, of sharp objects, or many other possible associations; the actual responses being particular to the child and the actual situation. In whatever emotional or mental postures the child becomes trapped, there will be repercussions in the physical body. This is true even when the mental or emotional aspects of the event have been repressed or forgotten.

Psychological tension. The concept of general tension effecting the body is something most people can relate to quite easily. For instance, being in rush hour traffic and looking down at your hands, realizing that your knuckles are white from over-gripping the steering wheel. Or at the end of a rough day, noticing that the back of your neck, for apparent reason, is quite sore. Generally then, what we are talking about is needless and excessive muscular tension, due largely to ^spsychological stress.

THE FOUR ASSUMPTIONS

The preceding are examples of the different ways in which the disalignment of the Body/Mind occurs in fairly "normal" individuals. Inherent in these examples are some basic assumptions as to what the Body/Mind is capable of.

~~Phenomonologically~~ Phenomonologically they can be broken into four basic principles: (a) The muscles of the body are able to save the Mind considerable distress, by storing the threatening thoughts or feelings, (please, keep reading, I said phenomenologically) (b) In storing such energy, the muscles become chronically tense, becoming impaired in both function and flexibility: (c) Consciousness of this rigidity and tension soon begins to fade, leaving most individuals without any awareness that there is even a problem in their body; and (d) The releasal of the chronic muscle tension is soon accompanied by the releasal of the stored emotional energy and/or thoughts or *visè versa*.

TRANSLATION AND VERIFICATION OF ASSUMPTIONS

The proceeding part of the paper now looks at these assumptions which have been developed over the years by the phenomologicalists. The goal is to translate these assumptions into a learning based physiological theory of repression. For the sake of clarity, assumptions (b) and (c) will be looked at first} then (a), and much of what is said about assumption (d) will follow directly from the discussion on (a) •

Assumption (b). Physiologically, assumptions (b) and (c) are quite easy to translate and verify. Ghernan (1970) gives a simple, concise overview^W as to what type of tension induced self-perpetuating feedback loop can become established in the muscular system. Thus we look at assumption (b): The effects of chronic tension on the body.

excess muscle tension is both a response to stress and a secondary cause of stress. Chronically tense muscles complete a feedback loop and further stimulate the mind, thus perpetuating and perhaps intensifying the distress. We know that such stress can consciously be reduced by our altering our perceptions, objectives, or muscular actions.

(The] body adapts to anticipated stress by increasing general muscle tension. Signals from the

hypothalamus and the upper limbic area via the extrapyramidal motor pathway cause a variety of unconscious postures and rhythmic movements.

If a chronic state of muscle tension exists for an extended period of time, a wide variety of physical disorders may be produced or exaggerated. Among the numerous psychosomatic disorders *are* such conditions as:

1. Tension headaches
2. Backaches
3. Spasms of the esophagus
4. Spasm of the colon
5. Limited range of movement
6. Posture problems
7. Urinary problems
8. Dysmenorrhea
9. Limited range of flexibility
10. Susceptibility to muscle injuries
11. Insomnia
12. Asthma or hay fever
13. Tightness in the throat and chest cavity
14. Lockjaw
15. Some eye problems

The breadth of the repercussions of the chronically tense muscles should not be very surprising,

because the musculature system is involved in every active body process and in every feeling and expression of emotion. (p. 158-159)

Most of what Gherman says is self explanatory and quite clear. It is interesting to note the breadth of the symptoms brought about by simple, prolonged tension of the skeletal muscular system.

Assumption (c). The concept of losing touch with parts of one's body after a prolonged period of time, (assumption (c)), is easily accounted for physiologically. Grossman (1967) gives a discription of the two processes which may be involved.

[Adaption] ...occurs after prolonged and continuous stimulation of a sensory receptor or sensory pathway and represents exhaustion or fatigue of the neural mechanism. Habituation, on the other hand, occurs with widely spaced presentations of even very weak stimuli and does not represent a breakdown of receptor or transmitter function. Rather, the sensory mechanisms seem to be actively inhibited by some central process which is in itself subject to extinction or "disinhibition." The organism appears to learn not to respond or not to

transmit sensory information which has been without significance or consequence in the past.

(Grossman, 1967, p. 641)

Whether explained by habituation or adaption, or both, it seems quite likely that after a period of continuous proprioceptive feedback from a muscle, the information will soon become lost to the persons consciousness,¹ as it no longer serves in generating any new information. This leaves the person with a general insensitivity or "dead spot" on a area of their body.

Background Information

Physiological Theories of Emotions

¹ note that the same is not true for a phenomena such as pain, as pain serves a definate purpose in the activation of the body's defence mechanisms, and also that habituation will not occur for stimulations over a certain intensity.

Before actually looking at assumptions (a) and (d), a brief overview of the evolution of the physiological basis of emotion would be informative.

The first theory of this nature was proposed by William James in 1884, and was slightly modified a year later by Lange. Basically what they postulated was that emotions were nothing more than the sensing of autonomic and somatic arousal to emotional stimuli. These types of theories became known as peripheral theories of emotion, as the major locus of excitation was via the peripheral nervous system. Experimental evidence soon showed that these peripheral regions of an organism were not necessary for the experiencing of emotions, and new theories, centrally based in the nervous system, developed.

In 1927, Cannon proposed that areas of the cortex regulated thalamic mechanisms, which in turn controlled emotional expression and experiences. More experimental evidence brought about Papez's theory of emotions in 1937. He proposed the the thalamus, in conjunction with other limbic centers, interacted with the cortex to produce the phenomena known as emotion. Since then, little has been done to modify these beliefs, other than the relative importance of the various structures in the "circuit of Papez" (the preceding was summarized from Grossman, 1979, pp. 448-552.)

The main point of all this is that physiologically, emotions seem to be predominantly associated with certain brain nuclei, particularly those in the "circuit of Papez" part of the limbic system. The major interplaying systems are the hippocampus, the hypothalamus, the thalamus, and the cingulate gyrus of the cerebral cortex. hypothalamus seems to play a major part in these theories of emotion.

Assumption (a) and (d), that the muscles can store emotional thoughts and feelings, seems pretty absurd at first glance. Remembering, however, that these statements were derived from experiences and observations of intact organisms, and were used mainly as working definitions, not not scientific explanations, puts them in a different light. Rewording them back to their basics makes them a little more plausible. They can be rewritten as: (a) Muscle tensions interfere with the experiencing/expression of thoughts/emotions, and (d) the relaxation of this interference will once again allow for the experience/expression of these emotions and thoughts. (and conversely, if these emotions/thoughts are reexperienced, the maintenance of the tension/interference will no longer be needed.)

The Hypothalamus

In looking at the information gathered so far, it seems that the hypothalamus serves as a neurological interface between the emotions and the muscles. Experimentally this has been shown to be true. It has also been shown to be involved in the third process we are interested in: Thinking behaviour. Consequentially, its role in each activity will be examined.

The Hypothalamus and the Muscles

Neurophysiologically, the hypothalamus's connection to the muscles is divided into two parts: the anterior and the posterior. The anterior hypothalamus is connected to, and responsible for, the parasympathetic nervous system. When activated/ this part of the autonomic nervous system is basically responsible for slowing down the body, particularly after a stressful encounter. This means activation of the anterior hypothalamus would decrease general muscular tension.

The Posterior hypothalamus works basically antagonistically to the anterior part. (Gellhorn, 1964, p.459) It is connected to, and responsible for sympathetic nervous system activation. In general, it increases bodily arousal and general muscle tone.

Neurologically, the hypothalamus is involved with a large part of the afferent feedback from the Skeletal muscular system.

The Hypothalamus and the Emotional System

Back in our discussion of assumptions (b) and (c), we learned that the hypothalamus seemed to play a large role in effecting the expression of emotions, via the musculature of the body. (Gherman, 1977)

Thompson (1975), elaborates a little on the hypothalamus's neurological interaction with the emotional system.

The autonomic nervous system is under direct control of various nuclei of the brain stem. These in turn are influenced by the hypothalamus and certain of the limbic forebrain structures. The autonomic nervous system is the peripheral motor system for the brain structures most involved in the mediation of the emotional and motivational aspects of behaviour. (Thompson, 1977, p. 377)

Astrand and Rodahl (1970), in their discussion of the reflex activities of the anti-gravity muscles which maintain our upright posture, note that it is probably the most important relay center involved in this unconscious activity. They state that feeling of happiness, alertness or attention

will increase the general gamma² fiber activity, whereas opposite types of feelings will decrease it. "In this way the very noticeable relationship between an individual's mood and posture may be explained." (p. 100)

Gellhorn (1964) gives us a little more indepth look at the interrelatedness of the muscles and emotions. He explains that the feedback from the musculature of the body is a very effective stimulant of the posterior hypothalamus. As mentioned previously, this would activate the sympathetic division of the autonomic nervous system, increasing general muscle tone, thus completing a positive feedback loop by further stimulating the posterior hypothalamus. (p. 461) He offers more support for this relationship by stating that "weakening of this activity system can be accomplished by reducing or eliminating proprioceptive impulses." (p. 462)

Knowing that the posterior and anterior hypothalamus are antagonistic and self-regulating, that is any increase in activity of one automatically decreases activity of the other, (Gellhorn, 1964, p.461) we can conclude that any decrease in proprioceptive feedback would automatically increase the activity of the anterior hypothalamus. This would have the effect of activating the parasympathetic nervous system, thus further decreasing the general muscle tone and

² The motorneurons which regulate the sensitivity of the proprioceptive feedback system of the musculature of the body.

further decreasing posterior hypothalamus activity.

This type of relationship would explain why it is so easy to get "stuck" in a mood or posture. For example, a depressed person who is walking around all hunched over and withdrawn is actually perpetuating those feelings and postures due to the impinging proprioceptive impulses on the posterior hypothalamus.

Gellhorn also cites a study by Pasquarelli and Bull, done in 1957, which helps substantiate these ideas. Using hypnosis, they found it next to impossible to induce any other mood or feelings which were not congruent with the physical posture the subject was "locked" in. They found that a "depressed" mood could not be induced until the physical posture of "triumph" was first released. After further review of the relationship between muscle activity and emotions, he suggests that:

Although a specific stimulus, mostly in the form of symbols (words seen or heard), appears to be the direct cause of mood or emotion, the setting of the hypothalamic balance through the total quantity of proprioceptive impulses impinging on the hypothalamus per unit of time is of considerable importance.

The Hypothalamus and Cortical Activity

Much of the relationships between the hypothalamus and cortical activity has been inferred indirectly, through experiments dealing with muscular tension.

Von Eiff (1952,1957), cited in Gellhorn (1964), found that:

Total metabolism and activity of the striated muscles are greatly increased during mental work which arouses emotional reaction, but... [not if these] •..same tasks are carried out without emotional excitement. (Gellhorn, 1964, p.457)

Courts, (1942) in reviewing the literature on the relationships between muscular tension and performance, makes the following type of generalization. He concludes that there is a general inverted U-shaped curve which typifies the relationship between learning and degree of muscular tension. The type of learning can be anything from classical conditioning to the memorization of nonsense syllables. Basically what he is saying is that there seems to be an optimal level of tension, above or below which, learning seems to be impaired. Several explanations are offered for this. They basically can be summarized as: There is an optimal level of tension which induces an optimal level of proprioceptive feedback to the brain, which: (a) acts as a stabilizer by holding constant extraneous stimuli, and/or (b) increasing the general excitation of the cortex, allowing for a facilitation of any connected neuronal activity.

Thompson (1975), on page 391, in describing the circuit of Papez, states that the hypothalamus is indirectly, neuronally, connected to the neD-cortex, particularly the associative and motor regions. This corresponds to the above empirical data.

Gellhorn (1964), in his review, finds that an increase or a decrease in posterior hypothalamic activity leads to a corresponding change in general cortical excitation; and that this has been fairly well established. (p.465) He goes on to state that faint stimuli, which would normally go unattended, and probably not even perceived, by a cat, becomes noticed and followed, under mild posterior hypothalamic stimulation. He also summarizes others findings regarding hypothalamic-cortical interactions:

It seems not improbable, therefore, that the sensory- hypothalamic interaction in the neocortex accounts also for the qualitative changes in sensations and perceptions during emotional excitation. The fact that this facilitative action of the hypothalamic-cortical discharges is not confined to the sensory projection areas and to the motor cortex (Murphy & Gellhorn, 1945) but extends to the association areas as well (Gellhorn, 1954) suggests that it may play a role in recalling past events. It should also be remembered that memory

processes as well as perceptions are facilitated in the emotional state.³ (McGinnis, 1949; Miller, 1950; Rapaport, 1942). (Gellhorn, 1964, p.466)

Hypothalamus and Repression

So far we've found that the thinking areas of the brain, the physiological base for the emotional system, and the afferent and efferent fiber of the muscular system all have a common neurological connection; the hypothalamus. In the remaining sections, this interrelatedness will be used to explain assumptions (a) and (d), forming a physiological basis for repression.

The Progression of Repression

We shall use the child learning to grin and bear it as a prototype for the translation of assumption (a) into physiological terms and learned interactions.

³ Note: Common sense would suggest he is not talking extreme degrees of emotion when he makes this statement.

Lets begin where the child, in a situation where he wants " to be big ", has just hurt himself in front of his friends and begins to become overwhelmed by the emotions of wanting to cry. The first and easiest thing he is able to do is stop the actual expression of these emotions. This can be done by merely not allowing the body to be an expressive instrument. By making rigid those muscles most involved in expression, such as those involved in breathing, the lower abdominals, and the face muscles} the child can outwardly say, " it doesn't hurt. " Usually, however, he must leave the group of people, go to some secluded place, and relieve the conflicting tensions he has just set up between his emotions and their expression. His little maneuver, has been successful in that he did not actually cry in front of his friends. Thus, from a learning point of view, the behaviour of tensing muscles in such situations has been reinforced and similar reactions are more likely to recur in the future.

Next time, the child, now having learned an effective maneuver for dealing with emotional expression, incorporates it even sooner when trying *to stifle* an emotional process. After a various number of occurances of such situations, the child soon finds he has a lot of control in handling these experiences.

There are also some subtler processes taking place during this learning process. There is a reason why his maneuver is able to evolve effectively from just attenuating expression to such full control over his emotions. As his muscle tensing behaviour moves closer in time to the onset of his experiencing of the emotions, the proprioceptive feedback from his muscles, via the hypothalamus begin to interfere with the subtle emotional processing taking place. The *earlier* in this sequence it begins, the more likely it is to have a relatively greater proportion of control over the activation of the hypothalamus/ limbic system. Thus the activation due to the muscles would actually interfere with the activation due to the emotional system. As this is what the child wanted, the onset of muscle tension, due to its reinforcing qualities, would be literally be shaped into occurring sooner and sooner in the process.

The aforementioned interaction of the Body/Mind is fairly straightforward and without any particular repercussions, other than the child losing touch with an integral part of his existence. (emotional expression) The example however is based on the stifling of emotion due to physical pain.

In a situation due to trauma or any situation where an actual thought or thought series elicits an emotional reactions has many more repercussions on the Body/Mind. In a sense it is like an extension of the previous example, ex-

cept instead of the dampening process being intentionally induced. In a physical situation, the subtler forces of shaping due to reinforcement play a larger role. An example best illustrates this. Suppose a person remembers an emotionally producing situation. Immediately the emotional system comes into play, moving the person towards re-experiencing that event. As with the first example, the person learns that tensing his muscles will interfere with this experiencing. However, the person does not have to be conscious of this process, as it will reinforce itself through the attenuating of the anxiety anyway. Anxiety reduction has been shown to be a very powerful reinforcer. see Martin, 1979, for a full discussion of the reinforcing qualities of anxiety reducing behaviour.

In applying these concepts to general psychological tension, I have already shown that much of it occurs because of a physiological positive feedback loop between the muscles and the hypothalamus. The only thing that can be added, is that perhaps this activity does indeed alleviate some of the psychological stress encountered throughout the day.

Assumption (a). In summary, the important aspect of all this, is that muscle tensing is self-reinforcing and that the process does not need a person's conscious participation

for it to occur. The fact that anxiety producing thoughts are very easily cued, causes the conditioned response of muscle tension to be activated an incredible number of times in a given period. Eventually, the muscles themselves become chronically tense, losing their ability to relax properly. This fact, taken in conjunction with the observation that the person has lost conscious contact with certain feelings, yields the superficially valid conclusion that the muscles are storing the emotions.

Specificity of muscle groups. I mentioned earlier that in the case of the child stopping his crying, he tensed certain muscles. This section develops a "rule of thumb" as to which muscles would be used to interfere with certain emotions. In general it is an interaction between the emotion being experienced and the expression being repressed or suppressed. If a person is angry and wants to hit something, different muscles would be called into play than if the person were angry and wanted to run away. The initial thoughts of expression cause the activation of muscles which would carry out that activity. Immediately the corresponding antagonistic muscles would be called into play to offset that expression. As emotional experiencing gains more intensity so do the sets of antagonistic muscles being acti-

vated, until finally the muscle tension is great enough for the proprioceptive feedback to the hypothalamus to interfere with the emotion, causing it to subside⁴ This increasing muscle tension of sets of antagonistic muscles may be one cause of the well know phenomena of shaking with anger, fear, etcetera.

As the process becomes shaped closer and closer to the onset of the emotional expression, it literally becomes a conditioned response for the emotional experience, soon shaping itself to react to the onset of just thinking of the situation. This secondary set of shaping occurs because the increase of muscle tension can also interfere with general cortical activity, thus interfering with the present thoughts, and being reinforced for doing so. (anxiety reducing, remember?) As the muscular reaction starts happening to the thought, there would be less tension needed to interfere with the thought, as there is less activation of the various brain centers to have to interfere with. However, since thoughts can be cued and get inhibited at a relatively faster rate than emotions, the decrease in necessary intensity is made up for by an increase in the rate of activation of responding. (see figure 4) This explains why what

⁴ Just an interesting fact here. The face has a very high proportion of proprioceptive feedback to the hypothalamus. This would explain why it seems to get incorporated into many conditioned responses to stress. This also bears some light on why people develop such unique facial distortions over the years, which give them their "character".

starts off as being a total muscle group tensing soon becomes a "knot" in that particular muscle system. The body, in its own usual, efficient way, puts only as much energy as is needed for handling any given stress.

The four steps of regression. As the activation of the muscular system begins to shape itself closer to the onset of the emotion producing thoughts, an interesting phenomena presents itself. We find that this progression can be used to explain why certain types of people are like the way they are emotionally. Early in the process, where the stifling is occurring during the expression, the person may appear to be distant and withdrawn. (see figures 1 and 2) Later, when the stifling occurs during the actual experiencing of the emotion, the person is described as intellectual and out of touch with his feelings. (see figure 3) Should the stifling occur during the actual thoughts themselves, the material has become partially repressed. (see figure 4) Finally, should the stifling occur before any conscious experiencing of the thoughts, this would be complete repression. (see figure 4) It has been shown in the lab that this latter type of process is possible. (Martin, Stambrook, Tataryn, & Beihl, 1980)

Assumption (d). The assumption that the releasal of the tension will elicit the emotion/thought (and vice versa) actually means that the stopping of the act of tensing the muscular system will cause it to 10 longer interfere with the process of thinking and feeling, next time the stressful thoughts take place. This process does not have to take place in an all or none fashion, in fact it seldom does, What usually happens, is the onset of muscle tension starts to begin later and later on the thought to expression time scale. Hence, the person only handles as much as he can at any given time, each step allowing him a little more experiencing than the last time. Conversly, when a thought or feeling process has been "worked through", it causes the extinction of the muscle tensing reaction to take place as it is no longer being reinforced. The muscles, no longer being tensed all the time, begin to relax back to their natural state. Thus alleviating eitner the psychological tension or the musclular tension, can cause the other tension to also be alleviated.

CONCLUSION

This paper started with some facts about the interrelatedness of the Mind, emotions and the body, as accepted by certain segments of the population in general. Translating them into a language which could be scientifically researched, the areas were investigated, unveiling a large amount of information on the interconnectedness of these areas at a physiological level. These facts were then used to build a learning based physiological model of repression. The model, in turn, appears to offer a fair amount of insight as to the workings of the Body/Mind.

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Emotions, Muscles, and Repression

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Schematic for First Learning Control

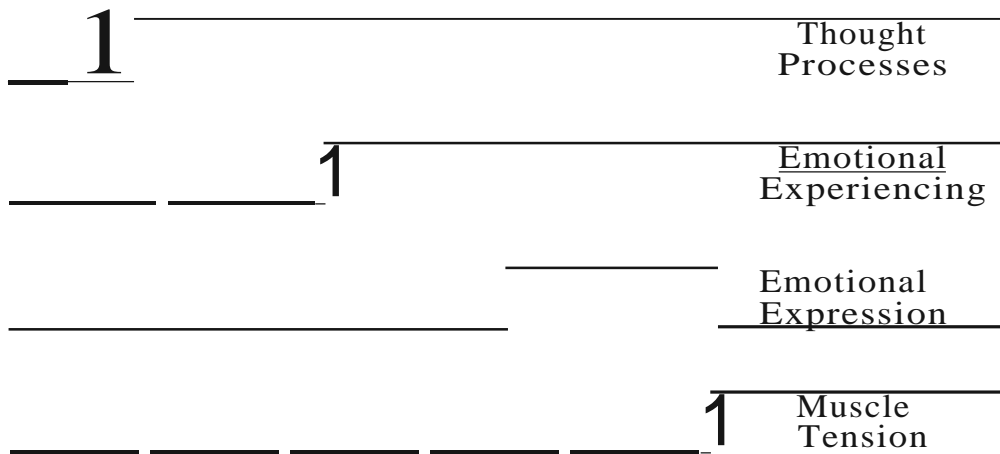


FIGURE 2

Schematic for Stifled Expression

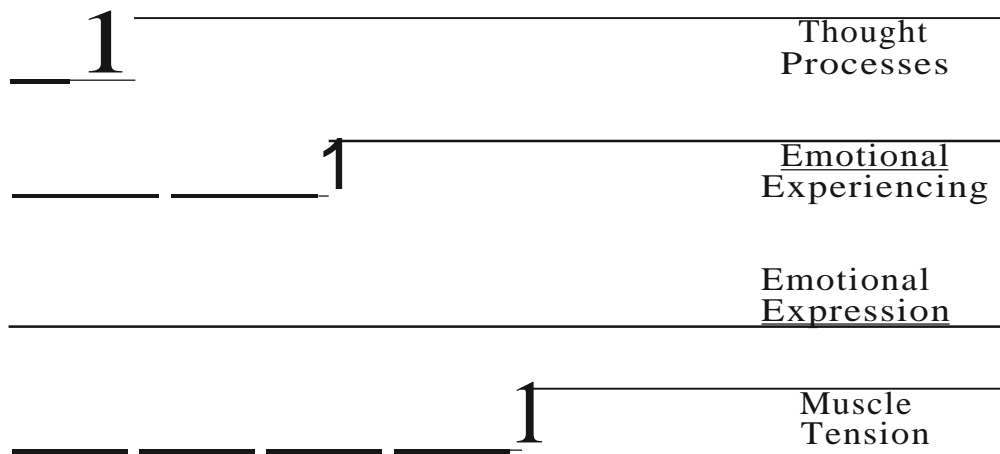


FIGURE 3

Schematic for the Intellectualizer

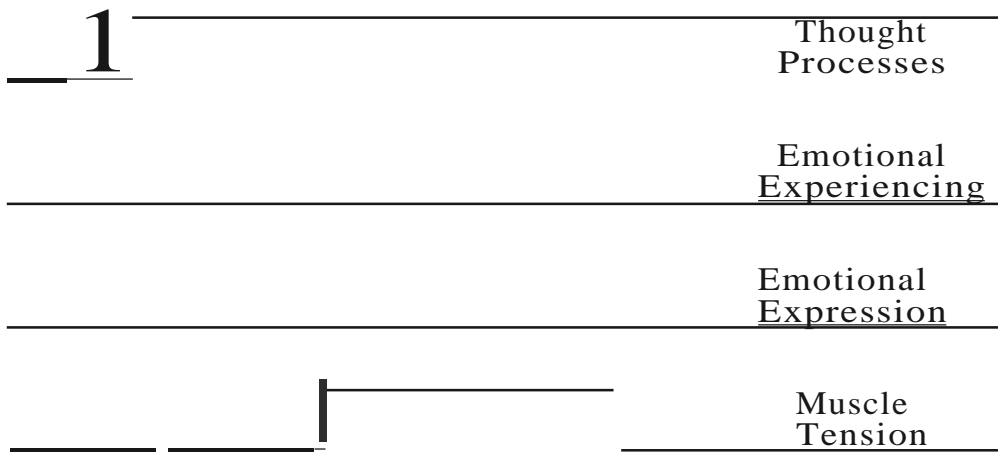


FIGURE 4

Schematic for Repression

