

## **Audio-Visual Entrainment: The Neurobiology of Affective Disorders and Clinical Implications of Audio-Visual Entrainment**

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***Abstract:** The author discusses the origins of mood and aggression from a neurobiological and an evolutionary/genetic point of view. Affective disorders pertain to disorders of emotion, most commonly depression, anxiety and mania. Affective disorders have profound effects on violence, the ability to love, sleep, health, sexuality, longevity, ethics and so much more. Trauma is the neurologic/somatic/social outcomes of the perception of life events. The “weighting” of an experience as to trauma/non-trauma status is dependent on the net result of factors involving both genetic and life experiences which varies widely from person to person. Audio-visual entrainment plays a part in raising the perceptive threshold and in recovering from affective disorders, be they trauma-based or not. The aftermath of trauma and affective disorders is so profound and far reaching that all approaches that could aid in recovery must be considered.*

### **Introduction**

Affective disorders pertain to disorders of emotion, including depression and anxiety and mania. Affective disorders are generally the product of factors of genetic origin and of environmental and lifestyle influences, more commonly known as the nature versus nurture paradigms. Depression is the most common psychiatric disorder by far. About 14% of the population will experience clinical depression in their lifetime. Of these, an alarming 15% will unfortunately commit suicide (Rosenfeld, 1997). The helplessness of depression is not a quiet, passive state, rather its active, all-consuming dreadfulness!

Continuous bouts of activation of the hypothalamic-pituitary-adrenal-axis (HPA) exact a personal toll, resulting in irritable bowel syndrome, tension and migraine headaches, neck and spine problems, temporo-mandibular dysfunction, heart disease, skin rashes, slow recovery from viral and bacterial infections, insomnia, alcoholism and drug abuse (Everly, 2002). Trauma also poses a socio-economic toll, producing aggression and violence, family breakup, and lost productivity in the workplace, not to forget hundreds of millions spent annually on prescription and recreational drugs. The effects of cortisol damages neurons of the hippocampus and in turn impairs declarative or explicit memory, the ability to recall details of events (Sapolsky, 2003). While it is now apparent that hippocampal volume shrinks following severe stress and this shrinkage is correlated to increased sensitivity to stress, the issue as to whether or not people with a smaller hippocampus have increased sensitivity to stress is not yet resolved. Gilbertson, et al. (2002) has investigated this issue by analysing the hippocampal volume of identical twins, one of whom had post traumatic stress disorder (PTSD) from military combat in Vietnam and a twin brother who was not in combat. He compared these twins against other twin pairs where the brother in combat didn't develop PTSD. They found that in the twin pairs where PTSD developed, both brothers had small hippocampi, whereas in the non-PTSD pairs, hippocampi volume was normal. Could it be that simple declarative memory testing in young children may serve as an indicator for sensitivity to stress and pathology? Early family counselling in stress management in these “sensitives” may circumvent pathology later in adulthood.

## How it Happens

Depression, anxiety, suicide and the serotonin connection are all outcomes of the processes of the hypothalamic-pituitary-adrenal (HPA) axis (Ezzell, 2003). This is a “triangle” in which the hypothalamus and pituitary glands in the brain communicate with the adrenals. In response to stress the hypothalamus releases corticotrophin-releasing factor (CRF), in turn causing the anterior pituitary to make adrenocorticotrophic hormone, which in turn causes the adrenals to produce glucocorticoids such as cortisol. Cortisol raises blood sugar concentrations, increases energy to the periphery and inhibits the immune system. Serotonin is part of the HPA axis in that it sets the threshold of the flight-or-fight response to the level of stimulation or perceived threat.

## Nature vs Nurture

Strong definitive evidence supporting the nature side of depression lie in animal studies such as the 1959 study of silver foxes by the Russian geneticist Dmitri Belyaev, (Shermer, 2003). Silver foxes used in the furrier industry were bred for friendliness toward humans. In just 35 generations, tail-wagging, hand-licking foxes were created. In addition to reduced aggression and a reduced fear response to unknown stimuli, they also produced less cortisol, a hormone produced by the adrenal glands and directly involved in the flight or fight response and had significant increases in serotonin, a neurotransmitter involved in the reduction of aggression.

## Death By “Numbers”

Like Dmitri’s silver foxes evolution by selection has played a critical genetic role in many cultures among humans. For example, accounts of savage dysfunctional humanity, or “dyshumanity” (as these terrible acts were beyond inhumane) of Europeans toward aboriginal peoples and frequent “stonings” and persecutions within the Judeo-Christian/middle-eastern cultures would certainly suggest a shaping of the genetics of behavior. The Jewish Torah serves as the basis for Christianity and Islam where “an eye for an eye...” and “spare the rod and spoil the child” are classic examples of religious-based aggression. Whether or not the first writers of the Old Testament spawned a few millennia of aggression in keeping with the writings of “God” based brutality is unclear. However, how could humane, loving people brutally stone others and even their own wives to death, without a dash of attachment disorder mixed in? A classic example exists in the chapter Numbers in the Bible where Moses and the people of the village stoned a man to death for gathering sticks on the Sabbath” It would seem that Moses and the others forgot that in playing cop, judge and executioner, they too were working that day. Perhaps it’s a matter of “he who points the first finger wins!” Research has now discovered that impulsive aggression is a survival technique - act out before being acted upon (Kotulak, 1997).

Aggression is also sparked by hardship. An article by Homer-Dixon, et al. (1993) shows that shortages of water, forests, and fertile land, when mixed with dense populations has lead to violent aggression and war in developing countries. In present times, we see disheartening news

reports of child slavery and child prostitution in countries under duress in meeting basic human needs. Two thousand years ago, people lived on subsistence farms, only a few acres in size to feed themselves and their families. The average lifespan of a man was 31 years and for a woman, 26 years. She would have had an average of six children and four would have died by the time of her death, certainly a life of hardship where only the strong (and perhaps aggressive) survived.

### **There Goes the Neighborhood!**

If violence and death are brought to life by hardship and religious dogma, then how do the powerful, wealthy and privileged account for it? When Columbus landed in Hispaniola (in the country of Haiti) in 1492 and met the Taino, the literate men of his ships wrote about the idyllic life of these gentle, family-oriented people (Hartmann, 1998). On his second trip in 1495, Columbus captured about 2000 Taino from the village. A crew member of Columbus', named Cuneo, recorded in his diary about a teenager girl given to him by Columbus to enjoy as he pleased. But when he tried to have sex with her she resisted with all her strength, so he had her thrashed mercilessly – then raped her. Innocent, heartbroken Taino girls at nine and ten years of age were in particular demand and enjoyed by affluent Europeans. Columbus wrote, in 1500 that 100 Castellanoes could be fetched for such a girl comparable to the price of a farm. To justify his tyranny and dyshumanity, Columbus discredited the Taino as cannibals. Under Spanish law, slaves were only allowed from tribes that practiced cannibalism, so it was documented that most North American natives (NAN) were cannibals, contributing to fortunes made by the European conquerors. A misleading 1594 drawing by Theodore de Bry depicting a large fire with NAN eating the limbs of others, bought public support in Spain. Spain set up a fort at Hispaniola and invoked severe discipline on the now enslaved Taino. As a result of routine persecution by the Spaniards, the peaceful and defeated Taino quit having babies and participated in mass suicides. Their population diminished from an estimated eight million prior to the arrival of Columbus, to extinction by 1555.

The Spaniards weren't the only predators. Accounts of the English in India and the deportation of thieves (starving English children caught stealing food) to Australia, accounts by Winchester (2003), of the brutality of the Dutch in the East Indies all provide testament of severe European/Judeo-Christian brutality. Records suggest that the indigenous people of "La Florida" lived a rather easy and healthy lifestyle prior to the arrival of Europeans (Larson, 2000). Analysis of isotopes of carbon and nitrogen in the bones and dentition of the deceased natives revealed that their diet consisted mainly of a variety of fruit, nuts, wheat, acorns, meat and seafood. With the arrival of Europeans, their diet became primarily that of corn, which contributed to poor oral health, anemia and iron deficiencies. With corn, the natives now also suffered great losses in three essential amino acids: lysine, isoleucine and tryptophan (a precursor to serotonin and related to aggression). Analysis of the bones of La Florida natives following the European rule showed much greater bone lipping and joint polish, indicators of osteoarthritis from hard work and heavy lifting. They also developed *retzius lines* in their tooth enamel – signs of poor diet and disease, and lesions on leg bones were the results of infection.

## Love Thy Neighbor

A significant volume of evidence also suggests that North American Natives (NAN) were, by and large, respectful of each other and maintained a peaceful co-existence together, until the arrival of Europeans (Ferguson, 1992). The first recorded evidence of a shift in native temperament was in Hispaniola, when, upon Columbus' return he found that the Taino had slaughtered all 38 of the crew he had left behind the run the settlement. In fact, antropologists have come to realize the fact that the mere presence of Europeans coming to document the "New World" resulted in a cultural "Heisenberg effect". Generally, Europeans were well received, until their predatory nature became overwhelming. Europeans introduced the NAN to slavery, offering strives slaves of other NAN following victorious assaults,

The Europeans used divide-and-rule methods to control and destroy the NAN, which included turning tribes on one another in exchange for goods and hiring tribes to destroy other tribes. A demand in Europe for the NAN "shrunken heads" became a major export business and the Jivaro people were paid one gun for one head, setting off a deadly arms race and indiscriminate slaughter. As the Europeans pushed the NAN into territories, fighting broke out amongst all of the NAN, for reasons of hardship, territory, arms, power, food, wealth (such as the fur trade and head-shrinking), most of which was deliberately propagated by the Europeans.

The major causes that destabilized North American natives were diseases from settlers (the society of NAN was maintained through a life of kinship, and losing up to half of their population was extremely destabilizing), an altered ecosystem by alien plants and animals (such as making corn a staple diet), changes made possible by new goods and technologies (steel axes and guns), trade (such as payment for furs, scalps and heads) and a divide-and-rule program implemented by the Europeans (fragmenting or pitting NAN on each other). The effects and duress of the European influence on natives throughout America and world-wide shows the power of cultural influence which pitted cooperative societies into brutal enemies. Some of the NAN nations wiped out by the Europeans included the Cherokee, Navaho, Pima, Yavapai, Yanomani, Blackfoot, Cheyenne, Apache, Carib, Kwakiutl, Taino, Haida, and Tsimshian (Ferguson, 1992).

Prior to the arrival of Europeans, natives generally had peaceful coexistence. Most tribes didn't have chiefs and there were no people of wealth and power within a tribe. The structure of chiefs came from the European model, which gave the Europeans more control by holding someone accountable for the tribe's actions. When cultures get hit with hardship and turmoil, aggression increases. However, the first Europeans were men of wealth and affluence, who would kill anyone who stood in their way. Power on all levels seemed a way of life for Europeans. Where did they acquire this brutal aggression?

## A "Mean" Gene?

It makes sense that in parts of the world where brutality was a main component of culture and religion, that a citizen's biggest threat was from other humans, not animals? To this end, a survivor would need to anticipate a potential threat to his/her life through attentive listening and

observation, would need a quick wit to conjure up the arguments necessary to avoid persecution and if that failed, would need to resort to quick aggressive action to throw off or kill the attackers? Perhaps, like the reverse of Dmitri's silver foxes, evolution through selection has provided many of our ancestors with a "mean" gene, necessary for survival within their cultures.

In support of this is the discovery a mutant human gene that raises noradrenaline levels and increases impulsive aggression in the men of whom it resides (Brunner, et al. 1993). Further adding to the genetic argument is the discovery of another aberrant gene, which is widespread throughout all populations studied to date that lowers serotonin levels and increases aggression (Linnoila & Virkunen, 1992). Linnoila also found that infant monkeys whose fathers were aggressive, also showed aggression, even when they were separated and cared for by loving mothers, and infant monkeys of passive fathers remained relatively passive, even if raised in a hostile environment. These genes come at a price by wreaking havoc in those people within whom they reside, through increased dis-ease, sleep disorders, fatigue, social conflicts and family instability.

### **Cerebral Blood Flow, Depression and Some Electrifying Thoughts**

Several studies have examined cerebral blood flow (CBF) and metabolism using positron emission tomography (PET), single photon emission computerized tomography (SPECT) and functional magnetic resonance imaging (fMRI) analysis (Rubin, Saxeim, Nobler & Moeller, 1994). Much controversy surrounds these studies. Functional imaging studies have shown confounding (both high and low) irregularities in metabolism, primarily in the basal ganglia, prefrontal and limbic areas that tend to normalize in those who respond to medication. In some cases, sleep deprivation reduces depression and is tied to reductions in abnormally high CBF within the anterior cingulate gyrus. (Wu, et al., 1992). PET scans of those with seasonal affective disorder (SAD) showed both hypo and hyper perfusion of CBF in various regions of the frontal cortex which normalized following treatment (Cohen, et al., (1992). Antidepressant medication has been shown to affect capillary permeability and the brain-blood barrier (Preskorn, Rachle & Hartman, 1982). Electroconvulsive therapy (ECT) in which the electrodes are placed for whole-brain or right-side electrical stimulation has been widely used to treat depression. CBF reductions follow shortly after exposure to ECT, even with people who already have hypo-perfusion of CBF. For depression, ECT is generally administered to the right-hand side (Rubin, et al., 1994). Right-side CBF reduction would help offset the "alpha" asymmetry, recognized in the QEEG field to be associated with depression and disturbed mood (Rosenfeld, 1997; Siever, 2003). Rubin also found that anti-depressants increased global CBF in those who did not respond while those who did respond showed no change in CBF. Rubin concluded that both antidepressants and ECT (even with clinical improvements) can affect regions in the brain in the direction of further abnormality, not normalization. An analogy would be: a car that is always pulling to the left because of a flat left tire and punching a hole in the right so that the car will drive straight, although very slowly.

## The Chemical Connection

Shealy, et al. (1992) studied blood-serum levels of five neurochemicals (melatonin, norepinephrine, B-endorphine, serotonin, cholinesterase) in depressives. He found that 92% of depressives had abnormal levels in at least one of the five neurochemicals tested and 60% showed three or more abnormalities. In over half of the depressives he found either elevated or low levels of norepinephrine/cholinesterase ratios. He also found magnesium deficiencies in 80% of depressed patients and 100% of those with depression were deficient in taurine, an amino acid found in meat and fish, which is used to help absorb fats and fat-soluble vitamins. His work supports the notion of dietary supplements for the treatment of depression.

The nucleus accumbens within the forebrain is a primary reward and pleasure center and is primarily sensitive to dopamine, serotonin and endorphins (Ratey, (2002). Stimulant drugs such as amphetamines and cocaine produce a sense of pleasure by changing the concentration of dopamine in the accumbens. Noradrenaline, a close relative of adrenaline is also a player in aggression. Low levels of noradrenalin are associated with under-arousal while high levels are related to impulsiveness and violence of the hot-headed type (Kotulak, 1997).

## Feeling Fatigued?

Chronic long-term stress and HPA activation produces continuous wear and tear on the adrenals, resulting in losses in cortisol and norepinephrine. This largely unrecognized condition, known as *hypoadrenia* or adrenal fatigue (AF) is the central (medical) focus in Wilson's, 2001 book, *Adrenal Fatigue*. Simply put, Wilson attributes AF as the adrenal "burnout" aftermath of long-term accumulated stress. These "adrenal" stresses include maternal stress to the mother and fetus during pregnancy, workaholism, marital tension, poor diet, refined foods, caffeine, fear, sense of helplessness, lack of sleep, life traumas, lack of engagement (dissociating) in rejuvenating activities, respiratory infections and so on, to which point the endocrine system exceeds a threshold, and "burns out."

According to Wilson, AF precedes low blood pressure, chronic fatigue, and fibromyalgia AF is accompanied with frequent respiratory infections and difficulty recovering from them. Behavioral components are extreme fatigue in the morning – leading to consumption of caffeine, and an energy surge in the late evening – leading to consumption of alcohol and drugs for sleep. Major lifestyle changes, exercise, a healthy diet, supplements including magnesium, calcium, B, C & E vitamins and minerals are recommended for recovery. In my opinion, the treatment of AF also supports psychological interventions through the use of "talk" therapy for resolving issues and arousal control techniques such as peripheral feedback, neurofeedback and AVE.

## The Power of Serotonin

Serotonin is involved in dominance and has been shown to be high in dominant male vervet monkeys (Walton, et.al., 1992). Walton's group also found that male salespeople with high sales performance had high levels of whole blood serotonin (WBS), a reliable marker of

serotonin, of an average of 180 mg/ml, whereas the poor performers had average WBS levels of 140 mg/ml of blood volume. A study by Raleigh (Kotulak, 1997) found that when sub-ordinate monkeys were given a serotonin uptake inhibitor like Prozac, they became dominant through friendship and alliances with the females. Dominant monkeys that were serotonin deficient ruled with aggression. Like the “Prozac” monkeys and salesmen, college students with the most friends had serotonin levels 20 to 40% above the norm. Serotonin has an influence on aggression. Females have 20 to 30% more serotonin than men which contributes to their reduced aggression.

Young and Pihl (1988) set up an experiment with normal, young males where the first person to push a button when a light flashed, could give his partner an electric shock in the range from 1 (mild) to 8 (strong). Normally, the shocks given were mild and relatively “tit-for-tat”. However when one of the pair was given a serotonin antagonist, that person would frequently deliver more severe shocks above “4” even if they received shocks that were mild. On the other hand, if one of the pair was given tryptophan, a pre-cursor to serotonin, that person would deliver milder shocks to his partner even if he received strong shocks from his partner.

Low levels of serotonin are tied to loss of control (helplessness), which manifests this deficiency in temper and rage (Sapolsky, 2003). Reports from my clients indicate anxiety from traffic congestion, tight scheduling, computer problems, corporate “right sizing,” the oxymoron of “customer service” with many businesses, and other factors that have come with the “modern” age. Merchandising has been designed around corporate convenience at the expense of the common citizen, playing a part in peoples’ frustrations and anger. Monitoring electro-dermal activity, I have watched people’s arousal increase when shown one of those frustrating sealed plastic “blister packs” that many items come in nowadays). All of these “highlighters of helplessness” contribute to highly increased frustration and aggression much alike studies with mice when they are given random electrical shocks beyond their control (Sapolsky, 2003).

## **Dying to Know More?**

Serotonin has been well implicated as a driving mechanism for suicide, in which both genetic factors and a string of upsetting life events combine to trigger suicide (Ezzel, 2003). In sectioned brains, it is clear that suicide victims have fewer than average neurons in the orbital prefrontal cortex. A defect in the serotonin transporter gene, resulting in fewer transporters was responsible for the deficiency (Mann, et. al., 2000). However, they found more serotonin binding per neuron. Also, at the dorsal-raphé nucleus of the brain stem, where serotonin is synthesized, resides large amounts of serotonin synthesizing enzyme, indicating high serotonin production. These factors are strong indicators that the brain attempted to make the most of what it had. A study by Chaouloff (2000) reinforced the hypothesis that the HPA axis, in reaction to stress, affects serotonin neurotransmission, partly through the actions of corticoids. Violence and suicide are related. Aggression is aimed at others when there is a combination of low serotonin and high norepinephrine (Kotulak, 1997), whereas aggression is aimed inward (increased suicidal ideation) when there is a combination of low serotonin and low norepinephrine.

Arango and Mann (Oquendo, et al., 2003) observed, with positron emission tomography (PET) scans, a direct correlation between ventral pre-frontal hypofunction, levels of serotonin, also in the pre-frontal cortex and the severity of the suicide. Slightly lower levels may produce death by an overdose of sleeping pills while extreme deficits will lead to the person jumping off of a cliff or blowing his/her brains out.

It's unclear as to why, but platelets have serotonin binding receptors on them. Because of this, Pandey, (1995), found that risk for suicide was measurable through a simple blood test, as people considering suicide had many more serotonin receptors on their platelets than did non-suicidal people.

## **Teach Your Children Well**

Conditions such as anxiety, depression and tendencies toward alcohol and drug abuse have been shown to run in families (Virkkunen, 1989), where a study of 114 male alcoholic violent offenders and fire-setters showed that low levels of cerebral spinal fluid (CSF) 5-hydroxyindoleacetic acid (5-HIAA) and homovanillic acid (HVA) were strongly associated with a family history of paternal violence and alcoholism. My depressed/ anxious clients frequently report being parented under particularly harsh discipline and a general lack of compassion and empathy towards them as children. Most were afraid of one or both parents and were generally never “good enough” for their parents. Most experienced a deep sense of helplessness, humiliation, rejection and emotional abandonment as children. Their present sense of helplessness is also self-generated. So many people with anxiety and depression have tried to give up drugs, alcohol and cigarettes over and over and over again, but were just too anxious to succeed, leading to increased feelings of helplessness and failure. And as adults with a “trauma-induced” inherent fear of helplessness, they obsess on over-control in the logistics of daily living and relationships, further adding to their anxiety. In the presence of these modern day factors, it's no wonder that while the population in the USA increased by 40% between 1960 and 1991, violent crime increased by 560%, murders by 170%, rape by 520% and aggravated assault by 600% according to the FBI (Kotulak, 1997).

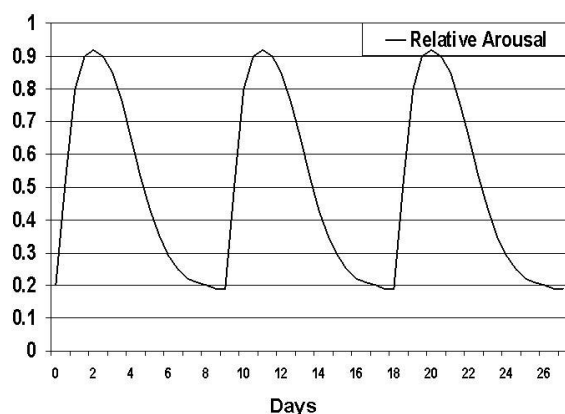
## **Bonding by Oxytocin**

This is where oxytocin enters the picture. Oxytocin is an amino acid that produces the desire to “bond” with others (Moberg, 2003, Ratey, 2001). Females produce larger quantities than males, and females also produce larger quantities of oxytocin during orgasm, which increases bonding with their mates. Both mother and child produce oxytocin during childbirth to enhance bonding. Oxytocin is present in breast milk. Rats given oxytocin supplements will nurse-feed puppies and kittens and when given an oxytocin antagonist, will neglect their own offspring.

It is clear that when serotonin falls and adrenalin and noradrenaline increase, impulsiveness and aggression also increases and relationships deteriorate. This means that the aftermath of stress and anxiety is a reduced ability to bond or show compassion with family and loved ones, increased road rage, human conflict, attachment disorders and the subsequent added stress and anxiety, once again, leading to increased serotonin, adrenaline and noradrenaline imbalances.

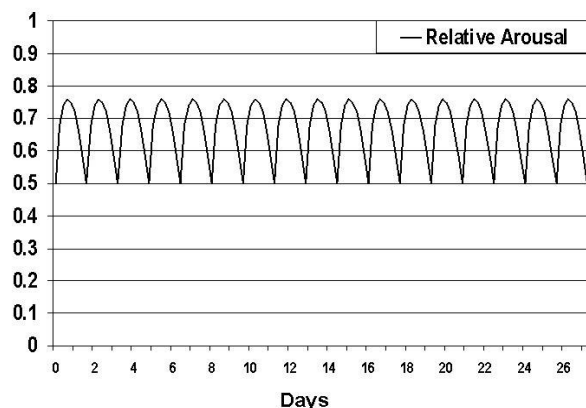
In ancient times, going for a hunt, fighting disease, defending against both animal and human enemies were stressful events but were not daily occurrences. There was time to relax in between stressors, as shown in Figure 1, which would in turn allow cortisol, serotonin and the adrenal load to return to homeostasis. Once again, this fact is supported by analysis of bones of the native American Indians, *La Florida*, where it is showed that natives lived with considerable less stress and better nutrition before the arrival of the Europeans (Larson, 2000).

**Figure 1 (Theoretical Arousal Pattern of Ancient Man)**



In modern times, a less dramatic but constant stress load relating largely to sensory overload, noise and signs plus a sense of helplessness from hectic schedules, computer crashes, traffic jams, work issues, spousal conflicts, raising children, fear-based news articles, fear of crime, financial concerns (Figure 2). There are few breaks in the stress causing depletions in cortisol (increasing guardedness), depletions in serotonin (increasing aggression) and a constant adrenal loading. (Some of our clients keep a DAVID system in their cars and run a relaxation session before they hit the freeway. It's not surprising that anecdotes from our customers indicate that their relationships with their families have improved and in some cases marriages have been saved!)

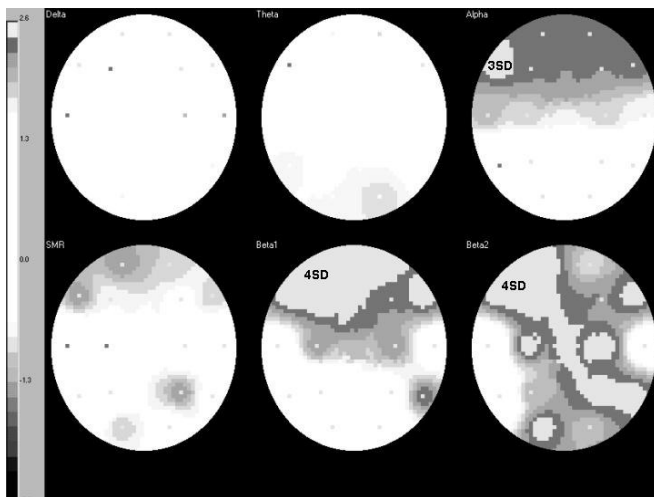
**Figure 2 (Theoretical Arousal Pattern of Modern Man)**



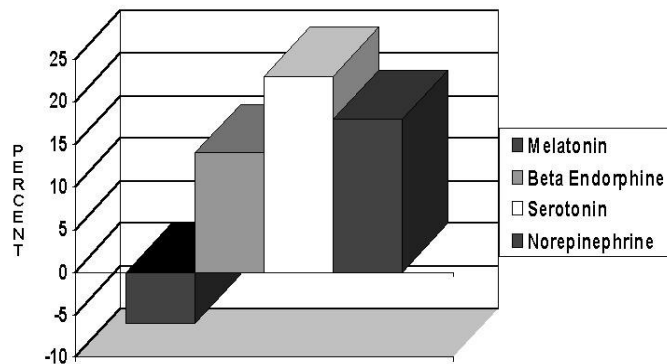
## Brain Activity

It has been found that the left hemisphere activates (and therefore suppresses alpha electrical activity as seen on an EEG) with happy thoughts and the right hemisphere activates (suppresses alpha) with negative thoughts. Right brain strokes spawn cheerful survivors while left brain strokes leave the survivor with depression (Rosenfeld, 1997), which supports the “happy-left” and “depressed-right” scenario. Other studies (Davidson, 1992; Baehr, 2003) including my own observations have shown increased left frontal alpha concurrent with negative thoughts. As one could expect, people with unresolved trauma are plagued with negative thoughts, often waiting for something bad to happen to them. Therefore, what one thinks has a direct impact on their degree of depression. But this brings on the chicken and the egg dilemma - does the alpha asymmetry bring on negative thoughts or do negative thoughts bring on alpha asymmetry? Figure 3 is a statistical analysis as shown on the Skil database (Serman, 1999) of a young woman with constant negative and depressed thoughts (high left frontal alpha) coupled with high anxiety (high levels of beta activity).

**Figure 3**



Audio-visual entrainment (AVE) is an effective tool for dissociating the depressed/ anxious person out of his/her destructive thoughts, leaving them with emotional neutrality and somatic re-stabilization (Siever, 2000). Even with increasing anxiety, AVE has been shown to reduce heart rate and may be used as a desensitization tool (Leonard & Telch, 2000). AVE has been used to reduce jaw tension from stress (Siever, 2003). Depression has also been implicated in low glucose metabolism in fronto-limbic regions. Unlike ECT and anti-depressants, AVE has been shown to increase blood flow in the eyes (Polak, et al., 2002), along the optic nerve and increase whole brain metabolism (Fox and Raichle, 1985) and increase peak-alpha frequency (Budzynski, 1998). AVE also increases norepinephrine and serotonin (Shealy, 1989). Dopamine has yet to be tested. Figure 4 shows the results in neurotransmitter production following a 30-minute, white-light AVE session.

**Figure 4 (Effect of AVE on neurotransmitter production)**

## The Home Stretch

In conclusion, aggression and depression are associated with alterations of serotonin, norepinephrine and dopamine. The threshold of how threatening one perceives an event is based on serotonin and the response level and direction of aggression is dependent upon norepinephrine. In trauma, GABA receptor losses in the amygdala also set the tone for “idling” speed and anxiousness. Genetic, environmental and family factors play a significant role in setting and exceeding the threshold of aggression and suicidal tendencies. There are children raised in a good loving home and yet traumatized by every little event - a genetic connection. There are also those children who are born genetically fine but traumatized through blatant abuse. Both have much the same result in the end.

AVE plays an important role in settling down both the parents and the children. Many homes have two to three systems in them for family members to use following a stressful, tiring day in the modern world!

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