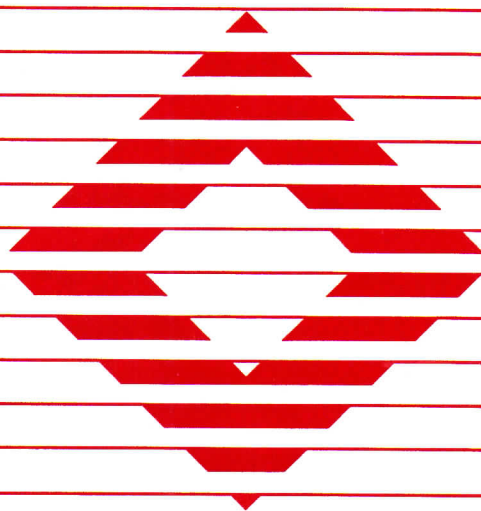


**SPECIAL
ISSUE ON
NEURO
FEEDBACK**

Volume 2, Number 4



MEGABRAIN

R E P O R T

THE JOURNAL OF OPTIMAL PERFORMANCE

THE BIOPOLITICS OF SEROTONIN: FROM PROZAC TO BRAIN TECH:

in which we replace
cosmetic psychopharma-
cology with meta-cosmic
neurotechnology.

THE CHURCH OF BETA:

One scientist finds the
True Path and learns
how to save the human
race with EEG feedback
training.

ATTENTIONAL FLEXIBILITY: THE EMPEROR'S NEW BRAINWAVE?

"Good theta" versus
"bad theta," and the
difference between
brainwave training and
near-asphyxia.

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FAREWELL LETTER FROM ALEX KOCHKIN, CEO AND PUBLISHER (1993 & 1994)

December 1994

Dear Friends and Consciousness Explorers,

Recently it has become increasingly difficult for me to devote full time energies to Megabrain and to devote the quality of attention to some new projects related to the emerging new consciousness.

Therefore, after working with Michael Hutchison and Dennis Campbell for nearly one and a half years, I am resigning my role as publisher and CEO of Megabrain Communications. Dennis Campbell, one of our partner-owners, will be assuming full responsibility for publishing and company management. He has my full support and confidence.

One of my chief interests with Megabrain has been its potential to promote the application and development of mind-tech for personal transformation. It is in this way that mind-tech can contribute to facilitating the conscious evolution of individuals and our species. Michael Hutchison and Megabrain have already performed valuable service in this regard, connecting people of wide interests and it is my hope that Megabrain continues to do so in an expanding manner through publications, workshops, television and other media.

The human species is now at the threshold of a new epoch as more people expand their awareness to the extraordinary.

We are discovering cosmic or divine sources within ourselves. This is the real foundation of mind-body medicine and the basis for death and illness becoming optional rather than a "fact of life". A new paradigm is upon us - at its core is a sublime and transcendent love of immense proportions. It is now imperative for everyone who is ready, to make the process of waking up to their true nature their highest priority as they go about their daily affairs.

Some of my future work includes a large-scale assessment of the extent of the awakening process taking place in the U.S. and the feasibility of special centers where people can accelerate their own awakening process, and the use of global communications to further the process. Thank you all for your support of Megabrain and your bold interest in exploring the frontiers of consciousness - the human species' most important frontier. Please feel free to contact me at PO Box 1195, Point Reyes, CA 94956 or through Compuserve Information Service, 75363,3270.

In Light and Love,
Alex Kochkin

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EDITORIAL:

FROM PROZAC NATION TO THE NEW REFORMATION

The publication you hold in your hand is a revolutionary document. Powerful claim, and one I wouldn't have imagined making until now—that I have it all before me and send it off to the printer and begin to see the extraordinary nature and implications of the information it contains.

This issue is revolutionary in several ways. First, there are descriptions of clinical studies of EEG feedback that are, to state it most simply and clearly, unprecedented in their findings and their implications. Alcoholism, drug addiction, post-traumatic stress disorder (PTSD), attention deficit disorder with or without hyperactivity (ADD and ADHD), and PMS have been notoriously resistant to treatment. And yet articles by Drs. Eugene Peniston, Siegfried Othmer, Nancy White, Thomas Budzynsky, and Julian Isaacs, published in this issue of Megabrain Report, describe success rates for all of the above disorders so breathtaking that if they are substantiated by further studies they must surely revolutionize not just the treatment but our very conception of the nature of these disorders.

One of the most striking and surprising findings is that a whole host of seemingly unrelated disorders actually may share exactly the same underlying pathology. The findings described by the scientists and clinicians in the articles that follow suggest that a host of mental and psychosomatic disorders that we have until now considered to have disparate origins must in fact be seen as manifestations of a single overriding disorder. That is, problems such as epilepsy, depression, anxiety, phobias, panic, dysthymia, Tourette Syndrome, ADD, ADHD, narcolepsy, alcoholism, obsessiveTM compulsive behavior, PTSD, closed head injury, and much much more, can be seen as “disorders of arousal”—overactivation or underactivation of the sympathetic or parasympathetic systems (overarousal or underarousal, or mixed under- and over-arousal).

As Othmer has described it, all these disorders can be traced to “paroxysmal events” in the brain—spikes, slow brainwaves, kindling, irregularities, seizures and brain storms of greater or lesser magnitude. And all these paroxysmal events are the result of trauma. The trauma may be the result of head injury, stress, emotional shocks. These disorders can be significantly modified by altering and bringing more order or coherence to brainwave activity—and giving individuals greater power of self-regulation of brain states—through the use of EEG feedback techniques outlined in this issue.

How could so simple an intervention have such wide applications? Evidence suggests that EEG training may work in part not on the frequency level (i.e. by increasing or decreasing specific frequency ranges such as beta or alpha-theta) but on a functional level—by breaking up rigidities and increasing the brain's natural functional flexibility, its homeostatic capacity to move easily into optimal and balanced functioning. In fact, it may be that this very flexibility—the capacity to move quickly between various coherent brain states and

frequencies, between alert and diffuse attention, rest and reaction—is the hallmark of health and peak performance.

In “EEG Alpha-Theta Neurofeedback,” Eugene Peniston describes how he and associate Paul Kulkosky discovered that alpha-theta feedback resulted in unprecedented success in treating severe, chronic (relapse prone) alcoholics. Peniston describes how his first study produced an 80% rate of abstinence that had declined by only 10% at a three year followup (compared to success rates of 20% or less for traditional techniques), and concludes with the (characteristically) laconic observation, “Such success had never before been achieved.”

Pioneering in the use of what has now come to be called the Peniston Protocol, Peniston describes how the EEG feedback treatment has now produced stunning successes in treating depression, combat-related post-traumatic stress disorder, multiple personality disorders, and a variety of other disorders including chronic pain, learning disabilities, hypertension, and eating disorders. He concludes that EEG feedback has the potential to produce enormous social and economic changes.

Nancy White, in “Alpha-Theta Training for Chronic Trauma Disorder, a New Perspective,” describes how her use of the Peniston Protocol and other EEG feedback techniques has produced profound personality changes in her clients, changes that are mirrored by extraordinary “normalizing” of MMPI and Millon test scores. The evidence is so startling and extraordinary in its implications that White is led to suggest that all of us, no matter how healthy and functional, could benefit from alpha-theta training—that in fact such “discharging of negative emotions” can open the way toward a new level of human peak performance and peak experiences and transcendence.

Siegfried Othmer, in “EEG Biofeedback Training: A Journey Toward Personal Autonomy,” reveals that EEG training has stunning success with such problems as PMS, ADHD, ADD, migraine, depression, anxiety, and a panoply of problems of over and/or under-arousal. Over lunch recently, in remarking about his success treating over 100 PMS sufferers, Othmer told me, “With PMS, EEG training has simply never failed.” He suggests that EEG works by uniquely stabilizing the brain against “disruptions and discontinuities of cortical function which manifest in disturbances of attentional mechanisms, of sequential and parallel processing, of visual and auditory processing and memory, of other specific learning disabilities and of the normal sequence of sleep stages.” He concludes that EEG feedback, and mind technologies in general, represent a “Second Reformation,” challenging the modern authoritarian dogma of the “medical model,” and involving a “major power shift to the individual.” Othmer believes that EEG feedback and brain technology can

move all users toward peak performance states: "The combination of existing clinical wisdom with this tool is revolutionary in its implications for the future of mental health, and for the intellectual and spiritual journey that we are all on. At its best, biofeedback aids function, not merely dysfunction. In the hands of the human and supportive clinician, it gives flight to the soul."

Psychologist Julian Isaacs, in his essay on the "Church of Brainwave Training," makes no bones about it: with only a small tip of tongue in cheek, he discusses his own transformational experiences with beta brainwave training and the "grand vision" that has emerged from his experiences: the "saving of humanity."

Les Fehmi, who began his career as a "hardheaded" researcher in neuropsychology, discusses his personal growth over more than 30 years, and his growing awareness of the enormous powers for global healing and wisdom that can emerge from "attention to attention."

Thomas Budzynski, like Fehmi, has been a leading researcher and clinician and explorer of brain technology for over 30 years. And he too begins his article on "The New Frontier" with the statement that we are now in a period of "extraordinary breakthroughs" in this field of science. After a survey of developments in all areas of neurotechnology, Budzynski concludes with a vision in which neurotechnology can induce peak performance and serve as a "Neurofitness Program for the Brain/Mind."

Robert Fried makes an impressive argument that EEG may be producing some of its greatest benefits by helping users monitor and change brain metabolism. Since a key to optimal brain function is sufficient fuel—oxygen—and since Fried argues that most people live in a state of mild hypoxia or hyperventilation (which prevents the brain from getting sufficient oxygen), then EEG can provide rapid training in increasing brain oxygen. In fact, as in the personal account by Julian Isaacs, one of the most frequent comments by individuals undergoing EEG beta training is that "my brain feels like it's tingling!" This is probably a result of increased blood and oxygen flow the brain. In that sense, EEG feedback may truly be, as users intuitively suggest, "brain aerobics."

As a result of these dramatic breakthroughs—and largely as a result of the work of the contributors to this issue—there has been in recent months a sudden sea change in attitude toward EEG feedback. When Dr. Peniston presented the results of his first controlled study of alpha-theta training and alcoholics at the convention of the Association of Applied Psychophysiology and Biofeedback in 1989, he was widely derided and his work rudely dismissed by the majority. At that time, as described by Dr. Othmer, alpha biofeedback had been in "disrepute" for many years.

Even as recently as last year, the work of Peniston and other practitioners of alpha-theta feedback was largely scorned by the AAPB. At this year's AAPB convention, however, Peniston was accorded recognition as an honored speaker, and the number of AAPB clinicians and researchers using EEG feedback has skyrocketed. Even the hardest of the hard science neuropsychologists are recognizing that something extraordinary seems to be happening.

This shift is in keeping with the times. Of late there has been a growing acceptance by the scientific and therapeutic mainstream that human behaviors and capacities have biological roots. Scientists are

still battling it out—witness the nationwide debate over the biological inputs to IQ, or the controversy over the use of drugs such as Prozac for "cosmetic psychopharmacology." But on the whole most people see that this approach has profoundly optimistic implications. For what has been produced by biology can be put right by biology—such as taking a drug that boosts serotonin and thereby increases self-esteem. And what can be "normalized" by simple biological adjustments can also be "optimized" by those same adjustments. Thus our contributors, independently, move from descriptions of clinical breakthroughs and therapeutic applications to strongly positive visions of ways the biological self-adjustments made possible by EEG feedback can transform us as individuals, boost us to new levels of achievement, intelligence, wisdom, joy and even spiritual experience.

As you can see, Megabrain Report is also going through its own biological fine-tuning—self-adjustments that we hope will boost us to new levels of achievement, intelligence, wisdom etc. The new glossy cover and expanded list of contributors are hints of major changes to come in upcoming issues. Other projected changes include regular sections devoted to in-depth reviews and discussions of new types of mind machines and performance boosting tools and nutrients, ranging from new portable EEG systems to light-sound devices to Virtual Reality tools to smart drugs; reviews of new books, tapes, CDs, and CD-ROM programs having to do with understanding the brain-body, and optimizing human performance; regular features each issue on major areas of brain tech, such as EEG, light-sound, and psychoacoustics; an expanded correspondence section; and a section of Classified Ads.

Our adjustments also include increased coherence (i.e. regularity) of publication. With this issue we come to the end of Volume 2. The four issues of Vol. 2 emerged in just over one year. We intend that in Volume 3 we will appear with even greater regularity and reliability.

In the next issue we will include a special section on Oxygen and the Brain—all the newest information on how breathing can alter and regulate brain wave activity and optimize brain function; nutrients that increase oxygen levels in the brain; how breathing techniques can mean the difference between producing "good theta" or hypoxia and near-asphyxia; recent research exploring the scientific bases for ancient and traditional oxygen-regulation techniques such as pranayama, qi gong, kung fu, and various meditational breathing practices; articles and reviews of new breath-regulation tools and techniques such as the Breathwork Explorer, ozonation, and more.

In the same issue, and in upcoming issues, we will feature a variety of articles on Sound, Healing and Peak States, including an article by controversial sound-healer Sherry Edwards; a discussion of "primsounds" based on a new (and very ancient) seven tone scale linked to brain wave frequencies, by developer and composer Ralph Losey; articles by other leading figures in the field of psychoacoustics; and reviews of the latest psychacoustic products, including tapes and CDs by Steven Halpern, Dr. Jeffrey Thompson, Spectrum Research, Dr. Lloyd Glauberman, Richard Bandler (co-creator of Neuro-Linguistic Programming) and much more.

— Michael Hutchison
November 1994

LISTENING TO THE BRAIN:

MIND TECH AND THE REMAKING OF THE SELF BY MICHAEL HUTCHISON

"There must be an epidemic of depression among successful women," my friend told me. Over the last year, she said, she'd heard from half a dozen of her friends scattered around the country. All of them were in their late 30s or 40s, well-educated, financially secure, high achievers—"they're all just super women," she told me, "who've had exciting, happy lives." And in the last year, each of them had begun taking the anti-depressant drug Prozac. "What," my friend asked, "is going on?"

Several thoughts popped into my mind. Prozac became available in December, 1987, and very quickly became the one of the most widely prescribed drugs in history. It is the hero of psychiatrist Peter D. Kramer's phenomenal best seller *Listening to Prozac: A Psychiatrist Explores Antidepressant Drugs and the Remaking of the Self*. Lots and lots of people like what this drug does for them.

Prozac is, of course, much more than an antidepressant. As Kramer's subtitle suggests, Prozac seems to go beyond treating depression to a transformational "remaking of the self." It works by selectively inhibiting the reuptake of serotonin in the brain: i.e. it effectively increases brain-serotonin levels. Serotonin, according to Kramer, enhances "security, courage, assertiveness, self-worth, calm, flexibility, resilience. . . ." A pretty good wish list. It's no wonder that millions of people with no real symptoms of depression are demanding that their doctors prescribe this drug for them.

THE BIOPOLITICS OF SEROTONIN

Serotonin brought to mind a variety of studies, described in my book *Anatomy of Sex and Power: An Investigation of Mind-Body Politics*, exploring the links between dominance and serotonin. Scientists studying primates found that in every mixed-sex band there is one male who has far higher levels of serotonin, and in every case that is the dominant or "alpha" male. In studies of primates ranging from monkeys to baboons to chimps to humans, researchers have found that:

*dominant males have high levels of serotonin; *when a dominant male is removed from his position of dominance, his levels of serotonin plummet by some 50%, and his former unshakable confidence and self-assurance turn into insecurity and anxiety; *when formerly nondominant monkeys are placed into positions of dominance, their serotonin levels soar by 40 to 60%; *sexual activity raises levels of serotonin

in formerly subordinate males; *when dominant males are removed from access to sexual activity, their serotonin levels decline sharply.

Clearly, levels of serotonin are strongly influenced by social status. But this link between status and serotonin levels works both ways, in what's called a bidirectional feedback loop. For example, researchers have conducted studies in which laboratory animals were given drugs (including Prozac) to increase or decrease levels of serotonin. They found that, while all the animals began with equal levels of serotonin,

*those who had their serotonin levels boosted by Prozac achieved dominance over monkeys with lower levels; *even in "crossover" studies, when subjects who formerly had received drugs to lower serotonin and been subordinate were switched to drugs like Prozac that raised serotonin, they became dominant over subjects who had formerly had been dominant, but who had had their serotonin levels decreased, and vice versa; *in aggressive encounters, the high serotonin monkeys won at over 85 percent and usually 95 to 100 percent of the time.

So while status influences serotonin levels, changes in serotonin levels also clearly influence social status or dominance.

Humans who take Prozac, of course, have increased levels of available brain serotonin.

There are of course other neurochemicals and hormones involved in dominance, including norepinephrine, testosterone and the stress hormones cortisol and ACTH. However, levels of these neurochemicals vary widely in individuals over time (i.e. they are "state variables," that can vary widely, not "trait variables," which are more like aspects of personality or temperament that generally remain relatively stable over long periods of time). But serotonin levels, as Kramer points out, "are so stable that they appear to be trait variables, and to show that a trait variable changes according to social status is remarkable."

In one study of college males placed in a stressful, competitive situation, the researcher found that "serotonin levels correlate with self-assessed social rank and leadership qualities." The researcher also found that very strong type A behavior "encompassing drive, aggressiveness, mistrust and competition, correlates with high blood serotonin levels." Other studies of both males and females have linked low levels of

"A low serotonin setting in a sense is low self-esteem...to have low self-esteem is a particular neurochemical state, one responsive both to the experience of social dominance and to the effects of serotonergic drugs."
— Peter Kramer

serotonin to depression and suicide.

Serotonin level also appears to be the key to self-esteem. In fact, Kramer goes so far as to assert that "a low serotonin setting in a sense is low self-esteem—a feeling of unworthiness or submissiveness—and leads to low self-esteem by engendering unassertive behavior and an acceptance of low social status." That is: "low self-esteem exists as a state of the neurons and neurotransmitters . . . to have low self-esteem is a particular neurochemical state, one responsive both to the experience of social dominance and to the effects of serotonergic drugs."

There has also been extensive research into what happens to subjects who are placed in positions of powerlessness, helplessness or loss of control. Among the things that happen are distinct biochemical changes, such as drops in serotonin levels, that cause the subjects to become depressed.

THE EPIDEMIC OF "THE THIRD WAY"

Evolution has produced the fight or flight response as a protective mechanism. But recent evolution seems to have required that humans develop a "third way" of dealing with threat, necessitated by our complex social environment, where neither fighting nor active flight is a practical option. This third way is described by Dr. James Henry of the Department of Physiology and Biophysics, USC School of Medicine: "In a social situation in which there is a hierarchy with a single dominant or an establishment group in control, this third option is of utmost importance. It involves submitting to the demands of the dominant animal or to the establishment and involves inhibiting previous patterns of behavior." This "submission," says Dr. Henry, leads to depression "associated with the loss of control. The depressed animal . . . no longer competes but accepts the unpleasantness of frustration."

Most of us have experienced the physical unpleasantness that results from submitting to a dominant animal or the establishment—you can't fight or flee when your boss is a jerk, or the judge ignores your requests for justice, or the IRS asks for an audit. Says Dr. Henry, "helplessness is a crucial determinant of depression." Helplessness, of course, is linked with decreased levels of serotonin.

All this, I think, casts light on the immense popularity of Prozac. We live in a world that in many ways can feel like a techno-social juggernaut, massive and out of control—or at least beyond the control of any individual. Many individuals find it hard to experience or believe in their own power, potency or sense of control.

In one sense we have unprecedented powers: we drive cars that are technological marvels; but in another sense, these marvels simply increase our powerlessness: we sit stalled in rush hour traffic, can't find anyplace to park, are strapped to seemingly endless monthly payments. Our mass media give us the power to know what's happening anywhere in the world virtually instantaneously with vivid color video images; and there we sit powerless, watching children die of starvation and epidemic, watching piles of headless bodies, watching genocidal armies massacre innocents—and there's nothing much we can do about it. Clearly this pervasive powerlessness, this sense of helplessness, of being subordinate, not in control, must have an effect on serotonin levels of large numbers of people.

My friend said she felt there was an "epidemic" going on. And in fact, she's right. Compared with earlier in this century, depression is over 10 times more widespread, and the rate is skyrocketing. Also, depression strikes people on an average of ten years younger than in the past. Recent research shows alarmingly high, and increasing,

rates of depression among adolescents (over 7 percent of adolescents in on recent study had suffered a full-blown episode of depression by age 14). In America, according to psychologist Martin Seligman of the University of Pennsylvania, depression "has become the common cold of mental illness. . . . It is shocking that Americans, on average, may be victims of unprecedented psychological misery in a nation with unprecedented prosperity, world power, and material well-being. . . . This is enough to warrant shouting 'epidemic.'"

But while major or acute depression is clearly widespread and increasing rapidly, there is an even more widespread discontent that I think my friend was talking about that seems less severe or acute than clinical depression, but which is experienced by even greater numbers of people.

For while we're living in a world that seems out of control, and with increasing evidence of our own powerlessness, at the same time, paradoxically, we are living in times of unprecedentedly high self expectations—when we are being told we can "have it all," that we can have, in the words of Tony Robbins, "Unlimited Power," that we have not just the capacity but a responsibility to seek independence and self-fulfillment. For many this means that if they are not completely satisfied with their lives, if they don't feel unyielding self-esteem, if they are insufficiently assertive, if their social status or dominance is unsatisfactory, then something is wrong with them, that they have failed, that they're not quite as happy as they should be.

Since our world and modern life is almost by definition out of control, highly competitive, and pervaded with conspicuous displays of wealth, status, and power, virtually everyone who judges his or her life, status or personal power by these distorted standards must feel somehow faulty, deficient. We may have a nice house, for example, but when we compare it with those on "Lifestyles of the Rich and Famous," or in the Sunday Times Magazine or Architectural Digest, or possessed by people like O.J. Simpson, we are made to realize what a paltry shack we live in. The result is a pervasive malaise that is not major or acute depression, but the result of simultaneously heightened and frustrated expectations, what Kramer calls

a new category of mental disorder, dysthymia (ill spirit . . .), lying at the periphery of depression . . . a chronic condition in which a person has periodic intervals of depressed mood that are briefer or less severe, or involve fewer deranged functions, than episodes of major depression. Dysthymia sits in the penumbra of depression. . . .

This epidemic of dysthymia, I believe, rather than the epidemic of acute depression, is an explanation for the enormous popularity and effectiveness of Prozac. Serotonin, as Kramer notes, enhances "security, courage, assertiveness, self-worth, calm, flexibility, resilience," all of which have the effect of making one "feel safe." And, in Kramer's works, "many things will go right when an animal, including a human animal, feels safe."

BRAIN TOOLS AND COSMETIC PSYCHOTECHNOLOGY

In this light, it's intriguing to note the evidence that mind machines have a direct and profound effect on serotonin levels. For example, studies by neurosurgeon C. Norman Shealy, M.D., Roger Cady, Saul Liss and others have shown that cranial electro-stimulation (CES) produces rapid and significant increases in serotonin levels. Shealy, Cady and others have also found that ten minutes of simple photic stimulation, such as that produced by light-sound systems, produce

significant and almost instantaneous increases in serotonin (as well as other biochemicals such as growth hormone, melatonin, oxytocin, beta endorphin, and luteinizing hormone).

There are strong indications, in the form of pronounced and lasting personality shifts in subjects who make regular use of mind tech, that changes in serotonin levels are durable and maintained after periods of regular mind tech use. Ray Smith investigating brain changes as a result of CES use, Eugene Peniston investigating alcoholics using EEG alpha-theta feedback, Shealy and others investigating users of flickering light devices have all found that lasting personality shifts take place, frequently after about 2 to 3 weeks of daily use. Dr. Nancy White, for example, has sent me a statistical analysis of changes in MMPI and Millon Clinical Multiaxial Inventory (MCMI) scores of depressed clients she has treated using brain tech therapy: the mean Depression scale of MMPI dropped from 63.4 to 52.7; on MCMI, the mean Dysthymia score dropped from 59.1 to 33.9; the mean Major Depression score dropped from 55 to 29.8—all of these changes are statistically significant, and suggest a powerful therapeutic effect on depression.

There are indications that other types of brain technology, including EEG feedback, acoustic stimulation (such as that provided by binaural beats tapes and CDs and sound-table systems), motion systems, flotation, and devices that increase oxygen in the brain (such as the Breathwork Explorer) also increase serotonin levels. It's significant, I think, that sales and use of these devices are increasing rapidly. Robert Austin, head of Synetic Systems, maker of some of the most popular light-sound devices, has estimated that in 1994 alone, as many as 175,000 light-sound machines were sold worldwide. Others have estimated that there may be more than a half-million light-sound devices in use by several million people.

Tapes and CDs that use psychoacoustic techniques to alter brainwaves, are consistent best-sellers, and sales by such psychoacoustic practitioners as Steven Halpern, Dr. Jeffrey Thompson, Doc Lew Childre, and Robert Monroe's Hemi-Sync series increase year by year. Literally scores of millions of these psychoacoustic tapes and CDs are sold each year. While the FDA regulations prohibit the manufacturers and creators of these mind-altering tools from mentioning anything about their effects on brain chemistry in their advertisements, it's clear that these

light-sound and psychoacoustic products actually "do" something for large numbers of people, or else there would be no market for them.

So, the fact that mind machines clearly can boost serotonin levels, and the fact that there is a growing market for and use of these devices in the cultural mainstream suggest to me that one reason for the rapidly increasing popularity of these devices is that they are working, like Prozac, to eliminate dysthymia and increase feelings of control, self-confidence, self-esteem and power among users.

One reason for the rapidly increasing popularity of these devices is that they are working, like Prozac, to eliminate dysthymia and increase feelings of control, self-confidence, self-esteem and power among users.

There is a substantial body of evidence that brain tools work—in many cases with unprecedented effectiveness—against major depression and depression-linked problems. Norm Shealy, among others, has used these devices, including CES, light-sound, and EEG feedback, with great success in treating depression, anxiety, alcoholism and drug addiction. Neurofeedback practitioners such as Eugene Peniston, Siegfried and Susan Othmer, Len Ochs, Jon Cowan, Nancy White and many others, are finding that such EEG techniques as alpha-theta training, beta training, and "Disentrainment Feedback" are producing remarkable successes with depression (for more information about EEG feedback therapy see the articles by these practitioners elsewhere in this and the preceding issue of Megabrain Report). Hundreds of other doctors and therapists are now making clinical use of these devices. Many thousands of other individuals are probably using the devices to self-treat or self-medicate for the same purposes.

And, of course, just as a substantial number of the millions of people take Prozac are doing so not to treat illness but to enhance or slightly "improve" their personalities or temperaments—what Dr. Kramer calls "cosmetic psychopharmacology"—so are many of those using mind machines doing so because they find the devices useful for helping them "tune"

their brains and make them feel better—what we might call cosmetic psychotech-nology.

FROM BUNS OF STEEL TO BRAINS LIKE A STEEL TRAP

There's an interesting parallel with the physical fitness boom. Beginning in the 1970s, Americans found that physical fitness was not just for jocks, but could improve their appearance and the quality of their lives, and boost their own self-esteem and sense of control. Simple jogging and aerobics led to the development of new advanced fitness technologies: Nordic Ski tracks, computerized jogging tracks, ergometers, and specialized Nautilus devices.

Not too long ago, people accepted their genetic physical configuration as a sort of given: skinny, unathletic guys, for example, tended to stay skinny and unathletic throughout their lives. Today, they can use Nautilus and other technologies to build slab-muscle torsos that would have been considered extraordinary only a few decades ago. Today, physical fitness has become a means to increased power, status, self-esteem. We've all been witnesses to the transformation drama of many former wimps, wusses, weasels weaklings and lawyers who by dint of computerized Stairmasters and gleaming weight machines, have turned themselves into supercharged spandex-clad hardbodies with Buns of Steel, ready to stand up to any bullies who might kick sand in their faces.

It's no coincidence, I think, that the widespread obsession with personal fitness has emerged out of the same post-60s technocharged mass-media-fused amalgam and at the same time as the explosive epidemic of dysthymia and depression. The same feelings of individual powerlessness, helplessness, insecurity, lack of control and loss of self-esteem that produce dysthymia also trigger the need for a sense of personal power, strength, control, dominance and security that can be fulfilled by pumping iron, armoring yourself with slabs of protective muscle, conquering the marathon.

As anyone who has spent time in prison knows well, prison is an environment expressly designed to crush self-esteem and induce powerlessness, helplessness, loss of control; so it makes sense that so many inmates spend hours every day pumping iron, getting buff and tough, building up a permacote of protective personal armor, and nurturing a feeling of control and self-esteem.

Over the last 20 years there has been a con-

tinuing stream of research proving that regular physical exercise is not only good for your body but has powerful beneficial effects on depression. One reason for this is surely the effects exercise has on serotonin—numerous studies of exercise techniques ranging from running to weight lifting show substantial serotonin-boosting effects (as well effects on many of the other neurochemicals associated with depression, including cortisol, ACTH and norepinephrine).

Psychologically, there's no doubt it's a powerful antidepressant to have the body of a superhero. The world may be going to hell in a hand basket, you may be losing your job to a robot or a foreigner, but as long as you can get to the gym each day and squat 700, bench press double your weight, and keep your body fat under 10 percent, then you can keep your self-esteem buffed to a high gloss, with the assurance you've got everything under control.

Not coincidentally, paralleling the rise in the popularity of physical fitness, and in the use of drugs like Prozac for what Kramer calls in the subtitle of his book "The Remaking of the Self," has been the widespread acceptance of and explosive increase in the use of cosmetic surgery (Ms. magazine, for example, announced that plastic surgery is a way of "reinventing" oneself, and is "for women who dare take control of their lives," while feminist novelist Fay Weldon proclaims that plastic surgery is a tool for self-transformation, and issues a call to arms: "Sisters, to the clinics!").

But of course the 90s, as Congress has decreed, is the decade of the brain. Most of us work with our brain, not our brawn; push keyboards not plows; cultivate and harvest knowledge not crops; weave ideas not cloth; work in information factories not steel mills. Social status and dominance derive not from physical strength and assertiveness, but from mental strengths like confidence, imagination, optimism, intellect, resilience, quickness, concentration, flexibility, wit, stability. What use is the body of a Greek god or goddess if your brain is too flabby, sluggish or puny to permit you to be just as assertive, dominant, in control and powerful in the mental realms as you are in the physical? Who wants to have the brain of a 98 pound weakling?

Millions of people over the last two decades have found their genetic physical endowments unacceptable and pumped themselves into physical embodiments of power, dominance, and assertiveness. In the same way, millions are now concluding that their genetic mental or temperamental endow-

ments are no longer satisfactory: they are no longer willing to accept that by nature or nurture they may be shy, introverted, unaggressive, or insufficiently assertive, confident, creative, smart or potent. And so, just as millions have used the best available technology and pharmacology available to build muscles—ranging from Nautilus machines to steroids to peptide-bonded amino acid power drinks—people are now willing to use the available technology and pharmacology to build or develop those desired qualities.

The most widely used technology or pharmacology of this sort is Prozac. Vast numbers of people who meet none of the criteria for depressive disorders, and who would never consider themselves mentally ill, have demanded prescriptions for Prozac from their doctors simply to increase their feelings of energy, optimism, self-confidence, social fluency and mental agility. This widespread use of prescription medication in the absence of any illness to increase mental agility—what Kramer calls "cosmetic psychopharmacology"—leads him to suggest that in that sense Prozac and its cousins may be seen as "steroids for the business Olympics."

It's no coincidence that the widespread obsession with personal fitness emerged at the same time as the explosive epidemic of dysthymia and depression. Psychologically, there's no doubt it's a powerful antidepressant to have the body of a superhero.

The enormous interest in "smart drugs" is also part of this phenomenon—everyone who has taken ginseng or ginkgo biloba to increase memory or alertness, choline or lecithin to increase brain function, or tried Hydergine, piracetam or other cognition enhancing drugs to boost their brainpower is clearly engaged in cosmetic psychopharmacology.

While less widely known or used, mind machines also show evidence of being effective for such cosmetic psychopharmacology (or cosmetic psychotechnology) applications. So far I've only mentioned the evidence that brain machines boost serotonin. There is substantial research evidence that the devices have equal or

greater effects on other neurotransmitters, peptides and hormones. For example, research in recent years into the biochemical effects of cranial electrostimulation (CES) devices, light-sound systems, flickering light-color machines, ganzfeld masks, psychoacoustic sounds such as some bin-aural beats tapes and CDs, sound tables and sound beds, motion systems, flotation tanks and others have proven that these devices can produce sharp alterations in such biochemicals as:

***GROWTH HORMONE:** just 10 minutes of stimulation with flickering lights, for example, produce significant increases in this hormone, which is the key to maintaining youthful vitality and maintaining a strong body and immune system.

***BETA ENDORPHINS:** effects include producing rapid increases in these natural opiates to reduce pain, anxiety and induce states of profound comfort; on the other hand, there's evidence that regular long-term use of mind tech with recovering alcoholics reduces overall levels of beta endorphins; since elevated beta endorphin levels are linked to high levels of stress, the researchers believe this indicates that these subjects are recovering more easily and comfortably, with reduced levels of stress, in contrast to control groups of alcoholics receiving traditional treatment, who show elevated levels of beta endorphins;

***DOPAMINE:** CES, light-sound and other brain technology produces increases in levels of this neurotransmitter which is crucial to cognition, sex-drive, fine motor control, motivation, and immune function (increased levels of dopamine bring about feelings of increased energy, vitality and euphoria);

***MELATONIN:** brain tools have been found to boost secretion of this crucial hormone, which influences sleep and waking patterns, reduces stress, directly influences memory, learning, alertness and concentration, and is being investigated as a treatment for depression, jet lag and cancer.

There is additional evidence that mind machines alter levels of such other biochemicals as luteinizing hormone, norepinephrine, cholinesterase, progesterone, prolactin and oxytocin (the "love hormone," linked to human bonding).

Pharmaceuticals are the treatment of choice under the prevailing chemical-mechanistic paradigm of the medical establishment: drugs produce changes in brain and body chemistry that can at least temporarily ameliorate symptoms. Prozac fits right in.

While medical professionals may disagree about how widely it should be prescribed, and what its side effects may be, everyone agrees that it has its effects by altering levels of brain-serotonin.

The beneficial effects of brain tools can also be explained by this paradigm: the devices produce changes in brain and body chemistry that can ameliorate symptoms. The major difference is that instead of producing biological changes by putting some synthetic substance into the brain and body, mind machines seem to stimulate the brain/body naturally to produce the biological changes. Since there is no synthetic substance entering the system, there is little chance of producing harmful or upsetting side effects, or of producing addiction. In that sense, the use of brain tech to naturally produce biochemical changes seems preferable to the use of pharmaceuticals.

But changes in biochemistry are only a part of a wide spectrum of psychobiological effects produced by brain machines. It's been well established, for example, that various types of brain technology ranging from flickering lights to binaural beats to EEG feedback produce rapid and profound changes in brainwave frequencies. It has also been well established for decades that a variety of disorders are linked to abnormal brainwave activity. The use of mind tools for brainwave "entrainment" or "driving" has enabled therapists to produce increased brainwave activity in desired ranges and thereby to "normalize" formerly abnormal brainwave activity and associated disorders.

The use of brain technology to alter brainwave activity now includes boosting activity in the beta range of 15-18 Hz (with dramatic and even unprecedented therapeutic effects for Attention Deficit Disorder/Hyperactivity, PMS, depression, brain injury and a huge variety of brain disorders); in the alpha-theta range (with unprecedented effects in treatment of alcoholics and drug addicts, as well as treatment of Post-Traumatic Stress Disorder [PTSD]; and in other frequency bands, such as the Sensorimotor Rhythm (SMR) and the "Tansey" frequency. Most of the articles in this issue of Megabrain Report deal with the beneficial effects of using EEG feedback or light-sound machines linked with EEG feedback to increase brainwave activity in certain frequencies—Julian Isaacs explores the benefits of beta, Seigfried Othmer also discusses beta training, Eugene Peniston and Nancy White explore alpha-theta training, etc.

In addition to altering brainwave frequencies and patterns, there is now evidence

that mind machines seem to produce more general "optimizing" effects on brain function that include regulating the communication and interaction of the hemispheres, and between the cortical and subcortical regions of the brain. For example, Seigfried Othmer, in his articles in this and the preceding issue of Megabrain Report suggests that the enormous range of benefits noted from EEG training is a result of "improved cortical regulation . . . accomplished by activation of the brain stem and thalamic activating system, and inhibitory feedback circuits involving both nonspecific and specific thalamic nuclei. Hence, we are in all likelihood effecting change subcortically."

Julian Isaacs, in his article elsewhere in this issue, suggests that EEG training permits the development of "a thalamo-cortical locus of control operating independently from the limbic system. The thalamic system is responsible for the overall management and control of the higher brain centers and the cortex. Thalamic control of the cortex allows rational thinking, logical sequential processing and all the cognitive and cultural goodies we associate with being human."

Lester Fehmi, in his interview in this issue, asserts that "with EEG training you're paying attention to how you pay attention. And that changing brain waves is changing attention: brain wave training is attention training. . . . Becoming aware of how you're paying attention, becoming aware of when to choose what, and then having the actual capacity to manifest the appropriate attention—that, I think, is what makes a realized human being."

Len Ochs, who wrote in the last issue of Megabrain Report about his success in using a system that links EEG and light-sound feedback, which he calls EEG Disentrainment Feedback, suggests that by "There appears to be such a thing as optimization of one's EEG. . . . As the patient learns to 'cruise the frequencies' and do 'nothing' under the stimulation of the lights and/or sounds, i.e., gets better at not directing or processing consciousness but instead lets go and permits it be pulled however it goes, the activity observed in each of the bands becomes minimized, equalized, and reduced in variability. . . . It is important to say that except for the skills involved in desensitizing the individual and remaining comfortably present and yet unobtrusive, it is the interaction between the EDF system and the individual's brain that is most intelligent. That is, the therapist does not need to pick out helpful frequency stimulation strategies: the floating relationship between stimulation and brain activity

becomes the program."

As Thomas Budzynski explains this disentrainment process in his article in this issue, "We know that when the brain is injured physically or even psychologically some sort of process, a sort of 'rigidification' takes place. The brain becomes less adaptable, flexible, less able to allocate resources to changing tasks or multitasking. The EDF seems to break up these 'rigid patterns' and allow a more adaptive reorganization of the cognitive process."

There are numerous other explanations for the effectiveness of this type of EEG and light-sound technique, as well as for brain-stimulating devices in general, including:

The Dissipative Structure or Chaos Model, which sees the brain as an "open system" or complex structure, in which brain tools produce greater instability, perturbations or "chaos," thus breaking up rigid structures and causing the brain to "escape to a higher order" of greater flexibility, interconnectedness and power;

The State Dependent or "Desensitization" Model, based on the fact that during childhood our dominant brainwave frequency is theta (and later alpha), and that by returning us as adults to these childlike brain states we gain access to and can "process" and integrate traumatic material and experiences from childhood;

The Brain Growth Through Stimulation Model, based on the neuroscientific evidence that increased brain challenge and stimulation in the form of novelty and "enriched environments" causes actual brain growth in the form of increases in dendritic length and size, related to increased density and richness of neural connection (this may explain why light-sound systems, CES, and EEG feedback are proving so effective in treating and remediating brain damage—researchers such as Harold Russell and John Carter, of the University of Houston, and Ken Tachiki, of Sepulveda VA hospital, Sepulveda, CA, use brain technology to treat brain damage and establish new neural connections around lesioned areas resulting from stroke and closed head injuries.

The Increased Metabolism Model. As Robert Fried points out in his article in this issue, the brainwave activity revealed by the EEG is a product of brain cell metabolism. The changes in brainwaves produced by light-sound devices and EEG feedback, then, are clearly indicating changes in brain metabolism. And in fact, there is evidence of this: one group of researchers used a

PET scan to map cerebral blood flow and found that when subjects used a flickering light device the cerebral blood flow increased by as much as 40% (there were increases at all frequencies, by the way, but the greatest increase was at a flicker frequency of 7.8 Hz). Increased blood flow to the brain means increased oxygen, glucose and other brain building nutrients, and boosted activity in parts of the brain that may have been injured or disordered—this could explain many of the benefits of brain technology.

I started out by exploring why Prozac was so popular, theorized that it may have to do with a widespread cultural malaise or feeling of lack of control and/or self-esteem combined with an equally widespread desire to increase feelings of power, control and self-esteem.

I think there's a lot of evidence that many of the brain tools now widely available can have equally powerful anti-depressant, anti-dysthymic effects, but with several obvious advantages over Prozac and similar drugs.

Mind machines are non-invasive and have shown no dangerous side effects. Another clear advantage over both Prozac is that these devices are available without prescription. Further, they are, comparatively speaking, dirt cheap. One light-sound machine, for example, at a cost of a couple of hundred dollars, will provide daily brain training sessions for years, while a normal dose of Prozac approaches \$1000 a year.

It's also the case that while Prozac may help the brain function better temporarily, it does not appear to "cure" any problems, and does not appear to heal the brain or produce optimal functioning that continues after the drug is discontinued. On the other hand, there is now evidence that brain technology works by healing brain disorders—by moving the brain into its optimal state—and that once this optimal state is achieved, the brain has a natural homeostatic mechanism that tends to keep it functioning optimally, without further brain stimulation or medication.

"Anything Prozac can do, we can do better," according to Siegfried Othmer, describing the powers of neurofeedback. "You don't have to keep taking it. Prozac

works over a wide spectrum of problems, but it isn't the answer to all these problems—it temporarily pushes the brain into a place where it manages better. But brain tech, neurofeedback, can train the brain to live there. Permanently. With no side effects. Neurofeedback intrinsically takes you toward homeostasis—toward where you belong."

Since these devices and technologies are inexpensive, easily purchased and easily used, they could present a challenge to the medical and pharmaceutical interests. In recent months, in fact, the FDA has gone so far as to seize the inventory of Synetics Systems light-sound machines, arguing that these are "medical devices," and must be registered with the FDA as medical devices, which would restrict their availability. The possibility that mind machines could be a safe and effective non-invasive alternative to pharmaceuticals such as Prozac raises some interesting questions and prospects. For some intriguing explorations of these questions and prospects—from world salvation through the Church of Beta to the "encounter with one's essential self" of alpha—read on.

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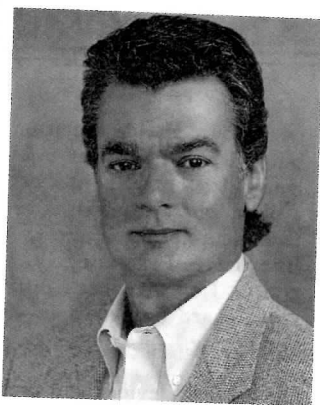
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BROTHERS AND SISTERS, COME JOIN THE CHURCH OF BRAINWAVE TRAINING!

WHEREIN THE AUTHOR IS CONVERTED AND SEES THE TRUE PATH FORWARD...

by Julian Isaacs, Ph.D.

Some of my closest friends think I have gone a bit nuts, got religion, become a "true believer", despite my psychologist's chronic scepticism and previous staunch rejection of all organised religions. And I must admit they have a point.

I do have some of the symptoms of the conversion experience. That's because I'm in the grip of a grand (some might say grandiose) vision—a vision of how humanity might be saved no less, and not in some distant millennial future, but pretty damn quick. This has made me a bit preachy. To the merriment of close friends, I have turned many conversations in the direction of my new religion. I feel I'm going around with new eyes, seeing the predicament of the human race with a new, deeper understanding. This can make me pretty bad company to keep at times, but then I have seen the promised land, so to speak. I've actually experienced some of the benefits of the "new way of being".

Of course, the "religion" is not your regular, run of the mill fundamentalism: it has claims to scientific exactitude. But the belief that it will save humanity from itself has been the (false) foundation of many a creed (assuming it's not so elitist that only the elite gets to be saved). My religion is potentially much more democratic, but there are some thorny problems involved in democratising it, which is one of the major themes in this essay.

Have you guessed that I'm talking about biofeedback training of brainwaves—so called "neurofeedback"? What I want to do here is to relate my own recent and revelatory experience of doing beta brainwave training—as a client—and communicate the power and impact of its effects. I also want to describe the development of what may be, for me at least, better beta learning strategies in the context of the regular beta training protocols; discuss beta related states of consciousness; outline the underlying theory leading to the new "vision"; justify and outline this grand vision; and explore how the "saving" of humanity might be accomplished. Finally I will at least mention some of the possible societal and political resistances which the spreading of brainwave training may encounter.

IT'S OK, I'M ONLY JOKING ABOUT THE CHURCH OF BIOFEEDBACK!

First, I want to deal with the objections that most experimentalists will feel towards an approach that starts from a personal, experiential basis, rather than exclusively from the published experimental studies. Having a doctorate in experimental psychology, I can understand that reaction. Obviously, my own experiences of the (to me) powerful effects of beta training could be pure placebo, artifact generated by expectation. I would not argue against that viewpoint. In reality I regard my experiences as the basis for testable hypotheses, to be confirmed by well designed and properly controlled studies. The "Church of Brainwave Training" conceit was adopted because in discussing something so serious as causing major shifts in the psychology of the human race I felt it crucial to leaven this discussion with a little humor.

THE REASONS FOR TESTIFYING.

There are several considerations that prompted me to undertake and then write about my experiences in EEG training. First, since I became initiated into the priesthood of neurofeedback practitioners by taking the excellent certification training from EEG Spectrum, I expect to be doing a lot of client training at the Corte Madera, Marin County facility of EEG Spectrum in California. As an experimentalist it was part of my creed never to put my subjects through procedures which I would not put myself through. So following my own value system, I had to experience neurofeedback as a client first, before inflicting it on others.

I had also self-diagnosed the need for a little cognitive remediation. My growing suspicion was that my subtly psychologically abusive English familial background and the ravages of the drug-crazed 60s, age, and stress, were beginning to catch up with me, neurologically speaking. Also, as I read more of the literature on attention deficit disorder (ADD) I found disquieting similarities between full blown ADD and some of my own traits. Maybe, I decided, it was time to take the old brain in to the shop for a tuneup.

More relevantly for the community of researchers investigating neurofeedback, I have been very surprised to find that rather few practitioners have actually done EEG training as clients. Yet the practitioner would be much more likely than the lay client to notice incidental, undocumented effects of the training and hence pull these into the realm of study by communicating them to researchers. Some practitioners may also have had extensive meditation experience, which is helpful in developing a sophisticated internal observational capacity. James Hardt's article in the last Megabrain Report (Vol. 2, No. 3) demonstrates how a powerful transformative experience on the part of a creative, self aware and energetic experimenter can lead to innovation.

Thus it was my intention to use my experiences as the basis for my own future controlled research and to contribute towards our community's fund of information. So my intent is not to self-indulgently spread myself over these pages, but rather to present a case study and then to develop what I think are legitimate implications of the case study. In this instance the case will be myself and I will dare to be somewhat self-revealing in hopes that this will make the case study material more useful to others. The implications I arrived at certainly blew my socks off and I want to share them in hopes of receiving feedback from the biofeedback and psychotechnology communities.

In reading Dennis Campbell's review of the 1994 Key West conference in MEGABRAIN REPORT Vol. 2, No. 3, I was happy to note that consciousness of the revolutionary implications of neurofeedback is widespread in the professional neurofeedback community. In this article, I want explicitly to prevision and imaginatively explore the future of neurofeedback and its sociopolitical ramifications, because these may be a crucial factor in the development of the field.

Finally, I have noticed an absence of extended discussion of internal strategies for achieving beta brainwave states and of descriptions of the subjective, experiential characteristics of beta brainwave states within the community of practitioners. Since I have had longstanding interests in states of consciousness, shared by investigators in the fields of transpersonal psychology, meditation research, peak performance and parapsychology, I would like to initiate an extended discussion of all of the relevant subjective states encountered in beta, SMR (sensorimotor rhythm) and alpha/theta training because I think that this will contribute towards progress in our field.

Some neurofeedback practitioners view the production of beta and SMR as totally non-conscious functions, having no specific correlates in consciousness. I think this view is partly a result of their own lack of extensive self-training in beta or SMR, and could hinder the development of more efficient internal training strategies. I describe my own exploration of different internal strategies for beta training below. I believe that extensive practical experience of beta training by self-observant individuals might reveal hints as to what constitute beta "states" if such exist.

Efficiency is crucial. If we are to "save" humanity with brainwave training, we must dramatically reduce the expense of training

I do not deny that it is indeed possible to perform beta training successfully without the trainee becoming aware of detailed characteristics of the associated subjective states. These are likely to be subtle and complex, and only controlled research will definitively identify

them. However, I remain unconvinced that the "sit down and make it go" approach is necessarily the most efficient.

And in the case of brainwave training, which is a direct function of the efficiency of the training protocol. James Hardt's paper in the last MEGABRAIN REPORT clearly shows how consciously identifying the internal strategy for alpha production led to an effective way of increasing clients' production of alpha (in this case by psychologically processing resistances), and of increasing the psychological benefits of alpha training, hence making alpha training both more efficient and more effective.

I think a discussion of adjunctive procedures to neurofeedback training and other factors that affect training efficiency is sorely needed, and hope to encourage such a discussion within the pages of MEGABRAIN REPORT. Jon Cowan has done us good service in his contribution to the last issue, wherein he outlined the theoretical constructs used to explain the success of alpha/theta training. This kind of summary and discussion can lead to fruitful research. The area of EEG training has huge promise and stands a much better chance of being properly researched than does, for example, the use of light and sound devices, because the practitioners of EEG training already have most if not all of the equipment necessary for professional level research. Also, a much greater proportion of them have the skills necessary for research than say, the lay users of light and sound. This makes it worth trying to encourage such research.

THE BACKGROUND OF MY BETA TRAINING

I used two systems to perform my training. One was the EEG Spectrum system situated at their Corte Madera office in Marin County, where Jay Gunkelman of Telemedx ably administered the training process. The other was at home, where I used a BrainTracer, being both client and my own therapist. These systems were very different from each other in ways that made me more aware of factors that seemed to affect my training progress. I did a total of about 15 sessions on the EEG Spectrum system and about 15 sessions on the BrainTracer. I wish now that I had documented my training formally, but at the time I did not expect such massive effects as to make documenting my personal voyage worthwhile. Self-explorers, heed the testimony of a sinner and make notes!

TECH TALK (Non-tech readers may skip this section). The EEG Spectrum system monitors three frequency bands—theta from 4 to 7 Hz, low beta from 15 to 18 Hz and high beta from 22 to 30 Hz. It has the great advantage of continuously displaying each of these bands on the therapist's computer monitor in a polygraph like format in addition to the raw EEG waveform. This enables the ready identification of spindle activity in real time. "Spindles" are bursts of brainwaves in the form of groups of sinewaves having a gently peaking form, where the amplitude smoothly reaches a maximum over a few cycles and then smoothly declines over a few cycles.

The system is fast in giving feedback—about 120 milliseconds between the brain generating a change and the feedback and display systems being activated by the event. Feedback latency (time between brain event and feedback relating to it) is crucially important in brainwave training. If feedback is delayed much longer than 300 milliseconds, learning is slow and finally stopped. Ultimate slope of the filters is 24dB/octave. This is a measure of the sharpness of cutoff of the filters distinguishing the EEG outputs in the theta, low and high beta bands. The system uses a monopolar placement, with reference on the ear of the dominant hemisphere and ground on the nondominant ear, with the active electrode placed on the site selected as being the best according to the client's presenting symptoms and responses to training. My active electrode placements var-

ied during the course of training, but in the early stages most were at Cz, in the middle of the central area of the scalp.

The protocol used at EEG Spectrum suppresses theta and high beta (over 20 Hz) and enhances low beta (15-20 Hz). The feedback contingencies are set such that one receives positive feedback between 60% and 70% of the time. Feedback goals are set to shape the EEG output of the client towards a broadly defined norm, where under feedback conditions, low beta is in the range of 10 to 15 microvolts average peak amplitude, theta is around 10 microvolts average peak and high beta is under 10 microvolts average. All measurements with the EEG Spectrum system are peak to peak, not RMS, and all figures mentioned here relating to the EEG Spectrum system are peak to peak values.

Management of the feedback contingencies depends on the client's pre-training EEG spectrum and the results of the evaluation process performed prior to training. However, in my case, typically, inhibition of the positive feedback (i.e. feedback of success) due to excess high beta was set to occur about 5% of the time or less. Inhibition of positive feedback due to excess theta was set to occur about 30% of the time and the low frequency beta threshold was set so that I exceeded it about 70% of the time.

PRE-TRAINING EEG PROFILE

At the start of the first session when Jay Gunkelman took a look at my EEG (we used the Cz placement) he saw that I had labile theta—my theta amplitude was very variable and could reach high peak amplitudes—around 35 microvolts at times. So a primary goal was suppression of theta to the point where it remained stably at a much lower level. My low beta was in the normal pre-training range of about 7 to 8 microvolts average, eyes open, and my high beta was quite low, around 10 microvolts or less. I readily produce alpha with eyes closed and had some years previously done quite a bit of alpha training, without theta suppression. My low and satisfactory level of high frequency beta (over 20 Hz) was not unexpected, since high amplitude high frequency beta is associated with anxiety and I felt very comfortable in the Corte Madera office setting. Also, high beta output would in part be a result of contamination with EMG output from the face and scalp musculature, and I was muscularly pretty relaxed too. In later use of the BrainTracer at home I found very big differences in both low and high frequency beta amplitudes, dependent on muscle outputs (EMG outputs go surprisingly low in frequency—with tired

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muscles having peak EMG outputs around 17 Hz). If I sat up straight, "beta" was normally much higher than when I reclined. I very soon discovered that the seemingly crucial variable was whether my neck was relaxed or not. So very early into the training process I performed all my sessions in a reclining position with my neck supported in order to minimise contamination of the beta range of EEG by muscle artifact. I wonder if other EEG feedback practitioners have noticed the effects on EMG artifact of not supporting the client's neck, or am I unusually prone to scalp muscle tension when my neck is unsupported?

WHERE DID THAT EXCESS THETA COME FROM?

My large theta outputs were disturbing. Seigfried and Sue Othmer, the founders of EEG Spectrum, have charted the supposed etiology and phenomenology of high resting state theta. According to them, the factors predisposing to high theta are legion, including any form of trauma to the brain, psychological or physical abuse or injury, accidents, blows to the head, whiplash, substance addictions, high fever, toxins, birth complications, genetic predispositions, etc. So most of us have probably suffered one or more of these predisposing events.

Now in my case I knew that I had many of the predisposing factors. Mine was an induced birth (as a young child I had a recurrent birth-related nightmare). From extensive psychotherapy I had discovered that I had been traumatised by a forceps delivery followed by circumcision. I had had nearly all of the childhood infectious diseases, with fevers in each case. My family, although not physically or sexually abusive, had been an extremely toxic psychological environment, replete with the repressive and emotionally distant, judgemental qualities of English culture. I had suffered from many years of low grade depression caused by the unprocessed psychological sequelae of the death of my father when I was 11. In my early teens I had suffered a burn followed by blood poisoning which had resulted in a fever of 105 degrees wherein I both hallucinated and had an out of body experience. From my late teens onwards I had participated, at times rashly, in the drug craze of the 60's and had experimented with most of what was around, although I had relinquished drug usage at age 27. I had also lived a very stressful life, especially since relocating to the US in 1984.

So much for causes: in terms of a behavioral and emotional profile of effects, I had taken many decades to realise that in spite

of my perceiving myself as a primarily intellect-dominated individual, I am also highly reactive emotionally, a fact that the repressive style of my English upbringing had concealed from me for a long time under cover of the English "stiff upper lip". I was also very subject to stress, since in stressful situations I tended to brace and mobilise, speed up to meet the challenge, further exacerbating the stress response. I was also easily subject to anxiety and rage, and at times depression.

As I had grown older, my memory, which as a youngster and young adult had been excellent, was starting to deteriorate in ways that were very threatening. Probably a high stress lifestyle and a low grade depression from the breakup of a relationship with a long term girlfriend were at least partly responsible, but still it bothered me.

Finally, although I had never seen myself as having ADD—because I have a very powerful capacity for total absorption in cognitive tasks for long periods (I suffer from "attention surplus syndrome")—my attentional style is very rigid. I like to do one thing at a time, which makes "multitasking" difficult. Probably this is somewhat of a character trait, (I am an INTJ on the Myer Briggs scale) but it contributes towards stress, because it leads me to be an "absent minded professor", immersed in one thing, oblivious to everything else, which tends to compound stress.

I AM UNMASKED AS "LIMBO-MAN"

Now the viewpoint which Jay Gunkelman, myself and others take is that there are two activation centers in the brain, one being the emotionally activating limbic system, the other being the thalamo-cortical system, responsible for organising cognitive cortical functions. When the "limbo-person" is aroused, they simultaneously activate both limbic and thalamo-cortical systems, so that cognitive arousal is linked to emotional arousal. When this type of person tries to activate the thalamo-cortical system to produce beta outputs, along comes the theta too. This gives limbo-person only one button—"on" or "off". I call this type "limbo-person" because functionally this linking of control between cognitive and emotional arousal systems tends to lead to domination by emotional factors.

High theta individuals tend to be dominated by emotional inputs, conscious or unconscious, from the limbic system.

It also means that arousal of any sort caused by stress tends to be self-reinforcing, because the emotional response to the stressor is engaged by any cognitive mobilisation to meet the challenge, as in my case. The "limbo-person" will show high and fluctuating theta outputs as the limbic system inputs to the cortex. High theta individuals tend to be dominated by emotional inputs, conscious OR unconscious, from the limbic system.

The limbic system is the old reptilian brain, from which originate the primitive emotions, rage, fear, anxiety etc. Many authors including such notables as Arthur Koestler, have bemoaned the fate of the human race, dominated by the old reptilian brain. The spiritual teacher Gurdjieff talks of "three brained man". The newer mammalian and human brains rationalise the activities of the primitive brain, which still covertly controls the world, generating hate, wars, greed, repression, control and terror. So I was revealed as one of the many, the "unsaved", a specimen of limbo-man.

Beta training leads to the functional separation of emotionality from rationality, giving two centers of control, instead of one, and freeing the rational activities to be more fully rational, rather than being covertly driven by emotional factors.

By contrast, "thalamo-person" has a thalamo-cortical locus of control operating independently from the limbic system. The thalamic system is responsible for the overall management and control of the higher brain centers and the cortex. Thalamic control of the cortex allows rational thinking, logical sequential processing and all the cognitive and cultural goodies we associate with being human. In beta training the thalamo-cortical arousal system is trained to activate the cortex to produce bursts of beta spindle activity. Indeed in later stages of beta training

the electrode site may be moved from Cz at the center of the scalp to Fz, a more frontal position over the evolutionarily latest addition to the brain, the frontal lobes, the home of "man the rational animal".

The crucial point of beta training is that it leads to the functional separation of the limbic and the thalamic systems, giving two centers of control, instead of one. Separating the functions of emotionality from rationality frees the rational activities to be more fully rational, rather than being covertly driven by emotional factors.

SAVING THE WORLD BY CONVERTING HOMO-LIMBUS TO HOMO-THALAMUS

So here is the recipe for "saving" the human race. As a species we are dominated still by the limbic brain. By using brainwave biofeedback in ways we have already discovered, and will probably develop very much further, the human race can be converted from homo-limbus to homo-thalamus. Reversing the dominance of the limbic system to give us as a species two centers of action rather than totally linked emotional and rational centers will allow humankind to finally emerge into its full evolutionary potential — quite an idea!

As usual, the arts have pre-empted this. To use a currently popular image, remember the good Mr. Spock of Star Trek fame. At one time the Vulcans were subject to wars and all the greed, hatred and general nastiness of the human species. But then, by a process which is never explained in the series, the Vulcans evolved into entirely rational, peace-loving, unemotional beings. Now of course I am not proposing that we become mere unemotional intellects. It would diminish humankind and is also quite impossible because of our biology. But I am proposing that we do stand at the threshold of a future which could be radically different, and better than, our past.

It is my argument here that the world does need freeing from the effects of the irrational, over-emotionally reactive primitive reptilian brain. For evidence, look at the poverty, homelessness, crime, violence, murder, abuse and addiction that surround us. Below, I will attempt to relate these evils to my thesis and develop and add to it further, but for now I shall resume my own story.

TRAINING EXPERIENCES, FIRST ORIENTATION: SIT DOWN, EYES OPEN, MAKE IT GO!

The EEG Spectrum system now has three

feedback types: the original visual and auditory "Pac-man" game, where Pac-man lights up and moves, emitting a beep at regular intervals, when the client is in state; the traditional biofeedback display of "boxlights" where three boxes of different colors change in size according to the EEG amplitudes in the frequency bands they represent (theta, low beta, high beta), also with the Pac-man style audio beep; and a new kinesthetic feedback which I have not yet tried, but which appears very promising. My first session was with Pac-man. I found the activity of Pac-man distracted me from getting into state properly. I have never liked video games and have almost never played them. I also noticed that it was much easier to produce large amplitude beta spindles with eyes closed rather than open, using just the beep as feedback, a fact I found puzzling at first.

Beta training should be done eyes closed, like alpha.

I then tried using the boxlights. In principle, the three boxlights ought to be very efficient for training, because they present proportional, amplitude-related information relating to all three frequency bands under training. I hated them! Now here was a deep paradox. Both my scientific training and my trainer told me that this was THE feedback display of choice—it gives the most information, so it ought to be best, right? For me—wrong! It clearly was even more inhibitory than Pac-man. By this stage too, about four sessions into the training regime, I was additionally using the BrainTracer at home, which only has audio feedback, and I was doing very well in producing larger amplitude beta, with eyes closed, listening to the tones (more below on the BrainTracer system).

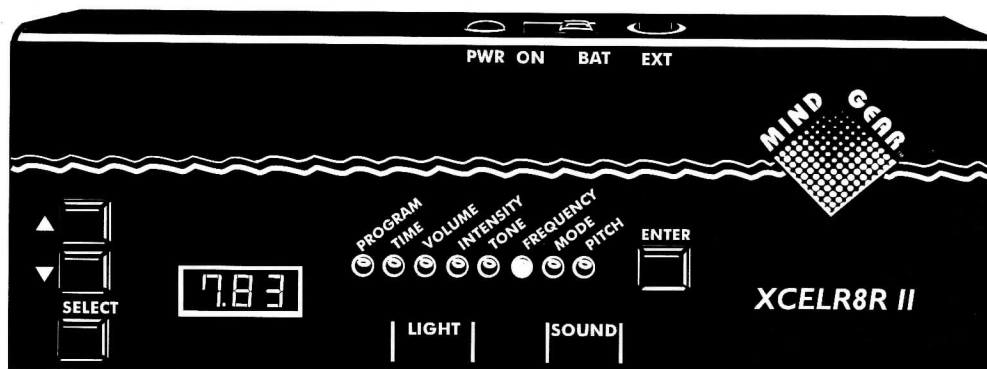
FEEDBACK FOR BETA SYNCHRONY: MAKE IT SIMPLE

Then the truth dawned on me. This kind of complex visual feedback is, I suspect, based on an incorrect paradigm for beta training. If the brain is processing complex visual information then the EEG output will be desynchronised, representing the occurrence of the processing of the feedback signal. Yet what is wanted to increase beta amplitude in the training situation is synchronised beta, because only by producing synchronisation of the outputs of neuronal populations does one get those nice big beta spindles! So to get big beta one should reduce the processing demand on the brain, not increase it. In this way,

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beta is much more like alpha training. Beta spindles are a symptom of a lack of processing, not of vigorous processing. Thus the feedback system should not be visual, nor should it impose heavy processing demands. And beta training should be done eyes closed, like alpha.

Now let's immediately qualify this: if the trainee can't stay awake or attentionally focused with eyes closed, then they have to do training eyes open, whether or not the feedback signal is visual in nature. And this may be particularly true for ADD and ADHD populations, which are chronically under-aroused (an aside—could we produce an audio stream which sustains arousal and embed audio feedback into it for these groups?). Also, perhaps beta training would generalise to "real life" better if later beta training sessions were conducted eyes open—an eminently testable hypothesis. Regarding other feedback modalities, as of this writing, the development team at EEG Spectrum is very excited about the very promising preliminary results they are obtaining in using a kinesthetic feedback device. This is exactly the kind of feedback my hypotheses based on my own experiences would predict as best for beta training.

As soon as I really attended to the task, I found myself going into trance.

But early in my training, with eyes both closed and open, my prior training in self hypnosis worked against me. As soon as I really attended to the task, I found myself going into trance. I have taught many classes on altered states to university students and have always used hypnosis as a very handy tool to demonstrate altered states to students in class. The result was some personal facility with self hypnosis. At first I found myself instinctually slipping into trance—not the right thing to do! So I corrected this tendency and dutifully attended to the visual feedback. This was a horribly frustrating experience. I then closed my eyes during training, which greatly increased my ability to produce beta and was a much more comfortable experience. It also allowed me to attend to my inner state much more easily, even though eyes closed training produces more theta output.

BETA TRAINING AS "CONCENTRATIVE MEDITATION WITH FEEDBACK"?

My train of reasoning about feedback sys-

tems led me to appreciate much more deeply how extraordinarily unique the synchronised beta state is. Normally, we never get feedback of our brainwave state, except if we are meditating or doing some other highly introspective exercise where, with enough practice and tuition, subjective correlates of brain state can sometimes enter consciousness (see James Hardt's contribution to the last issue of Megabrain Report for an excellent description of subjective correlates of high amplitude alpha production).

In everyday life, there is almost no situation under which we would normally, without EEG feedback, produce large beta spindles. Usually, either we are relaxing, with eyes closed, most of us producing alpha, or else we are attending to some task (with periods of relaxation and of inattention too), producing desynchronised beta. Beta spindles, i.e. synchronised beta, would never be reinforced in ordinary life. With one exception: in concentrative meditation, the intention seems to be similar to the instructions given to the beta trainee—"attend exclusively to this signal"—as if beta feedback training were literally training in attentional control, pure and simple. I therefore wondered, is concentrative meditation really a concealed beta training situation? Is beta training "concentrative meditation with feedback"?

This thought led me to adopt a different training strategy. At first I had accepted the instruction to attend to the external feedback and simply "make it go". That was a familiar orientation even if the results, with eyes open, were very frustrating. I was used to the "passive volition" technique from my prior alpha training, where to get really good results you have to surrender even the desire to be successful. I have used other forms of biofeedback and found them fairly easy to master too. So I was not really complaining about the difficulty of beta training.

When it struck me that maybe beta training is "concentrative meditation with feedback", I played with that orientation for quite a while. I attended to some inner somatic signal, such as the sensations from my diaphragm, or the feeling of my breath in my nostrils. I surrendered to the process, adopted a passive volition attitude and relaxed my body as much as possible. This seemed to work quite well, certainly much better than open-eyed attention to the video display.

Perhaps "mental muscle" development follows the "no pain, no gain" law.

I found that I got fatigued at doing the beta training much more easily during the first few sessions of my training than during the later sessions—although even towards the end I could still find it fatiguing. What interests me is whether the fatigue was a result of unnecessary effort (i.e. using the wrong technique), or whether the fatigue is intrinsic to the beta training situation. Perhaps "mental muscle" development follows the "no pain, no gain" law—which I have always believed. More of this later, because this theme is relevant to the whole of the "passive driving" part of psychotechnology including light and sound devices.

LEARNING TO ENERGIZE MY BRAIN

To my great surprise, around session 12 in the training process, I found that I still got good results when I lapsed into daydreaming. This shouldn't be so! What was going on? Isn't this "attention training"? On closer reflection I realised that even in my daydreaming state, part of me was still attending to the audio feedback signal. But I was also clearly getting into an altered state of some sort, because at the end of sessions, it would take me time to reassemble my normal self and get back into the ordinary world. Very strange. I then dropped the "concentrative meditation" orientation and just hunted for states that seemed to work, irrespective of my theoretical orientations.

By the end of my training process, my peak beta was about two and a half times greater than the amplitude at the start.

By now, certain sensations and states seemed to regularly accompany success in beta production. My good beta was increasing in amplitude and the theta was slowly declining. By the end of my training process, my peak beta was about two and a half times greater than the amplitude at the start, and I can still produce high beta amplitudes in the feedback situation. I therefore do not agree with those colleagues, like Barry Serman, who state that beta training does not

increase beta amplitudes. In my (uncontrolled) case it clearly did.

The best strategy to reliably "switch on" beta was to get very quiet internally (to inhibit theta) and to imagine myself "energising" my brain,

The theta—ah, there's a different story, and a cautionary, but instructive tale, of which more later. But theta did decline steeply by the completion of my training. I was also starting to notice effects of the training outside the training sessions, effects I liked. I am quite good at biofeedback generally, so that by now I could fairly easily and reliably "switch on" beta. By about session 12 or so I had found that seemingly the best strategy was to get very "quiet" internally (to inhibit theta) and to imagine myself "energising" my brain, specially that part of it under the EEG scalp electrode.

The "energisation" produced a specific, if somewhat indescribable sensation. Like other trainees I got a slight sensation of warmth and of tingling in the area of the scalp electrode. Then it struck me—if I was increasing the metabolic rate of my brain, it would probably cause greater blood flow, opening of blood vessels and increase in scalp temperature. These would cause the tingling and warmth sensations. So in some later sessions at home I monitored the scalp temperature near the electrode and found it did increase by 1.5 to 2 degrees or so during a 45 minute beta training session.

LONG TERM EFFECTS OF BETA TRAINING ARE NOT THE SAME AS IN-STATE TRAINING EXPERIENCES

I found that my experiences in the beta training sessions were not the same as the subsequent effects on my state outside of the training session, except for the "Mr. Beta-head" incident detailed below. I believe this to be a crucial point to grasp. If we are training the thalamus and reticular activating system to do this very peculiar task—produce beta spindles to order, independent of the limbic system, rather than producing a "normal" desynchronised EEG—then we should not expect that the training state experiences be similar to the desynchronised states encountered outside of the training situation. Because although the thalamic system generalises the ability

it learns in beta training to use in ordinary life, the requirement for synchronised beta in ordinary life is non-existent.

Thus I do not think that we should view the beta training state itself as an attention training exercise. Doing beta training certainly improves attention, but the state I found most effective was not a "narrow focus" highly pointed attentional state focused on the feedback signal. The key state seemed to be internally "quiet" (reducing theta), but "energised" in the sense of "holding an intention to activate the feedback tone", while at the same time relaxing and surrendering any striving. In my case I even found that I could drift into reverie and still activate the feedback tone. I suspect that there may be an inbuilt "fatigue factor" associated with every particular strategy, so that shifting from strategy to strategy (e.g. from "feel your diaphragm" to "warm and energise the top of your head") improves performance by reducing boredom and "freshening" the task.

Beta training shifted the felt quality of my attention from being somewhat "warm and fuzzy" to being "cleaner", "emptier" and "quieter," and I noticed a much steadier and rock-solid quality to my attention.

I did not find the complete specification of a "best" beta state, but my preferred one was an altered state of inwardly centered attention, with attention only peripherally placed on the feedback tone.

EFFECTS OF BETA TRAINING: "THALAMO-MAN" EMERGES

What did I notice as effects of the beta training? First, my conscious state definitely became "cleaner". This sounds strange, but the experience was of a shift in the felt quality of my attention from being somewhat "warm and fuzzy" to being "cleaner", "emptier" and "quieter". Prior to the training, although I could not consciously experience the content of the information carried by the limbic inputs into my cortex (represented by my excess theta), the limbic inputs nevertheless contributed an informationally "noisy" background to consciousness. This became quieter with the suppression of theta.

I also clearly noticed that my hypnagogic state, with which I had become very familiar in performing research investigating twilight states (see my article in MEGABRAIN REPORT, Vol. 2, No. 3, "Julian's Adventures in Thetaland") had been inhibited by my training. I now slipped directly into sleep, with no consciousness of having drifted through the theta state on the way to sleep.

My girlfriend, who is a psychologist and a very acute sensitive, immediately noticed the difference in my attention and liked its "cleaner" quality. In addition, I noticed a much steadier and rock-solid quality to my attention. Now I could really pay attention to something, if I chose. I found that once again I could perform extended chains of mental arithmetic, effortlessly. My visual imagination improved too, and I found I could hold visual images stably for much longer periods of time. My short term memory had improved, but so had my long term memory. I felt more energy and motivation. I felt much clearer generally, but also my mood states were much better. I felt happier, more confident, less prone to catastrophisation and much more stress-hardy.

An example. Normally, physical danger frightens me a lot and tends to incapacitate me. One night, actually while attending the EEG Spectrum training in Encino after completing the majority of my beta training sessions, I was returning from the South of LA at 11.30pm to Encino, after attending a business meeting. I was driving my girlfriend's car, not having checked it before our trip south. Right on the offramp at the intersection of highways 450 and 101 a front tire blew out at 55 mph! I had no choice but to veer the car to the leftmost lane (luckily an unused extra lane), which I did successfully. Usually, an event of this sort would have reduced me to near-panic. But not this time. I got out, surveyed the tire (luckily no other damage), calmly got out the spare, and within inches of the roaring traffic to my right I changed the tire, put the old one and tools away, and continued my journey to the hotel, without even feeling nervous, just a gentle sense of achievement. If that's placebo, give me more!

To my surprise, I also found physical effects of beta training. I felt generally fitter, but also my coordination improved dramatically. For example, I found out by chance that I could now swat flies with my hands, something I had always been too slow to do before. Not, perhaps, the major selling point for beta training, but a very intriguing and suggestive pointer to applications of beta training for sports, musicianship—in

fact any high level physical skills and physical skills remediation.

Later in my training I tried different electrode placements. I seemed to find that right hemisphere placements increased my ability to handle and direct subtle energy. I have been interested in parapsychology since the mid 70s and have done research in the area of psychokinesis. I found that with my new-found stable attention and intentional states, I could direct subtle energy much more readily. My "cleaner" attentional field seemed to help my ESP ability because of the reduction of internal "noise" (ESP is a very small signal, so signal to noise ratios are important).

Beta training greatly improved our sex life. The stable attention to sexual processes seemed to make sensations clearer and more intense. . . .

Partly because of my improved attentional control, and partly because of my improved subtle energy control, my girlfriend and I found that my beta training greatly improved our sex life! The stable attention to sexual processes seemed to make sensations clearer and more intense, better subtle energy control allowed deeper levels of energetic and body-image merging. So I would recommend beta training for anyone interested in improving their sex life!

After using a left prefrontal placement a couple of times, I noticed that I would wake up planning my next projects—the frontal lobes are supposed to be concerned with planning action, but I prefer to believe that this was a case of my exhibiting placebo, or "doctrinal compliance", since I knew this ahead of time.

As I whizzed over the bridge at top speed immediately after the session with a devilish gleam in my eye I suddenly realised that I was in racing-driver mode. . . .

Now, a couple of minor "downsides" and some quick commentary on the use of the BrainTracer. About two thirds of the way

through my beta training, I noticed that I was waking up early in the morning, and sometimes I had trouble getting to sleep at night. I cannot ascribe this unequivocally to beta training because I have had instabilities in my sleep pattern for several years. Other neurofeedback colleagues have noticed the same effect with some clients. I also noticed, late in the training and with some amusement, that the beta training was making me slightly manic right after the session. I remember one great session where afterwards I had to drive to an appointment over the Richmond Bridge crossing the San Francisco Bay. As I whizzed over the bridge at top speed immediately after the session with a devilish gleam in my eye, enjoying the excitement of overtaking everything in front of me, I suddenly realised that I was in racing-driver mode and should try to slow down a bit! It did seem that I might be becoming over-aroused, neurologically speaking, so I added in some SMR (sensory motor rhythm) training sessions late in the training process. This is a common strategy if the level of stimulation from the beta enhancement seems to be producing undesirable side effects.

I was temporarily "Mr. Beta-head" and felt decidedly weird, somewhat like a robot.

I also had a beta training "accident" that was interesting. During one session I made a supreme (passive volitional) effort to get into a beta training state of extreme focus, and succeeded rather too well in doing so. I had used an autohypnotic technique to "lock" myself into beta, getting very high scores. I found that indeed I had involuntarily locked myself into beta. I was temporarily "Mr. Beta-head" and felt decidedly weird, somewhat like a robot, with a very unpleasant, "hard", forced, compulsive quality of attention that I could not shift out of. It took going to a hot spring and relaxing deeply for a day and a half to "unlock" this state. My girlfriend and I joked thereafter about whether she should "date a beta-head" or not! It taught me a lesson not to lock myself into the beta training state that I had adopted. More importantly, it suggested even more strongly that states suitable for training are not necessarily desirable for "real life" and that the training state is not the desired end product of beta training.

USING THE BRAINTRACER FOR BETA TRAINING

The Braintracer, which I reviewed in MEGABRAIN REPORT Vol 2, No.3, is an inexpensive two channel IBM computer based EEG. It has an audio output through a Sound Blaster card and can be used to train two, but not three, independent EEG frequencies. Since my high beta was already low, I used the Braintracer to inhibit theta and enhance low frequency beta. I set the audio feedback options so that one feedback channel would sound a high pitched note if I produced beta above the threshold and the other feedback channel would sound a low pitched note if my theta was under a certain threshold. That way my task was to get the device to produce both tones simultaneously. I set the thresholds so I got the combined feedback about 50% of the time. I could lie down on my own bed and deeply relax to train with the Braintracer and found it very pleasant to work with.

TECH TALK (Non-tech readers may skip this section). I used a set of electrodes from the "Electrode Store" (phone number below) because the standard electrodes accompanying the Braintracer are useless for placements on the scalp. Again, I used mainly Cz, C3 and C4 placements, sometimes monitoring two EEG channels (both left and right central areas), but mostly using a single EEG channel for Cz. One problem with the Braintracer is that unlike the EEG Spectrum system it uses the fast Fourier transform (FFT) technique for analysing the frequency components of the EEG. This gives much superior filter slope (sharpness of separation of similar frequency signals) and allows single Hertz bands of frequencies to be trained (e.g. you could train just 14 Hz), but the price is that the response has to be much slower. Since the lowest frequency submitted for FFT analysis is 1 Hz and 1/4 of the wave has to be analysed, the speediest response with an infinitely fast computer is 1/4 of a second. Allow some time for a real computer to perform and the response time is around 330 milliseconds (this with a 25 Mhz 386—faster with faster host systems). But this is ok if you are already quite good at beta production, because the spindles can last for appreciable fractions of a second. If the Braintracer manufacturer cut off the low frequency response at 3 Hz the feedback latency time would be much less. I used the same 4- 7 Hz inhibition frequencies and 15-18 Hz enhancement frequencies as the EEG Spectrum system.

The Braintracer allowed me to explore

some very paradoxical regions of EEG training. I found that I could start out having a hard time making my 50% score, then drift off to sleep for 15 minutes, reawaken and find that I had very significantly improved my ability to score—well above 50%—and could continue my training at this higher level of performance. Is this subliminal EEG training? Of course during the light sleep period, my theta would greatly increase in amplitude, as is normal for first stage sleep, and I suppose my sleep spindles at 15 Hz and above were being reinforced. Anyway, it felt like a pleasant way to add to my more formal training and perhaps suggests that really releasing the striving to succeed can assist in training, as per Les Fehmi's dictum "if something's worth doing, it's worth learning to do it effortlessly".

SATANIC WILES AND THE REAPPEARANCE OF "LIMBO-MAN", BUT THERE IS HOPE!

So it was that for several months after completing my relatively short course of beta training I enjoyed the many benefits of the process. I was conscious of reacting very much less extremely to stressful situations.

And thus it occurred that I became a convert to the Church of Brainwave Training. However, Satan, in the form of unremitting stress, and lack of further training, lay in wait for me.

I had embarked on the development of the Breathwork Explorer, a breath feedback device now sold by Tools For Exploration, and as the pressure from that project relentlessly mounted, together with other deadlines, I found myself once again slipping back into the bad old ways of limbo-man. The stress was such that I used medications to help me sleep, and I felt extraordinarily driven. The result was the gradual "re-clouding" of my consciousness. My theta has now reappeared, nearly to its original amplitude. My consciousness is not quite as bad as it was, but gone is the pristine quality it attained at the height of my beta training. Clearly I ended my training too soon.

The Othmers and other practitioners emphasize that the training has to be done for long enough for it to "stick", and my 15 sessions on their equipment and 15 on the BrainTracer were clearly not enough. However I do not feel downhearted about this because I will restart my beta training.

Already, using the Braintracer for a couple of sessions to inhibit theta, I can feel the difference. Looking at my EEG, it's the theta which has re-emerged, my beta amplitudes are nearly the same as at the end of my previous training.

So much for my journey. Now let's look at the broader implications. Saving the whole world is a big job, so let's first look at how some of America's major problems might be assisted by neurofeedback.

TO BE CONTINUED . . .

(Part 2, in which Dr. Isaacs discusses the social and political implications and potentials of neurofeedback, the use of neurofeedback for education, peak performance, cognition enhancement and "waking up," the creation of "mind spas" and the role of the FDA, will appear in the next issue of Megabrain Report)

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EEG BIOFEEDBACK TRAINING: A JOURNEY TOWARD PERSONAL AUTONOMY

**Siegfried
Othmer, Ph.D
June 1994**

1) EEG BIOFEEDBACK: MEDICINE, THERAPY, OR LEARNING?

There are three emerging trends within the field of EEG biofeedback. One branch is trying to gain legitimacy by proving itself within the terms of the traditional medical model. The second is focused on education: training the brain for enhanced performance. The third finds its roots in truly person-centered psychotherapy, with all its intrinsic complexity, and with the goal of a heightened sense of self and of personal autonomy.

The field of EEG biofeedback got its start with Joe Kamiya, who was examining the physiological correlates of different states of consciousness. But the field continued, in its modest way, with a change of emphasis to disabilities: epilepsy and Attention Deficit Disorder (ADHD). These conditions are medically managed, and therefore the claims of biofeedback are being subjected to criteria more appropriate to medical interventions.

Some practitioners in the field came to realize that the techniques of EEG biofeedback had much to offer people who did not meet clinical criteria for any mental disorders. Mental capabilities could be augmented with the training in people who were manifestly quite competent. To this kind of training an education model is more appropriate. The association with medically recognized conditions is not particularly helpful in these applications, and in fact may even be somewhat detrimental, given the dust that may be thrown up by the invasion of EEG biofeedback into the mental health domains. Power is not usually relinquished passively.

In support of psychotherapy, biofeedback is creating major tectonic shifts in the very areas which are most resistant to such ministrations: severe alcoholism, Post-Traumatic Stress Disorder (PTSD), and Multiple Personality Disorder (MPD). When the cases of severe alcoholism are looked at collectively, it appears that these are highly correlated with early trauma, such as child abuse. The same is true of MPD. EEG biofeedback is opening up opportunities of major reconstruction on the consequences of early trauma suffered by many children. This opportunity remains even late in life. Exciting as this field is, we will not dwell on it further in this article, and only mention it for completeness.

2) EEG BIOFEEDBACK: THE BETTER MEDICINE?

New insights are accepted most readily when they add incrementally to our understanding and our belief system—enough novelty to arouse curiosity and interest; not too much to threaten what we already believe. For this reason, the use of EEG biofeedback for mental disorders would probably best be defended by analogy to medical approaches—if that were possible. But controversy roils. Many feel that biofeedback will always be unfairly judged when it is seen from the perspective of the medical model. Others believe that the defense must be made on that turf in order to persuade those who need persuading, regardless of whether that places the technique at a disadvantage.

According to the dictates of convention, the efficacy of biofeedback must be proved in controlled studies with respect to each individual disorder. These disorders are treated as if they were all independent; proof for one says nothing about the other. Moreover, since EEG biofeedback is a physiologically based tool, it is argued that results must be proved with a physiologically based measure. It is not enough to get clinical results; we must also see change in the EEG. And there must be a unique relationship of protocol to disorder; preferably a single, unique protocol for each.

It may almost be said that when the brain is not well, it does not pay attention well.

According to the medical model, a person must meet "clinical diagnostic criteria" to legitimize use of the biofeedback "tool". Since the tool uses the EEG, there must be an observable "deficiency" in the EEG, correlated with the disorder, which is to be remedied. And the technique must in fact remediate that deficiency in the EEG before legitimacy of the technique can be accepted. Even if this strategy could be defended on its own narrow ground, and even if it resulted in the acceptance of EEG training by the dominant medically oriented culture, it confuses the essence of what biofeedback is about, and severely undervalues the technique in terms of its range of application. It perpetuates the patriarchal [authoritarian? hierarchical? priestly? heirophantic?] medical paradigm in which the repository of essential wisdom lies within the EEG or CAT scan or PET image, as interpreted by its elect acolytes, leaving the patient the tyrannized victim of yet another procedure. A single piece of hard data overrides the patient's own experi-

ence, behavior, and performance as having little or no import. By being even more effective than prior modalities, EEG training enhances the opportunity for health professionals to arrogate to themselves even more power over the individual.

It is increasingly recognized that the disease model of mental disorders has significant shortcomings. Disorder is inherently disorderly. Disorders are not easily compartmentalized by binary criteria: you have it or you don't; you are or you aren't. These conditions are measured on a continuum, with a somewhat arbitrary line drawn at the point where a person deviates too far from the norm. Every individual fluctuates over time, which makes divisions even more arbitrary and uncertain.

These complications are particularly apparent in the case of Attention Deficit Disorder. One of the tools used to assess attention deficits is the computerized continuous performance test. On such tests, variability is one of the most consistent indicators of a problem! This variability may be said to have a fractal property, in that it is similar on all time scales used to look at it. We also find that clean, single diagnoses are rare, particular in the case of attention problems. Children meeting criteria for Attention Deficit Hyperactivity Disorder are likely to also have Oppositional-Defiant Disorder (60%), anxiety disorders, depressive disorders, or Conduct Disorder (Biederman [1992]). This does not even consider milder conditions such as dysthymia (chronic, mild depression), specific sensory processing problems, sleep disorders, elimination disorders, teeth grinding, and Tourette Syndrome. With such a high degree of overlap of different disorders, is it not more correct to regard ADHD as intrinsically heterogeneous? Such heterogeneity poses a problem to the disease model. We would like to shift the spotlight to the word Disorder as being the central descriptor, and one which governs our thoughts with respect to remediation.

The heterogeneity posited above does not even deal with other neurological conditions that also have attention deficits among their symptoms, such as traumatic brain injury, birth injury, ischemic attacks in the elderly, chronic fatigue syndrome, and the consequences of immune dysfunction in women with silicone breast implants. In fact, many disorders of interest to psychologists and psychiatrists involve attention problems. It may almost be said that when the brain is not well, it does not pay attention well. We have found that EEG biofeedback training is helpful generally with attention problems, even when they are traceable to organic conditions such as these.

3) EEG BIOFEEDBACK: SELF-REGULATION TRAINING

A larger and more fitting perspective for EEG biofeedback starts with consideration of the healthy brain, one which has the versatility to modulate arousal states and attentional styles as the immediate situation requires. The competent brain must be able to navigate at will all the way from high-vigilance states to restful respites, and from narrowly focused activity to broad and inclusive focus. In the disordered brain, this ability is diminished to some degree, or brain function is compromised by discontinuities in cortical processing, or breakdowns in intra-cortical communications.

The EEG reflects first and foremost the state of arousal in which the individual finds himself. EEG biofeedback training, by favoring specific frequency bands, can "move" a person to a different arousal state in the general case, provided that the person is willing merely to "try to train".

Clients are liberated from dependency on all types of medication which modulate arousal, including anti-depressants, stimulants, sleep medications, pain medications, anti-anxiety medications and alcohol.

Moving a person to a different physiological state may benefit him in terms of the experiences he may have in that state, or in terms of an enhanced ability to navigate among different physiological states autonomously. Also, exercising the ability to maintain a particular state tends to reinforce and stabilize the mechanisms by which various states are maintained. These abilities need have little to do with pathology. In fact, these abilities are greater, and can perhaps be enhanced even more, in the more mentally competent person.

Whether someone derives benefit from the training therefore has little to do with any traditional diagnostic categories of mental disorders. The training accomplishes three essential tasks, in our view (for which a case will be made in what follows):

1) It enhances the ability of the individual to access and maintain different states of physiological arousal; 2) it enhances and supports the mechanisms by which the brain manages cortical hyperexcitability; 3) it reinforces equilibrium states, i.e. homeostasis.

With respect to the first, EEG biofeedback training enables remediation of disorders of arousal such as anxiety and depression; promotes entry into diminished arousal states of alpha and theta; and increases the inventory of attentional states (from narrow to broad focus). EEG training makes a unique contribution here, insofar as traditional biofeedback approaches have tended to address mainly conditions of overarousal and adverse stress reactions such as anxiety, hypervigilance, and panic disorders (all typically lumped under the rubric of "stress management"). EEG training also addresses conditions of underarousal such as genetically based (endogenous) depression and that which results from trauma (reactive depression) with equal facility. The efficacy for ADHD can also be seen in terms of remediation of an underarousal condition.

With respect to enhancement of stability conditions (2), we can identify several "degrees" of instability for our purposes: In the most extreme case, EEG training stabilizes the brain against chaotic excursions into pathological states such as seizures, rages, and migraines. Secondly, it stabilizes the brain against more minor excursions which manifest themselves in such phenomena as temper tantrums, night terrors, vertigo, sub-clinical seizures, ordinary headaches, motor and vocal tics, obsessive-compulsive behaviors, episodic dyscontrol (out-of-control behavior such as rages), panic attacks, bipolar disorder, and PMS. Thirdly, it stabilizes the brain against the even lesser disruptions and discontinuities of cortical function which manifest in disturbances of attentional mechanisms, of sequential and parallel processing, of visual and auditory processing and memory, of other specific learning disabilities, and of the normal sequence of sleep stages.

With respect to reinforcing homeostasis (3), the training achieves normalization of the pain threshold, normalization of appetite, and normalization of the blood glucose level. The stabilization of arousal level already discussed in (1) above can also be viewed as a return to homeostasis. The best evidence of the power of this tool may be seen in the fact that clients are liberated from dependency on all types of

medication which modulate arousal, including anti-depressants, stimulants, sleep medications, pain medications, and anti-anxiety medications, including those we select ourselves, such as alcohol.

When EEG biofeedback is tried by the mentally competent person, he augments his mental skills and his range of control further. Biofeedback, at its best, is empowerment of the individual.

When EEG biofeedback is tried by the mentally competent person, he augments his natural mental skills and his range of control further. What is this worth? That is not for us to say, but we can provide information about choices to the person training, and let him make that decision. Biofeedback, at its best, is empowerment of the individual. We are simply the agency of that empowerment.

An analogy may be useful here: When Klaus Tennstedt was first offered the opportunity to conduct the Vienna Philharmonic, he was asked by a reporter: "I guess you won't have to rehearse very much with the Philharmonic?" "On the contrary", came the reply, "with that instrument at my disposal, just think of the possibility of refinement, of nuance, that is not possible with ordinary orchestras. We will rehearse more, not less." Thus with EEG biofeedback.

EEG biofeedback training, when done well, takes into account the heterogeneity of the candidate population and adjusts the training appropriately. In the case of all generalized diagnoses such as depression or ADHD, we must assess who the person is who has been so diagnosed, and we must characterize the individual in terms of patterns of physiological arousal and attentional style. We must know his family and genetic history, and any history of trauma. Out of all this comes a preferred starting training protocol. This initial approach is tried during the intake session. We then teach the individual to observe himself so that he can be a witness to the impending changes. At the next training session, we ask about the results which have been achieved. In at least forty percent of cases, the person will have something to report which is clearly traceable to the training in that first session: sleep may have changed; mood or irritability may have changed;

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alertness and school behavior may have changed. This allows us to judge within three training sessions (in most cases) that we are on the right track; otherwise we change protocol. The multi-dimensional assessment we do on a session-by-session basis is the home turf of the qualified psychological or educational professional. Success is also aided by an informed, self-aware participant, who in fact ends up bearing the primary burden for a successful outcome.

He completed the training at 32 sessions. His Wechsler IQ score improved from 90 to 127. He improved four grade levels in reading.

An example or two may be helpful here. A boy of 15 came to us for problems of attention and reading. He had exhibited early hyperactivity, for which he had taken Ritalin for two years. He had also had a lot of other support, including psychotherapy and educational therapy. At session six, he reported that was able to pay attention better in school. At session twenty, he reported his best grades ever. At session 22, he said he was more organized; he established a budget for himself; he dismissed his tutor, and organized his own homework schedule. He completed the training at 32 sessions. His Wechsler IQ score improved from 90 to 127. He improved four grade levels in reading. He went from borderline to superior according to the Benton Visual Retention Test. He went on to a highly academic, residential high school which would not have even considered his application the way he was performing before the EEG training. The clinical psychologist who did the testing on this boy reported that he had never seen a more dramatic improvement in test scores in twenty years of working with learning disabled children. (He encountered many more surprises as he tested additional children who underwent the training.)

We did only one kind of training with this youngster, yet a variety of good things happened. The implication is that these are connected causally in some way. When the boy's brain had a diminished capacity to pay attention, he also manifested poor reading ability, and poor visual memory. When we worked to train "self-regulation of arousal", all of these problems remediated jointly. Not only are these conditions all remediable, which is startling enough, but they are all connected! It is a heady realization.

EEG training can confer generalized benefits for mental functioning in terms of alertness, attention, vigilance, and physiological arousal

The second case provides some additional insights. We worked with a nine-year-old girl with attention, learning, and speech problems. After making significant progress with attention and various learning difficulties, the educational therapist observed that we were not helping her speech. Was there anything else we could do? We decided to try training at Broca's Area, the part of the brain identified by the French neurologist Paul Broca as associated with motor speech. After a single training session at Broca's Area, the girl happened to talk on the phone with her grandmother, who exclaimed to the mom: "This is the first time I have been able to understand my granddaughter!" After a few more sessions, the speech therapist called up the educational therapist. She wanted to know what was going on. She had been working with the girl for more than nine months, making only modest progress. In fact, she had just tested her a few weeks before, and now had tested her again. The girl had made three years' progress in speech development in just a few weeks. The speech therapist was unable to account for the sudden progress. The educational therapist then told her of the EEG training. Here is a case in which a sequence of training protocols was cumulatively helpful, and in which a localized cortical function could then be helped by training at the appropriate cortical site. We have since seen many instances of improvement of specific functional deficits with "localized training" in cases of stroke and head injury as well.

It is apparent that EEG training can confer both specific benefits for certain deficits and generalized benefits for mental functioning in terms of alertness, attention, vigilance, and physiological arousal. Whereas these benefits are most striking in those who have the most obvious deficits, they are also discernible in those who are functioning adequately already, and who find their mental skills, the brain's energetic reserve, and their emotional resilience enhanced. The fact that EEG biofeedback training remains optional for such folks does not detract from the intrinsic significance of this claim. EEG training should be seen as education of the brain, and the brain that is more highly capable of learn-

ing is in fact in a better position to take advantage than the severely disabled brain. As we move in the direction of peak performance, however, we gradually lose our moorings in terms of our ability to monitor progress by conventional tests. We move even more in the direction in which the trainee himself perceives that he is functioning better in his life, or is managing his challenges better. A mountain climbing analogy comes to mind. At the outset, the instructor leads the climb, and the student follows. Ultimately, the student leads the climb, and the instructor follows.

EEG training should be seen as education of the brain, and the brain that is more highly capable of learning is in fact in a better position to take advantage than the severely disabled brain.

4) PROVING VALIDITY OF EEG BIOFEEDBACK IN THE MEDICAL MODEL

In the present climate, in which a predominant medical paradigm still clings to the notion that disorders are essentially hard-wired and therefore intrinsically immutable, part of our biofeedback community feels compelled to legitimize itself by conforming to the traditional medical model. They seek to show that a one-to-one correspondence exists between specific disorders such as ADHD and specific parameters in the EEG, and that these specific parameters change with training in a predictable way. This certainly has not been shown to be true, and it may not even be true.

we have observed dramatic recoveries from lengthy histories with PMS syndromes

We deal with many conditions that are not associated with any known features in the EEG. A particularly good example is PMS, where we have observed dramatic recoveries from lengthy histories with PMS syndromes. Since this is perhaps startling, let me recite a couple of case histories.

One woman came to us with multiple symptoms, including all the symptoms usu-

ally associated with PMS (which she has had her entire adult life). She said it was as if she was going into labor every month. She found her condition disabling. Asked how her symptoms affected her life, she answered "these symptoms are my life". After about forty EEG training sessions, she was essentially symptom-free, as documented with daily symptom checklists. Later she called to say that her period sneaked up on her—she had no awareness it was coming. Her daughter came to us for severe PMS symptoms as well, and the outcome was the same, but with fewer training sessions.

Another woman with disabling PMS symptoms of long standing came to participate in our clinical study on PMS, which stipulates a program of 24 training sessions. She quit after nine sessions. She was now symptom-free, and had taken a full-time job. "I no longer have time to continue in the study", she said triumphantly.

A third woman came to us long ago for migraine headaches. We did our usual thing, and got rid of her migraines. Her PMS symptoms, which were not under discussion at the time, remained untouched. Later, after we had established efficacy for PMS, we asked her back to try the appropriate protocol, and she responded to the training. The protocol we have used is essentially the same in all cases of PMS, regardless of what the EEG looks like. And most of the EEGs in fact look fairly normal. There is no known EEG correlate of PMS. One may be found eventually, but we will not discontinue our successful intervention to wait for that day. If the training works, we don't need a manifest EEG anomaly to justify our intervention. Many modalities are in use for which the mechanism remains obscure. It is quite generally true that clinical progress drives research, not the reverse. No apologies need be made. These observations are more evidence that we are training a brain mechanism; we are not training overtly to normalize the EEG, even though that may be an outcome.

Not even neurologists abide by the strictures to which our besieged EEG biofeedback practitioners feel themselves bound. Would neurologists support diagnosing epilepsy on the basis of the EEG? It may be surprising to know that they do not. If children's EEGs were to be measured to see who might be epileptic, an enormous number of false positives would be identified. And if a normal EEG is seen in a child with a manifest seizure history, the neurologist will not let the EEG override the phenomenology. According to George B. Murray, authority on complex partial seizures at the Harvard Psychiatry Department, "The EEG

manifestations of complex partial seizures do not usually appear with Cartesian clarity. . . . The scope of the EEG manifestations can be as broad as the entire field of EEG" (Murray, 1981). This is not auspicious for a diagnostic. Further, the neurologist would not determine which anti-convulsant to use on the basis of the EEG. Most of all, he would not quit using the anticonvulsant just because it failed to result in normalization of the EEG! In fact, most anti-convulsants have only a minor, if any, influence on the EEG. And Ritalin has no effect at all on the EEG of ADHD kids! The irony is that if the administration of Ritalin were governed by these restrictive standards, there would be almost none prescribed! By setting EEG standards for the practice of EEG biofeedback, we are not preparing the ground for acceptance by the medical community as much as we invite its ridicule.

Asked how her symptoms affected her life, she answered "these symptoms are my life". After about forty EEG training sessions, she was essentially symptom-free

Worst of all, an infatuation with EEG anomalies—of which only the most extreme are identifiable by current methods—constrains the field to an unfortunate focus on pathology. This focus is not all bad—that is how most of us make our living. But many of us see the larger potential of EEG training for the already competent or functional brain: to the "gifted but learning-disabled" child; to the highly successful engineer who now snores heavily at night and exhibits sleep apnea episodes; to the corporate executive who would rather nap in the afternoon than face his schedule; to the gifted artist whose knees turn to butter during auditions, or whose hands turn sweaty during piano recitals; to the pentathlete who needs to calm himself rapidly to fire his weapon after running or skiing; to the long-distance shooter in basketball who cannot get himself out of a slump; to the writer whose creativity is undone by too much alcohol. There is no framework for this which is consistent with the medical model.

The field of medicine insists that any new approach must be validated by controlled studies in which neither the researcher or the subject is influenced by extraneous factors beyond the therapeutic agent being tested. Hence, both researcher and

subject must be "blinded" with respect to what is happening to them, to eliminate subjective effects and tester bias. Also there must be controls, in order to further validate the "neutrality" of the test itself, and to measure placebo effects. One significant problem is finding control groups for many of the conditions we work with: cerebral palsy, traumatic brain injury, stroke, and epilepsy. The patterns of deficits in these cases are unique to the individual, and not uniform over a larger group of subjects. Even with ADHD, where control groups are at least possible, they usually are defined narrowly, which leaves out most of the interesting cases, namely those which also involve other learning and behavior problems.

A more basic problem is that of maintaining subject and researcher blindness. EEG training cannot be done without intelligent guidance by the therapist, who must set reward criteria intelligently and monitor progress for the purpose of any mid-course corrections in terms of protocol. And the subject is clearly part of the process, and is actively engaged in it. He cannot be blind to what is happening, since this is a learning process, not a unique way of infiltrating a better drug. Attempts are sometimes made to give the individual someone else's EEG to train on. This is called "sham training". Unfortunately, the subterfuge is too easily discovered. And the changes with the training are too profound to be ignored. Soon everyone knows it's real, and can discriminate between that and the sham training. The problem is similar to the one encountered in China, when they tried a controlled study of the presumed health-giving effects of garlic. It was obvious to everyone who was getting the real garlic, and who was getting the fake stuff! So much for blind studies of biofeedback.

Evidence of the body's own healing response is marbled throughout medical research. It is the skeleton in their closet, the noise in their system. By contrast, self-healing is what biofeedback is all about. For us, self-healing is signal, not noise.

There is an even more fundamental methodological problem with controlled

studies of EEG biofeedback. The key driver for such studies of drug efficacy is not merely to control for tester biases, but rather to distinguish the real effect of the drug from the ever-present "real" placebo effect, namely the subject's physiological response to the proverbial "sugar pill". Ullman and Sleator (1986), in a double-blind placebo-controlled crossover study of Ritalin, found 18 subjects (out of 118) who made 50% improvement on teacher rating scales with a placebo, which matched their improvement on Ritalin. On the basis of this finding, they recommend that all children considered for medication be tried on a placebo first. The "real" placebo effect is so strong that the best medical studies incorporate a placebo washout period to identify the placebo responders before the subjects are assigned to treatment and control groups. Evidence of the body's own healing response is marbled throughout medical research. It is the skeleton in their closet. It is the noise in their system.

Biofeedback is not something we do to a person, it is something the person does to support and strengthen his own brain's intrinsic competences for self-regulation

By contrast, self-healing is what biofeedback is all about. For us, self-healing is signal, not noise. Why would we want to control for it? Are there good and bad kinds of self-healing? Biofeedback is not something we do to a person, it is something the person does to support and strengthen his own brain's intrinsic competences for self-regulation. The only burden on us is to determine whether learning is in fact occurring, and we do that by testing.

5) PROVING VALIDITY OF EEG BIOFEEDBACK IN THE EDUCATION MODEL

If we shift our perspective on EEG biofeedback and regard it from the standpoint of learning and education rather than curing a disease, efficacy can be established the same way we evaluate all learning, namely by testing performance. This approach also allows for a measure of control of researcher bias, in that one can have the testing done independently. This we have done in all of our studies. Whereas testing is the way in which we

should measure progress and prove ourselves to the rest of the world, the biofeedback therapist does not have to wait for post-training test results to confirm that something has been accomplished. Again, if good feedback is being given, such confirmation comes on a session-by-session basis, as the client (or the parent) reports the changes he observes.

Nothing we have learned to date about EEG biofeedback was initially established by controlled studies. It was and remains simply a matter of good, skilled observation. Controlled studies are best used to validate what has already been demonstrated clinically.

Focusing on EEG biofeedback as an educational tool completely changes the terms of debate. For example, teaching one chimpanzee sign language says something about the capability of chimpanzees. No one would insist that we now do a double-blind and controlled study to rule out the possibility that we were misled, or that we happened upon a chimp with unique gifts. In fact, we don't use such studies to prove the ability to learn in any respect whatsoever. When a yogi was able to survive for several hours in an air-tight refrigerator without depleting the reservoir of oxygen (an experiment which would have killed anyone not so trained), he demonstrated that he had learned to regulate his metabolic rate. We don't need the evidence of hundreds of yogis to persuade us when one will do nicely. It is a matter of perspective whether one regards this finding as being of marginal significance or central. Western medicine has always regarded it as marginal. We regard as central to what we contend: man can learn to modify his physiological function.

Focusing on an education model also dispenses with the canard of the infamous "placebo". Whereas drugs have to be proven to be "better than placebo", that does not apply to learning. If learning has been demonstrated, no one would aver that the event occurred by virtue of a placebo effect. In other words, each instance of learning counts. We don't have to meet a statistical standard. Let me cite another example. Parents brought a child with cerebral palsy to one of our offices in a stroller. He was 2 1/2 years old, and had never expressed any interest in his legs, according to the parents. After a mere ten training sessions, he was walking from one side of the waiting room to the other. Learning had occurred. Now it would be churlish to insist that we must succeed in this at least 75% of the time before such an approach would be considered of interest. People line up for fertility procedures which have a demonstrated success rate of two percent, and they pay good money for them.

6) EEG BIOFEEDBACK: PATHWAY TO PEAK PERFORMANCE

Many are startled by the broad claims that we and others have made for the EEG training technique. Our objective was to compel the professional community to break out of compartmentalized thinking, to shift from a fixation on specific disorders to a focus on process. Nevertheless, it is the number and breadth of claims with respect to various disorders that elicit skepticism, and the message about process may be getting lost. I daresay that everything we have claimed to date will eventually be confirmed even by the standards that others may set. Even now, however, all the individual "claims" are mutually supportive of the underlying message of brain "responsivity", and of biofeedback as an effective tool for eliciting it. The essential message is that the biofeedback training, seen as a tool with general applicability, should have a favorable impact on a variety of mental disorders which have the common elements recited previously: lack of control of arousal level; lack of flexibility of brain state; and diminished cortical stability. (We make no claims for all the others.) Moreover, with respect to the hope we hold out to people in these regards, the watchword is progress, not perfection; remediation, not cure.

By teaching the brain the skill of paying attention it moves ineluctably toward a condition of homeostasis, i.e. its proper thermostat settings. Breathtaking.

Barry Sterman did not discover some unique feature of epilepsy which allows it to respond to his protocol. Joel Lubar did not discover some idiosyncratic feature of ADHD which renders it susceptible to remediation by training. And Eugene Peniston did not discover a unique characteristic of alcoholism that causes it to yield to our ministrations. They all discovered aspects of the intrinsic plasticity of the brain, its ability to learn about itself, which is one of its most basic capacities.

The first person to appreciate the generality of the method was perhaps Les Fehmi, who found that the entire enterprise of EEG biofeedback could be understood in terms of how the brain pays attention.

Significantly, he is able to elicit similar transformational experiences reported for biofeedback through verbal channels, by employing only the language of attention. By teaching the brain the skill of paying attention, either verbally or by biofeedback, it moves ineluctably toward a condition of homeostasis, i.e. its proper thermostat settings. Breathtaking.

Without a doubt, the research of Joe Kamiya and Les Fehmi, and the controlled studies of Barry Sterman and of Joel and Judith Lubar were necessary to establish the field. Without them, progress in this field would have been much delayed, perhaps by a generation. However, once a new paradigm is established, inductive methods may be more fruitful. After twenty-five years, Sterman has done biofeedback research only on epilepsy; and after twenty years Lubars have worked only with ADHD. Building on what has been done, clinicians are now expanding the field with a necessarily more comprehensive vision, and are discovering how all of these findings connect.

After he achieved mastery over his EEG in the comfortable setting of our office, he was then able to handle the challenge of failure in his skeet shooting.

This larger view of EEG biofeedback is not "revealed truth", and it is not innate wisdom on anybody's part. It has compelled itself on clinicians by virtue of results that were being obtained with clients. If one is doing EEG biofeedback well, these results happen. They are not always favorable. However, if undesirable results are being obtained, they simply call for redirection of the training strategy. We educate the client to anticipate a range of results. When these results are experienced, the client reports them, and we make mid-course corrections where required. Gradually we proceed from dealing with the most egregious symptoms to the more benign. The client progressively learns about himself, and is thus empowered.

With reference to ADHD, for example, this means that there is no single protocol for ADHD, or even two; there are many. The condition is not monolithic, and there are many etiologies. Answering the question of whether the person is ADHD is just the beginning of our inquiry. With regard to all the subsidiary issues, we are guided both by

testing and by thorough interview. The EEG data obtained then adds a final bit of information that may confirm what we have already determined (or it may even conflict with it). This the neurologist already knows. In his realm, an EEG can only confirm a diagnosis of seizure disorder; it can never overrule it.

The EEG training is a matter of increasing the person's competence sequentially and incrementally. An analogy I find amusing is to increasing the "flight envelope" of an aircraft: higher ceiling (peak performance); higher g-turns (stress tolerance); and lower landing speed (ability to relax from a vigilant state). This does not entail a single approach, but usually several. As key issues are resolved with a particular protocol, subsidiary issues come to the fore. They will usually require a different approach. When the training is done well, the brain wants this new competence.

An example of work toward "peak performance" may be helpful. A successful insurance executive came to us regarding his son, who needed our help. Once he understood what the training was about, he became interested for himself as well. As he watched the EEG parameters dance before his eyes, he noticed that he had difficulty mastering a particular challenge, one having to do with anxiety. The more he tried, the worse it got. Being a man used to bending the world to his will, it was intensely frustrating to be confronted so ineluctably with his failing. He learned that he needed to "back off" a little, and "allow" the anxiety measure to subside. He could not force it.

He then realized that this had relevance to his skeet shooting, where he was very competitive. Once he missed a skeet, he would become anxious, and would do worse on subsequent pulls. His performance would spiral downward relentlessly. Being aware of the pattern, there was no solution but to maintain a perfect score. Once he started missing, he would anticipate the pattern of subsequent failure; anxiety would set in, and he would of course then continue to miss targets. After he achieved mastery over his EEG in the comfortable setting of our office, he was then able to handle the challenge of failure in his skeet shooting. He later reported to us that the training was helping him master many professional challenges as well.

7) A NEW REFORMATION

Whereas our secular culture is fond of pointing out the superiority of Galileo's "scientific" approach with respect to the doctrinaire posture of his critics, the bishops of Rome, it is now the standard scientific

ic model (read "medical model") which holds dominion comparable to the authority of the Church in Galileo's day. It is now conventional scientists who are refusing to look through the telescope, and in fact have consistently refused to look through it for twenty years. Their dilemma is the same as that of the bishops: they would not know how to process what they might find in terms of their prevailing view. It is therefore best not to look.

The case can be made that we are in a second period of Reformation. By now we take the first one for granted. We surely find it difficult to imagine a time when ecclesiastical powers had complete authority over matters spiritual, and these were, of course, matters of life and death. Forgiveness of sins, which was essential to achieving eternal salvation, was dispensed by the priest, sometimes at a price. The sale of such "indulgences" offended Martin Luther, who found no support for this in the Latin scripture. He proclaimed that in respect to one's ability to approach God, all believers were in effect priests, and that all could ask for forgiveness directly. He also translated the Bible into the vernacular German, so that the ordinary parishioner could educate himself on these matters. This Reformation brought about a major power shift to the individual: he bore responsibility for his own spiritual welfare.

In this atomized and mobile world we must of necessity become the essential repository of wisdom about ourselves. This shift of responsibility to the individual will be dramatically accelerated with the new mind technologies.

In our Second Reformation, we will take responsibility for our own health much in the way that we already regard ourselves responsible for decisions respecting our religious and spiritual life. Just as the Bible is accessible to everyman, medical information can be understood by the lay person at least to the point at which he can make the appropriate decisions regarding treatment options. In this atomized and mobile world, where a long-standing relationship with a traditional family doctor is unlikely, we must of necessity become the essential repository of wisdom about ourselves. And taking responsibility for our own health will in fact have its own health-promoting effects.

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THE INSIDE EDGE ON PEAK PERFORMANCE

This shift of responsibility to the individual will be dramatically accelerated with the new mind technologies. Here the individual is very much in the driver's seat, and his skills at self-monitoring are gradually enhanced, with or without the aid of a therapist. The engagement with mind technologies will lead to a breakdown of the compartmentalization of diagnostic categories. It will diffuse the boundary between "normal" and "abnormal". It will give the individual non-medical, non-invasive options for dealing with mental shortcomings. And it will lead to a fuller utilization of one's potential, as brain training options are explored. The model for this is education, not medicine. We learn, we test, we challenge ourselves, and we explore some more. The fact that the field of medicine has totally dropped the ball on this will only speed our liberation.

Since the vision outlined above may be seen as threatening to the prevailing power structure, it is prudent to inquire whether we may be walking not in the footsteps of Martin Luther, but rather in the footsteps of John Huss, who was burned at the stake for his heretical views. Here I take solace in the example of "glasnost" in the Soviet Union. With the availability of the international telephone, the fax machine, the personal computer and its printer, mind control by the Communist Party was doomed. And just as the Revolution in the United States helped to kindle that of France, what happened in Russia gives us courage to confront our own domestic tyrannies.

The training at low EEG frequencies has an integrative function which persons almost invariably describe as a feeling of intense well-being.

Tyrannies? I have so far used the language of science, but the real issue, of course, is power. It is simply that the medical establishment has arrogated to itself the language of science to support its hegemony. With the publication of the book *Listening to Prozac*, a larger horizon opens up for the use of psychopharmacology, one which also extends beyond the classical diagnostic categories and clinical populations. There is the prospect of medical management of mood states of large segments of the population. And there is the push from a market for Prozac which

already exceeds \$1 Billion per year.

Whereas application of EEG biofeedback to clinical populations could become a "turf" issue among professions, that should not be the case for those who don't meet diagnostic criteria for dysfunction, which is even more the province of self-regulation techniques. We are able to routinely liberate people from dependence on Prozac with EEG training. How much more readily that should be possible with those who now take it simply to expand their mental competence, as opposed to dealing with clinical depression.

And if the society faces a choice of long-term use of mood-altering medications or of promoting self-regulation techniques, it is not merely our own sense of self-importance which causes us to prefer the option of self-regulation. It is important that the society be aware of this option before it succumbs to the seductive beckoning of a life with Prozac. (Once the Serbs are sitting in Bosnia, it's harder to get them out.)

The experience often is accompanied by major personal transformational shifts. The training creates the environment for an encounter with one's essential self.

EEG biofeedback has been shown to remediate addictions such as alcoholism. In this application, it has essentially no competition. The conventional approaches to alcoholism have an abysmal record. Much of alcoholism can legitimately be seen as self-medication for anxiety conditions. The brain ultimately adapts to the regular alcohol infusion and becomes dependent upon it. The same thing happens with prescription anti-anxiety agents. If anything, these are more highly addictive even than alcohol. EEG biofeedback is able to remediate the underlying anxiety condition, and to allow the individual to recover appropriately from his dependency. Thus, wherever the field of medicine takes an expansive view of its role in mental health, we evidently have a self-regulation alternative.

In the work with addictions, there appears to be a division between populations in which the chemical dependency is mainly physiological, and in which the addiction is maintained as a self-medication for deep psychic trauma, perhaps early in life. In the

latter case, training toward lower EEG frequencies, corresponding to states of reduced arousal, of decoupling from the outside world, and of internal focus, appears to have a special healing quality. In these states, which are alpha- and theta-dominant, there is opportunity for the wounded, non-verbal right brain to be heard without the censorship of the verbal left. Imagery relating to the prior trauma may surface, and may now be viewed from the perspective of the mature and adult brain. The underpinnings which sustain the addiction may be dissolved. The transformations observed in the course of such training are profound. The training should therefore be guided by suitably trained therapists.

The same training is also of profound implications for those who have no addictive propensities. The training at low EEG frequencies has an integrative function which persons almost invariably describe as a feeling of intense well-being. The training is anchoring in its effect, and it trains us in those momentary respites of relaxation that come between bursts of high demand activity. The brain, at its best, performs effortlessly. As Les Fehmi has taught us, we have really learned a task when we can do it in alpha. The training is a counter to our natural societal tendencies toward narrowly focused activities. Training the brain for peak performance is not complete unless the person can also readily navigate in alpha.

The combination of existing clinical wisdom with this tool is revolutionary in its implications for the future of mental health, and for the intellectual and spiritual journey that we are all on.

In addition to training brain competence, the experience of low arousal states often is accompanied by major personal transformational shifts. We observe that the individual undergoing such transformations almost invariably sees the shift as toward his essential self. The transformations are not random or chaotic, and therefore need not be anticipated with dread and uncertainty. The training creates the environment for an encounter with one's essential self.

8) SUMMARY

Three views of EEG biofeedback have been presented. One is oriented toward the remediation of pathology, based on established clinical categories of disorders. The second is based on increasing the competence, versatility, and stability of the brain generally. The third employs EEG biofeedback as augmentation of psychotherapy, and as a tool for discovering our essential selves.

The orientation toward mental disorders portends trench warfare against the prevailing medical establishment, disorder by disorder, drug by drug, and it promises contentious interactions with other health disciplines who consider their turf invaded. An orientation toward a general increase in brain competence and self-regulation is more appropriate to the underlying phenomenology, avoids the compartmentalization of mental disorders, and opens up the promise of benefit to the many who do not meet clinical criteria for "disorder" but can still manifestly be helped by the training. It augurs in a time of focus on health and peak functioning rather than on disease and disorder; an orientation toward education rather than toward treatment.

I have presented above, in the most concise way I know how, a more comprehensive vision of EEG biofeedback, which will hopefully empower not only the biofeedback clinician but also the interested reader to wrest

this technique from the hands of the exclusively left-brained researchers and make it his own. The combination of existing clinical wisdom with this tool is revolutionary in its implications for the future of mental health, and for the intellectual and spiritual journey that we are all on. At its best, biofeedback aids function, not merely dysfunction. In the hands of the humane and supportive clinician, it gives flight to the soul.

"Tradition teaches that soul lies midway between understanding and unconsciousness, and that its instrument is neither the mind nor the body, but imagination. I understand therapy as nothing more than bringing imagination to areas that are devoid of it, which then must express themselves by becoming symptomatic."

—Thomas Moore, *Care of the Soul*

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THE MEGABRAIN INTERVIEW:

INFORMATION, ATTENTION AND BRAINWAVE SYNCHRONY—Lester Fehmi, Ph.D.

It's been well over a decade since Les Fehmi first hooked me up to one of his multi-channel Biofeedback Brainwave Synchronizer EEGs. Back then, I knew little of Les's work (this was a result of my own ignorance, since at the time Les was already widely known and highly respected in the field of EEG biofeedback, and in fact I had made contact with him because on several occasions other clinicians and researchers in the field had told me, "Go talk to Les, he's doing really exciting work!"). In several lengthy phone conversations, Les laid out for me his ideas and discoveries regarding EEG brainwave biofeedback, brainwave synchrony, Open Focus and the key importance of attentional flexibility. It was an intriguing constellation of ideas and information, but it didn't really fall into place for me until I went to his New York office. There, Les attached the electrodes of his Biofeedback Brainwave Synchronizer to me, told me that the key to getting feedback (a beeping noise and a flashing strobe light) was "effortlessness," and left me alone.

Effortlessness, of course, is no easy thing. But after long minutes of intermittent bursts of elusive feedback (causing the classic "Here I am! . . . wasn't I" response), I seemed to almost accidentally fall into a zone that produced almost constant feedback (unless I tried to analyze what I was doing to get the feedback, at which point it would of course instantly cease). It was a zone in which I felt simultaneously blissful and excited, peaceful and exceptionally alert—

though the alertness was of a global or Open Focus sort, rather than narrowly focused. I emerged with an energy and sense of mental clarity and sensory acuity that was something like the feeling I got after a long session in a flotation tank, though this had taken only 20 minutes. However, I have to admit my first thoughts were covetous; Thinking "I've got to have this machine!"

OPEN FOCUS

In the accompanying interview, Les Fehmi describes his discovery that imagery or feelings involving space, or "objectless imagery," was the single most effective tool for producing whole brain synchrony. "Instead of focusing attention on some object," says Fehmi, "we expand our attention to limitless, timeless space. And as we experience space more intimately, we deepen the absorption of our attention in the totality of present experience. And this experience of expanded and intensified awareness is basically what many people describe as the experience of enhanced synchronous alpha production."

This synchronous state, which Fehmi dubbed Open Focus, "is correlated experientially with a union with experience. Instead of feeling separate and narrow-focused, you tend to feel more into it—that is, unified with the experience, you are the experience—and the scope of your awareness is widened a great deal, so that you're including many more experiences at the same time. There's a whole-brain sensory integration going on, and you become less self-conscious and you function more intuitively."

Fehmi's explorations of objectless imagery led to his development, with associate Dr. George Fritz, of a series of taped inductions called the Open Focus tapes. These various inductions, some only a few minutes long, others nearly a half hour, some designed for relief of pain, another for sports training, guide the listener through a progressive widening of attention.

When you listen to the basic Open Focus exercise, what you hear is a voice asking you a series of questions that begin with the words, "Can you imagine. . . ?" You begin with an expansion of awareness in your head that ultimately moves you beyond the limits of your own body to an awareness of everything within you and around you. The experience ends by having you imagine that you can enter this Open Focus state any time you wish, and you'll find that after you've gone through the exercise enough

times you can learn to enter the open focus state at any time, simply by remembering what it feels like and by intentionally being there. Most importantly for users of mind tools, the open focus state adds an extraordinary dimension to the use of any mind machine.

Once you have learned to enter the Open Focus state quickly, on demand, you can begin all of your brain tech experiences with a quick state change by first putting yourself into the Open Focus state, and then moving on to whatever else is your primary purpose, such as accelerated learning, sports performance training, self-suggestion, self-healing, etc.

Once you can move into Open Focus freely and quickly, you will find you have gained what Fehmi calls "attentional flexibility," or the ability to move freely among attentional states. For example, the attention training you acquire in learning Open Focus processing, Fehmi has found, also provides a "renewed capacity for narrow focusing. Persons complaining of an inability to concentrate, listlessness, diminished sexual activity, diminution of work productivity and depression find their narrow focus skills returning after some period of Open Focus practice. By releasing the effort associated with chronic narrow focus, narrow focused activities can be renewed with clarity, enthusiasm, and diminished stress." By practicing Open Focus with your mind tool, you can return to your daily activities with renewed capacities and energies, as well as greater control over your mental and physical states.

OPEN FOCUS EXERCISE

Here are some excerpts from various Open Focus exercises developed by Les Fehmi and George Fritz. To explore the experience yourself, have a friend read it to you, or read it onto an audiotape, allowing at least fifteen seconds for each image. I have suggested this pause with ellipses (. . .). As you record it, or have your partner read it, repeat the phrase, "Can you imagine the space between . . ." or "Is it possible for you to imagine the distance between . . ."

Ultimately I was able to use one of the machines in numerous Megabrain Workshops throughout the 1980s, and was able to hook up and observe the sessions of over a thousand people. It was interesting to watch. On many occasions, people with years of meditative experience would confidently begin their session and you could see their neck veins bulge as they tried harder and harder and with increasing frustration to attain the effortless mind state that is a key to brainwave synchrony. Many people with no meditative experience could sit down and immediately "get it," producing solid feedback no matter how high I raised the threshold. Invariably, when asked what they did to produce the feedback, they would say something

like, "Gee, I don't know, I just was doing what I call 'wool-gathering,' like when I stare into the fireplace," or, "I just saw purple." On occasion I would look at someone producing good feedback on the machine and find tears flowing down their faces. When I asked them if they wanted to end the session they would protest and say that their tears were tears of joy, or bliss. —MH

MBR: Les, why don't you tell us a bit about how you got into biofeedback and particularly EEG biofeedback.

LF: Okay. The critical step was research into information processing in monkeys that I did at the Brain Research Institute at UCLA with Joel

Adkins and Donald B. Lindsley, who is, in my view, the father of physiological psychology. Basically, we trained monkeys to respond to very brief flashes of information and then did various things to interfere with that information in order to determine what the code was for visual information processing in the nervous system. What happened was that we could interfere with almost the entire evoked potential. If we worked from the back end of it forward we could get to the point where we only allowed a very thin sliver of information through to the monkey's cortex, maybe 8 or 10 milliseconds worth of information. And with that little information—all the rest of the evoked response obliterated—the animal could still do 100 percent!

As the research progressed it became clear to me that the neural code for information in the visual system, at least, was not a temporal code, which would require many more milliseconds to unfold for all the varied kinds of information available in the visual system, but was based on *simultaneous, spatial or parallel processing*.

MBR: Synchrony...

LF: Yes, that research was the first link for me to synchrony. Because as I continued, it slowly dawned on me over time, that *information required simultaneity of activation*. Synchrony. That is, what tells the brain that a diamond or a square or a triangle is present is a number of nerves firing simultaneously, or synchronously. What I found, in other words, was

." before each image (i.e. after each ellipsis). To save space, in the exercise below, I have used this "Can you imagine" phrase only once at the beginning of each section, but you should repeat it with each phrase.

CAN YOU IMAGINE THE SPACE BETWEEN your eyes . . . your ears . . . your throat . . . your shoulders . . . your hips . . . that your thumbs are filled with space . . . that your first fingers are filled with space . . . middle fingers . . . fourth fingers . . . little fingers . . . that the region between the tips of your fingers and your wrists is filled with space . . . between your wrists and elbows . . . between your elbows and shoulders . . . between your shoulders . . .

CAN YOU IMAGINE the space between your toes . . . that your toes are filled with space . . . your feet and toes . . . arches and ankles . . . region between your ankles and your knees . . . between your knees and your hips . . . that your buttocks are filled with space . . . that your buttocks and the regions between your hips and your legs and feet and toes are simultaneously filled with space . . .

CAN YOU IMAGINE the space inside your lungs . . . inside your bronchial tubes as you inhale and exhale . . . the space inside your throat . . . your nose as you inhale and exhale . . . the space between the tip of your chin and the inside of your throat . . . between the space inside your throat and the space inside your ears . . . between the space inside your throat and the top of your head . . . between the space inside your throat and the space behind your eyes . . .

CAN YOU IMAGINE that your jaw is filled with space . . . your cheeks and mouth . . . tongue . . . teeth and gums . . . the space between your upper lip and the base of your nose . . . that the region around your eyes and behind your eyes is filled with space . . . that your eyes are filled with space . . . eyelids . . . nose and sinuses . . . that your forehead is filled with space . . . brain . . . spine . . . that your whole head is filled with space . . . that

your whole head, face, neck and your whole body including your hands, genitals and feet are simultaneously filled with space. . . that your whole being fills with air when you inhale and your whole being is left filled with space when you exhale . . . at the same time that you are imagining the space inside your whole body is it possible for you to imagine the space around your body, the space between your fingers and toes, behind your neck and back, the space above your head and beneath your body and the space in front of you and to your sides? . . .

CAN YOU IMAGINE that the boundaries between the space inside and the space outside are dissolving and that the space inside and the space outside become one continuous and unified space . . . that at the same time you imagine this unified space, you can simultaneously let yourself attend equally to all the sounds that are available to you, the sound of these words, the sounds issuing from you and any other sounds that you may be able to hear . . . that at the same time you are attending to the space and the sounds you can also attend simultaneously to any emotions, tensions, feelings or pains that might also be present . . .

CAN YOU IMAGINE that as you continue to practice this Open Focus exercise, your imagery of space will become more vivid and more pervasive . . . that as you continue to practice this Open Focus exercise, you will increase your ability to enter into Open Focus more quickly and more completely and more effortlessly. . . .

Open Focus. The best introduction to Open Focus is The Open Focus Handbook by George Fritz, Ed.D. and Les Fehmi, Ph.D., or the Open Focus Audiotapes, available in a six-tape or twelve-tape series, leading from a basic introduction through tapes for pain control and sports training. These are available from Tools for Exploration, 800 456 9887.

that synchrony was a key to information processing and perception; that in fact there was no information if there wasn't synchronous activity on certain related neurons. This dissertation research was completed in 1966.

So I became very interested in the possibility of enhancing brain wave synchrony, because it seemed to make sense that it would be a way to increase the clarity and efficiency of information processing and perception in humans.

Enhancing brain wave synchrony is a way to increase the clarity and efficiency of information processing and perception in humans.

By the time I got to the State University of New York at Stonybrook in 1967, I was asking, well, what are the occasions in the nervous system that related to the production of synchrony or were related at all to synchrony? And, obviously, the alpha rhythm jumped out as the most synchronous event.

LEARNING TO LET GO

Now I should interject here that I had known Joe Kamiya since the early sixties, though only socially, because I happened to be a classmate of his wife. And I remember him at one social gathering telling me about his work, saying that it was possible for people to distinguish when they were producing alpha and when they weren't. At that time he really awakened me to the possibility of doing not only awareness training, but also training to change a brain wave, which was my goal. So at that time, 1967, I was beginning to think, that if I could get more synchrony in the brain, perhaps I would improve information processing in my own brain and things would become more clear, more facile; I would have a much better sense of perspective and there would be mental and psychological benefits for this process. So I used myself as my first guinea pig and I started the training.

MBR: Alpha biofeedback.

LF: Right. And I had a hard time with this learning. It was hard for me. As I look back, I could suggest a number of reasons why. Mostly, that I was a very obsessive individual, 32

really immersed in areas that required a lot of obsessiveness from me, at least in the ways that I approached them at that time. But I was completely unaware of that fact. I didn't know that I was more obsessive and compulsive perhaps than normal people. I probably would have said that all us so-called academics or intellectuals are that way. But in any case, it took me 12 two-hour sessions with no gains in the production of alpha.

MBR: Whew. Now was this simple one channel feedback, or were you trying to get synchronous multi-channel feedback?

LF: Well, I started with just one channel. So, 12 sessions, no alpha. Then somewhere into the 13th session, I gave up. I truly felt saddened and disappointed that this idea that had been jelling in my head for some time just wasn't going to reach any fruition in this process because apparently, I was unable to create alpha. This was '67 and early '68, and I wasn't sure that anybody could have actual control over the production of alpha at that time. So I gave up. And at the very moment I gave up with disappointment and sadness, I noticed I was getting a whole lot more feedback!

And happily, I gave up while still being hooked up to the machine. Happily, I didn't just rip the electrodes off my head and walk out when I gave up and was so disappointed. But in any case, I produced a whole lot more alpha, and I experienced feeling very curiously at that time, because I had been led to believe that alpha was associated with feeling good. And here I was, you know, feeling disappointed and saddened, even when I started producing more alpha.

And gradually, as I allowed those feelings to pass over me and through me, the alpha increased.

I recognized gradually over the next few days that it must have been a kind of letting go that was really crucial to alpha production, and that I had no idea about such a thing before that time. I actually didn't feel stressed or tense or obsessive or compulsive. It was my "natural style." I had no sensitivity to that at that time. But after the event, after the production of more alpha, I looked back and I realized how tight I was, and then I said, well, if I could do that good just by giving up spontaneously, I bet I could really do great if I really tried to give up completely!

So I went back, after five sessions of pro-

ducing a lot of alpha compared to my initial amount—maybe five times as much—and I tried to produce even more alpha. And I ended up going right back where I started from, you know, the same performance I had during the first 12 sessions.

MBR: You'd gone from making an effort to an effortless state, and now you were making an effort again—

LF: Exactly correct. It was my intention and my effort that screwed things up. And the amazing thing is it took me a whole two hours of failure before I realized that. Only after the session was over, while I was walking around bewildered, did it hit me that the kind of "giving up" that was required was not in my power to make happen. It was something that you created permissive conditions for and allowed to occur as best you could. Which is, hanging out there, being, and knowing that there's no thing you can do, no thing - n-o - dash - thing — no process — no active involvement that permits this.

And so it happened that I was searching for what the keys were to that permissive condition for a number of years. And as I'll get to later, space turns out to be the best of them, the awareness of space.

ALPHA AND THE TRANSFORMATION OF THE GUINEA PIG

MBR: So that experience of letting go and producing alpha was really a turning point for you.

LF: Yes, I want to say that it is certainly part of my interest in propagating and continuing this work that this relief was so significant to me personally, not just an interesting scientific detective story—it's a very personal thing to me, as you know. I'd like to read you a passage from an article I'm preparing for a book of readings emerging from the 1993 Key West EEG Conference, edited by Joe Kamiya. It describes how important the experience of synchrony was to me:

"These increases in brain synchrony were accompanied by many releases and positive changes in personal experience and perception and behavior. . . . I felt more open, lighter, freer, had more energy, and felt more spontaneous. I felt less urgency and gripping. I experienced more verbal fluidity and seemed to grasp things more easily, as if I had greater perspective which allowed me to

experience a more grand, whole and subtle image. As the letting go unfolded, I felt more intimate, intuitive, and emotionally expressive. My interpersonal style changed and became lighter so that people of various ages seemed more inclined to gravitate to and be playful with me. My relationship with my children became softer and more personal. At times, I literally felt as if I were walking, gliding effortlessly. All of this was unexpected and occurred without damaging . . . my ability to teach the hard-nosed physiological psychology courses and neurophysiological techniques laboratory courses that my position at the University required. Even chronic rheumatoid arthritis which had peaked in graduate school was disappearing. . . .

It was impossible for me to deny that I was experiencing something very significant and revolutionary, both in a physiological and experiential sense."

So my interest, then, was in how to bring other people to the same event. Meanwhile, I was looking at lots of EEGs. I was using the EEG biofeedback device that I had designed and had built with the help of University personnel, and looking at an 8-channel EEG, and watching the response of others to this process. Well, first of all, the others didn't want to sit there for 12 hours and then give up and then produce alpha! They certainly didn't have the drive to achieve that I had for intellectual reasons. They just wanted a personal hit out of it.

Some people had a lot of alpha and they could keep on the amount that they had and generally felt better after the session. Some of them had quite nice experiences, particularly artists and very sensitive and creative people and athletes. Dedicated athletes who practiced every day and meditators tended to do better right from the start and had some control over on/off.

PAYING ATTENTION TO ATTENTION

And I want to say one more thing here. This on/off idea, which runs right through

my work—and which I felt right from the start—was a crucial part of the training. Even my own first training required that I try to turn it on and off and I had no ability to change either. But it's somehow in that effort that I think we learn the dimension on which this change occurs. And it's learning about this dimension and how to impact it that relates to our control. Our personal control over our own physiology, certainly, but I'm going to relate that to our own attention, which is the critical issue in my mind. Being able to be aware of how we pay attention, and then being able to choose the style of attention that's appropriate for the moment and then being able to actually bring that form of attention about is, I believe, what a fully realized human should be able to do.

And I think this thread which is related to EEG activity makes it very doable. The fact that EEG activity is so directly related to the way we pay attention makes attention training and awareness training a much easier task, because we have objective referents to be guided by in the training. And I think that's the most wonderful thing that has come out of this, that EEG and attention are so intimately related. So, where was I?

The creative people had the best experiences. And once they had one experience, they wanted to come back many times and learn how to get in and out of that state.

MBR: You were in the process of trying to find out what made EEG synchrony easier to attain.

LF: So I examined my EEG records before and after; and I looked at all the records of the people that I ran—and I ran some people every day for years—trying to look for commonalities. The first thing I noticed was that my own brain wave activity was much more synchronous than almost all of the people that I've measured, even to date. I don't know why that is, and I think that may be responsible, partly, for the very dramatic changes in my experience.

So gradually over the next year I moved toward multi-channel synchrony, trying

to get people to have this experience even stronger than they did before. Some had none; some had light; some had moderate; and some had very very nice experiences. It's usually, as I said, the creative people had the best experiences. And some, once they had one experience, wanted to come back many times and learn how to get in and out of that state.

MBR: In essence, these people were learning how to produce synchronous activity throughout the whole brain?

LF: Yes. I tried all these experiments with trying to strobe them into alpha, which worked; and I tried auditory driving as well, which worked; and I tried relaxation exercises, which worked. But all these things, and other things I'll mention, worked only somewhat. They worked, but certainly not dramatically, and certainly not powerfully, though for an occasional individual they might be sufficient for a time. But the same words and the same protocols a few sessions later would not do anything of significance to the brain waves.

I tried music and colored lights and incense because I had read that certain incense drives the olfactory system and that might be an initial drive to synchrony in the whole brain. And that, of course, led to raised eyebrows among people in the university, smelling incense coming from this laboratory.

MBR: They were probably expecting to hear sitar music, too.

LF: Well, yeah, and I'm sure they were worried that we were doing drugs in there and just trying to cover up the smell of drugs with incense, but we weren't. We were straight arrow. Finally I decided the simple digital on/off feedback that we were using wasn't ideal, and that people could learn better when they heard an analog sound, a sound that grew louder when the waves were bigger and actually reflected the rhythmicity of the brain waves themselves, so we hear "wah-wah-wah-wah-wah" at 10 Hz if there was a train of 10 Hz waves. And that seemed to be accepted much better.

At one point, we added strobe flashes that were synched with those sound flashes. We even added tactile vibrations that reflected success with the production of alpha. We then found that the timing of these feedback signals was very important. You couldn't just put it out the moment that the person reached threshold. You had to

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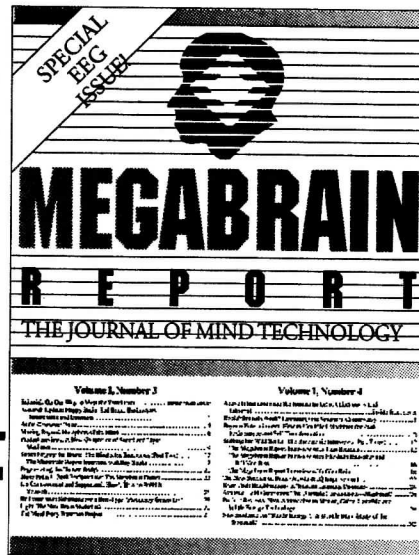
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adjust or delay the feedback sound or light for a certain number of milliseconds, according to when that information would reach the cortex and either increase or decrease the ongoing EEG rhythmicity by coming at a time where the excitation from the feedback signal would augment the inherent rhythmicity or interfere with it. So we got some added boost in synchrony and amplitude out of finding those delay times that idealize that relationship.

ZEN AND THE ART OF GIVING INSTRUCTIONS

One of the most interesting findings had to do with instructions. We gave really careful and detailed instructions to one group—instructions that were constructed by a number of people who did have the ability to turn on and off the alpha tone, so everyone was convinced these were good instructions. To another group we just said “Turn the tone on and off.” Amazingly, we found that people who weren’t given instructions did better. Very early in the game this strongly affected my approach to further learning and EEG training.

I realized it had to be a non-verbal kind of communication, so I learned how to talk in a way that left them with very little. It began to become clear that the most powerful of all the things that we did, and there are others I haven’t mentioned, was presenting an image of space as something that they should be with. When I say “image,” I don’t mean visual only. In fact, I mostly encourage a “feeling image” of space, because the body is so instrumentally involved with the gripping and the holding that slows the flow and prevents the inherent rhythmicity. But the big view is an equal attention to all sense modalities, and in the beginning, a little emphasis on feeling because that modality tends to be excluded from imagery if you don’t make a special point out of it for most people.

This experience of expanded and intensified awareness is basically what many people describe as the experience of enhanced synchronous alpha production.

MBR: And this feeling of space, you found, is the most effective way of producing this synchronous brain wave activity?

LF: Absolutely. I’ve come to call it “objectless imagery.” It is more effective for producing high amplitude alpha synchrony for more people over a longer period of time than any of the relaxation protocols, any imagery protocol I’ve ever run across. That led me to wonder why would space be so much better than anything else? And that slowly drew my attention to the differences with which we attend to space. *We pay attention differently to something that is not grippable, not graspable, than we do to a thing or an object.*

So I started wondering: what is the difference in attention, how would you describe it? And it’s only very slowly—I have to say that I’m telling you in a short time a story that I lived through over many years—and it just slowly, slowly got through to me. I think a brighter man, a more subtle person, more expressive person, might have done this work in a lot less time, but for me, I couldn’t get here without going through it myself and slowly realizing what has happened. So it’s been a very personal journey for me. . . .

I found that when you experience this objectless imagery, because it’s not grippable, you end up *surrendering* much earlier in the game. For example, can you imagine, now, taking a bath in space . . . and letting it permeate you and pervade you in every way . . . and allow yourself to know that space intimately and directly with all your senses?

That kind of an experience is very different than imagining a sunset or a mountain scene or a beach scene or something of beauty. Although it is possible to pay attention to those things in the same way, few people do. They just appreciate it as perhaps a broader object, maybe a more intimate object, but not as intimate as one needs to get when attending to space. Space is everywhere, both empty and limitless. So one of the things you do is open to it, because there are no boundaries to space. And the theory is that you can’t make an object of it, so you naturally stop trying and you become more one with it.

And that’s the important change that happens with the Open Focus training references to space. *Instead of focusing attention on some object, we expand our attention to*

limitless, timeless space. And as we experience space more intimately, we deepen the absorption of our attention in the totality of present experience. And this experience of expanded and intensified awareness is basically what many people describe as the experience of enhanced synchronous alpha production.

ATTENTION AND THE SELF

Now, we change from day to day, moment to moment. One moment you’re in pain, next you don’t notice the pain. One day your problems seem overwhelming, the next day they don’t seem so bad. These moment to moment changes are almost like changes in who we are. What’s the explanation for these changes?

I believe these changes are a direct result of changes in how we pay attention to what we pay attention to—that *how we pay attention controls our behavior, our mental states, our experiences and sensations, and our physiology.* I also believe that we can use EEG feedback training to become aware of how we pay attention, and to learn ways to select and choose differing ways of paying attention that are best suited to help us function more effectively in specific situations.

MBR: So we can increase or decrease brain synchrony by paying attention in a certain way. What are the different styles or modes of attention?

LF: I gradually evolved a model of attention, or an attentional model of awareness, with four styles of attention: diffuse versus narrow, and objective or separate versus immersed, or “into it.” These four styles or parameters of attention, in various combinations, describe the styles of attention [See Figure 1].

There are various combinations of attentional styles. Narrow focus-objective attention (quadrant A) is the favored attentional style of our culture, one that values highly linear information processing skills and ability to completely and narrowly focus attention on concrete, external objects or tasks.

We are also very attached to immersed, absorbed or “into it” narrow attention [quadrant D]. Often people say they’re “in the zone” when they’re in immersed narrow focus. This includes the experience of being completely absorbed in something to the exclusion of everything else—reading, sex, sports, music.

These are the modes of attention that our culture holds to be most important or useful. They're on the narrow focus side of the narrow-diffuse continuum. But there are other ways of attending and, in fact, unless we spend some time attending in these various other ways, then we end up accumulating stress, because stress is prevented from diffusing when we don't allow diffuse and immersed attention.

Diffuse focus-immersed attention [quadrant C], for example, is exemplified by the loss of self-consciousness when you seem to merge with a wide range of stimuli and sensory experiences. Good examples include some types of meditation, and the effortless almost instinctive performances of accomplished athletes, performers and artists. Diffuse focus-objective attention [quadrant B] is exemplified by activities such as driving a car, going for a walk, watching a sunset, playing in a band—where objective activity takes place against a background of diffuse awareness.

The diffuse focus modes of attention provide a release from the tension and stress of narrow focus. All animals except humans spend a substantial amount of time in diffuse modes of attention. Unfortunately, I think we are gradually, as a species, becoming more and more subject to stresses which are not allowed to diffuse because we spend less and less time in these alternative attentional styles.

MBR: Such as the Open Focus state you teach with your EEG feedback training?

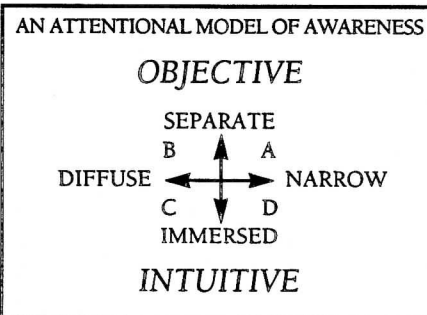
LF: Open Focus includes all the forms of attention simultaneously. Its goal is to have flexibility of attention, so that you can move freely among the attentional modes, and even use all of them at once.

This brings us to the physiological correlates of attention. If you remember, I said that space was the most powerful of all the images that I tried in producing more brainwave synchrony, and space is something that causes you to diffuse and become more intimate or into it or absorbed. And that's generally the physiological connection. That is, EEG synchrony is associated with diffusion and immersion; and EEG desynchrony, lower amplitude, is associated with objectivity and narrowness.

THE DOORWAY TO HIGH PERFORMANCE

Now, there's a frequency continuum here, and most people make a lot of that. And there certainly is an association with arousal and frequency; that is, lower frequency is associated with lower levels of arousal, and higher frequency with higher levels. However, my model and experience suggest that there's a middle range of frequencies that allows a medium level of

Fig. 1



arousal, which supports an integration of both narrow and objective attention and diffuse and absorbed or intimate attention coming together to form a more open focused kind of attention. And when this happens and when this balance of right and left associated with medial levels of arousal occurs, you pop into another way of being that's unusual. That is, it's balanced in attentional styles, which is unusual for us, and therefore, performance becomes the best at that time. It's the high performance state.

MBR: What frequency range is this?

LF: Well, I don't want to put a number on it. What I want to suggest is that it's a doorway, and once you pop thru it, I think the frequency is not the issue. I think to get thru the door, you have to do some practicing of this medial level of arousal. Which of course is like what meditators and artists and so on do. They're not hyped and they're not hypo—they find this groove and they start melting into it and stabilizing it, and they get to the point where they can find it again and again. And it is through that doorway that they find another kind of functioning, another kind of attention, which then would allow them to move freely through a whole range of frequencies without affecting arousal and awareness that much. Okay? And now, there'll be a figure or frequency that perhaps presents

that a little more clearly. Now, it may be for me, because I've recognized that I'm a little under-activated for certain tasks as a rule, I might have to move higher in my own training to reach this optimum level that makes it easiest to open the door.

MBR: Higher in frequency?

Brainwave synchrony is associated with diffusion and immersion; desynchrony with objectivity and narrowness.

LF: Higher in frequency. And for you, who perhaps more naturally do things, say, intellectually and verbally, I would suggest that you may move lower. I'm just guessing now. I'm just using you as an example of what I'm talking about. But, in any case, I've noticed that some people relax downward into a lot of alpha, and some people raise into a lot of alpha, and I mention alpha because, except for individual cases, I've pretty much stayed with the idea that I want to teach on/off control of synchrony in the alpha range.

Now, when I teach that control, I'm sure that almost all of my clients, when they turn off, do beta-like activities. So what they are learning is how to go into a diffuse absorption or immersion and then how to come back to a more narrow focus objective attention, and back and forth. And I think that's one of the healthiest attentional flexibility forms of training that exists, and I do it myself, and I teach my clients to do it regularly with significant positive results.

"JUST BEING": SYNCHRONY AND HEALING

MBR: You've conducted clinical research for over 20 years now in teaching people to go through the doorway, as you say, into open focus and synchronous states. Could you describe some of the benefits of this training?

Animals spend over 40% of all their waking hours resting: not doing, not moving, not particularly seeing, just being.

LF: Well, there are all the obvious benefits. I say obvious because I've been a clinician now since '73. Before that, I was only a researcher. So, I've been a clinician/researcher since '73, and my observation is that if you allow people to move from attentional rigidities that tend to center around narrow focus objectivity and allow them to move to a more diffuse broadened awareness, there's a natural diffusion of stress which supports normalization of function. Therefore, I'm suggesting that this is a general technique, *a general movement of mind and associated physiology, that allows normalization to occur.* So, for example, if there were any dysfunctions of the body that were the results of trying to stay in emergency mode all the time, which is associated with narrow focus objectivity, then we're preventing the body's natural healing processes from occurring. The body's natural wisdom is defeated because we're not allowing it to be applied; we're staying away from the state or the ways of attending and associated brain wave activity that allow for this normalization and healing to occur.

Recent research has produced evidence that all animals spend over 40% of all their waking hours resting: not doing, not moving, not particularly seeing, just being. They may be aroused on occasion by sound, but they immediately return to this "just being" kind of mode, which I assume is the time that normalization of function occurs. Human beings, on the other hand, do not do this. They get up in the morning; they have a schedule; there are deadlines; and even after work at night when things are less pressured, they have to do laundry; they have to arrange for dinner; they've got to pay bills; they have social pressures and so on. Today the socialization pressures are ever stronger in the direction of narrow focus objectivity and goal-oriented activity, which are synonymous in my mind.

Now I'm often asked, "Well, what symptoms are not going to respond to this? What symptoms do not have at least some stress-related, tension-related components?" And as of this time, I guess a bullet wound or an accident could be left out, and there are probably certainly biological assaults that are so strong that even if you were in tiptop health and fully normalized your body couldn't respond to them effectively. But in, 20 years, I have treated many, many, many different kinds of things using this EEG training, and it has a broad generality to it. Now, I'm not saying that this is a

cure. I am saying that whatever techniques are available to facilitate healing, one additional and very important one is creating an environment in which the body is allowed to normalize itself and to bring about healing. And we can learn to enter that state through EEG feedback training.

SYNCHRONY AND SPORTS

MBR: In addition to the therapeutic and healing benefits of this state, you've done research that indicates that there are benefits in performance for people who are already healthy and strong.

LF: That's my favorite interest. I've worked with Olympic athletes and some famous coaches and athletes along the way, and I'm very interested, now in golf, and I hope I can get it together to write something specifically oriented toward golf because it is perfectly suited. It's as close to meditation as any sport I know of. Maybe chess, although chess is very intellectual, and golf is much less intellectual—it's just being in this moment as fully as you can be, preferably in Open Focus, and letting this swing unravel itself, uncoil. And it is, I feel, a great gift that I found golf in my later years. I'm almost 60.

MBR: What about more active sports? Is it possible to be in this diffuse state even while . . .

LF: Sure. All of them. Another one that I personally was involved in is marksmanship, and I was on the Sixth Army Pistol Team, and some "Zen and the Art of Archery"-like experiences that I had at that time just point up how much attention affects everything we do. But certainly if one is interested in ever more optimizing performance, attention is a critical issue. And *beginning to practice attentional styles and flexibility is crucial to optimization of function.*

TWO BRAINS IN SYNC

I also did some work across persons, that is to say, I would train two or more people, such as teammates, to get into a state of in-phase whole brain synchrony, and some of the outcome phenomena were extraordinary.

MBR: Could you describe that?

LF: Well, in this kind of training, you set the

feedback signals, usually strobe light and sound, to provide feedback only when each and every person's EEG activity is in-phase or synchronous. When that happens, there's a very strong feeling or sense that somebody else or the other person is in the same space, the same experiential space. Couples might have the same thought-images, or be aware of the same sensory experiences. Often they report feeling a strong sense of oneness with their partner or partners. And some people take to it very positively; they feel kind of a union which is positive, no longer alone, so they're very together, which is, I think, very much desired by a number of people. And other people reject the event, although that's been much less frequent an occurrence.

Couples might have the same thought-images, or be aware of the same sensory experiences. Often they report feeling a strong sense of oneness with their partner or partners.

One occasion that stands out in my mind was when two people were in different rooms and didn't realize they were hooked together. And after the session was over and I debriefed them individually, one said, "Gee, I somehow felt like I left where I was and I went and," he sort of pointed over his head behind him to exactly the room the other person was in, "and I felt like there was a presence there and I was trying to enter it." And this was a male and he was trying to enter this female's presence. And when I debriefed the female, she said, "Well, you know, I felt like somebody was trying to enter my space, but I didn't want him in my space and I rejected him." Interesting.

MBR: This reminds me of the scientists at the University of Mexico City who hooked pairs of strangers up to EEGs and then told them to "feel each other's presence" or try to "communicate" with the other. And when this happened, they found that the EEG tracings became synchronous.

LF: Oh, interesting.

MBR: And the ones with the highest amount of synchrony were the ones who had the greatest success in communicating with their partners. So, they seem to have come

at it from the opposite direction—

LF: That's right.

MBR: —that you have. You've induced synchronous brain waves and found some sort of increased inter-person awareness and communication. They, on the other hand, induced inter-person awareness and communication and found that it results in synchronous brain wave activity.

LF: Except for the word "induced." I didn't get them to do it any way. I just said, "Turn the tone on." And the tone depended on their participating in a certain way with each other, getting in phase and producing more alpha. It wasn't induced so much as guided or trained.

MBR: In *Mega Brain Power*, I speculate that this type of brain wave synchrony could increase communication, for example, between romantic partners, sexual partners, and so on. I'm wondering if you have any thoughts about the mechanism—how people might share consciousness when they do have synchronous brain wave activity or share some sort of link.

LF: As for the communication between partners, I've found that's exactly what happens, romantic events are engendered and old married couples feel like they're newlyweds again—that same kind of union and oneness that was present when they were newlyweds, was present upon producing the light and the tone and increased phase synchrony.

One married couple in their sixties, arguing all the time, bickering all the time, said they both felt like they were on a honeymoon again when they were on the machines, that same kind of intimacy. But exactly how that happens, you know, the obvious things come to mind, but I'm sure you could state them more clearly.

SUBTLE ENERGIES AND ALTERED STATES

I wouldn't be surprised if there were not kinds of energy that are still too subtle, that we're not attuned to yet, and that do manage to cross space. By lining up some obvious biological function like the "awareness machine," the "attention machine" that the brain is, kind of aligns awareness in a way to allow something, perhaps frequencies, you know, common frequencies of energy. And I have had this experience personally a

number of times, where information about the environment seems to be flashed to my awareness at a much greater rate than normal. I'm normally somewhat phlegmatic and things come slow and relatively easy and calm for me. But on occasions, I've been popped into a state where it's clear that I'm moving twice or four times or eight times the speed of my normal movements, and my perception is greatly enhanced, and I sort of can stop things in mid air and catch things that have fallen as if they were in slow motion and see broken pieces of glass in an accident "tinkle, tinkle" as they go by.

So yes I suspect that there are rates of perception and ways of perception that are not readily available to us and that we're not readily aware of when we do get involved in them. And they sort of take a second order kind of awareness that I was referring to earlier just to tune into. And, in fact, if you remember, I was talking about an arousal level which acted like a portal through which we have a reorganization of attention from our normal oscillation and alternation between narrow focus objectives and then dropping out into diffuse, into-it-ness and back again.

OPTIMUM AROUSAL AND PEAK STATES

But when you go through this portal at the right medium levels of arousal, both attentional styles are simultaneously present—that is to say, for example, narrow objective and diffuse into-it-ness. When they're both present simultaneously, a switch occurs, a restructuring or a reorganization of attention, so that one becomes narrow into-it in the center of one's attention and with a diffuse objective surround, which is aware of a great deal. And it's possible to be into it and function like an into-it person can and be aware of not only one's actions but the environment in a very broad scope and in an objective way.

MBR: Sounds like a description of what many people describe as peak performance states in sports and other areas.

LF: Could very well be. I'm describing it in terms of attentional style, which is, you know, my long-term research and training emphasis. So whether one calls that a peak experience, I guess, depends a lot on how they attend when they do what they do otherwise. If a shift into that attentional state

pops them into a peak experience, then it's very likely they were very attached to other structures, like the "narrow/objective" and "diffuse/immersion," alternating instead of simultaneously present.

I've been popped into a state where it's clear that I'm moving many times my normal speed, and my perception is greatly enhanced, and I sort of can stop things in mid air . . . and see broken pieces of glass in an accident "tinkle, tinkle" as they go by.

But I do recommend and feel that having the option to have this form of attention, the one associated with peak experiences that you mentioned, is something worth experimenting with and striving for, and is available only when all forms of attention are simultaneously available, which is, at this middle arousal level.

SYNCHRONY FEEDBACK TRAINING

MBR: Could you describe how you use your EEG in the clinical setting, any information that you think would be of interest to other therapists or clinicians or people who would be interested in using your type of procedure.

LF: With regard to clients, I've seen such a wide variety of clients' symptoms that it's hard to rule out anybody. I think just about anybody that has come in who hasn't been helped by the medical profession and has tried a number of other therapies and has not been satisfied by them in terms of remission or reduced intensity of pain, I'd be willing to try neurotherapy. As a matter of fact, we've done remarkably well with such people—probably because they are very motivated. They've kept searching and they come upon us somewhere late in the cycle and they've tried everything else and they don't believe that this is going to work either and are presently surprised when it starts. And I've had a number of clients that have gone to full remission after 50 years of symptoms, particularly headaches and migraines, tension, and even some cluster

headache clients—which are not supposed to be responsive to biofeedback techniques. But most of the therapists who claim similar results have tried just muscle tension and thermal biofeedback. So it's clear to me that EEG offers additional potential.

With regard to how we approach the process, there's a general phase and then a more specific phase. The general phase involves attention training, explaining and teaching the person to move toward a wider scope of attention and more intimacy with experience, a closer, more immersed or absorbed experience. And that's done initially through verbal guidance the first part of each session. And then the second part of the session is with the EEG and with a tape, an Open Focus tape. We ask them to learn to listen to the tape in such a way as to keep the feedback tone and light on, and when the light and tone are on, that means they are producing more or above threshold levels of whole brain synchrony.

MBR: And both the light and the tone are rhythmic, at the same rhythm as the frequency that they're —

LF: Yeah, they actually mirror the brain wave activity, so for each wave that exceeds threshold, you get a sound that gets louder as the wave gets taller and actually stays on as long as the wave is above threshold and is off briefly and then comes on when the next wave increases. So you actually have an auditory image of this electrical event. And the same with the light, except the light has only one intensity; it doesn't get brighter.

MBR: But it's a very bright strobe.

LF: It's a bright strobe that goes through closed eyes. We do it with eyes closed because we found that just having the eyes open changes the attentional set of the person. It's much more conducive to moving in the direction of the fusion of attention and merging with experience if the eyes are closed, even in a darkened room. I have a room that's truly dark, and even when I know they can't see anything, and they know they can't see anything, they're still reaching with their eyes. If you have them hooked up to an EEG and you ask them to open their eyes in this completely darkened room, even 25, 30 trials into this process, they still shut down the alpha when they open their eyes. Suggesting that it's more a habit of attention that they're invoking than actually having to do with visual experience

and gripping of particular visual experience.

On the other hand, using Open Focus techniques we can teach them how to see with their eyes open, even in a lit room, without shutting down alpha. So then they have options. It's a softer, a more permeating kind of vision. It doesn't stop at a surface; it accepts and acknowledges the surface but it doesn't grip it.

We teach them how to see with their eyes open without shutting down alpha. . . a softer, a more permeating kind of vision. It doesn't stop at a surface. . . .

MBR: This training takes place in the alpha range?

LF: Yes. Almost exclusively. I do, for various reasons, move on occasion into theta, but almost all of it is in the low alpha range, somewhere around 10, 9 1/2, 9 Hz. Initially I choose the frequency that they produce the most of, so if they're up at 11 or 10 1/2, I center the frequency filter at that frequency, because I want them to get a lot of feedback and to encourage as much alpha and amplitude as possible, to help them find that state and learn how to stay there, and let themselves become more stable in the production of this alpha. But as time goes on, there is a drift that occurs, and as I rediscover their current center frequency—the frequency they produce the most of at that time—at the beginning of session, there's a movement towards lower frequencies. So you come down maybe by tenths of a cycle down to 10 and then 9.9 and so on.

MBR: There's been extensive research indicating that getting people into alpha states, no matter what technique they use, can have benefits for them. Is there something intrinsically beneficial about the learning process involved in EEG biofeedback that adds to the power or increases the benefits of the alpha state?

LF: Well, it's like endorphins and morphine. You can get a pretty big hit from a shot of morphine and you can also produce endorphins yourself. But learning to produce it yourself in more and more circumstances in your everyday life is far superior to being dependent on an external source, in that

you can learn gradually to invoke it appropriately in your life and not be dependent in any way. It's like having a skill. It's like learning how to be healthy and happy and driven by positive experiences, like creativity and union and oneness and, dare I say the word, 'love.' These are experiences that need to be cultivated. We, in our society, don't do that, so we become slaves to round-about ways of getting these experiences—or external sources.

And that's my argument, really, with all the external ways of doing it, even runners. As you may know, I've worked with the Olympic Development Committee, and long distance runners at one point. I asked these remarkably talented runners who had run for most of their young lives how they got started in this process. And most of them said the same general kinds of things—that when they were younger and things weren't going well and they felt bad, they started running and slowly realized that this really solved some problems for them. And they felt better afterwards, so they gradually did it more and more, ran longer and longer distances, and it became a very pleasurable thing for them to run.

However, I now want to tell you the other side of the story, that I have, because of that association, seen a number of other runners in my function as a clinician. They come to me and they say they can't run any more because their tension is now causing them to cramp up and even fall unexpectedly because some muscle doesn't function well. Their tension has reached the point where in their everyday life it's intolerable. Now, if running were a solution, a true effective long-term solution to their stress, they wouldn't be in that position. And, therefore, one must appreciate that there are some short-term beneficial effects to running, or other things, but one needs to continue to discover more long-term solutions to the stress-related problems.

MBR: Some of those who have used EEG feedback training believe there is something inherently brain expanding about learning to manipulate your brain waves. They've concluded that just the attention required in learning EEG, the process itself, seems to stimulate enhanced brain functioning. In other words, that there's something qualitatively different about the learning process of EEG feedback from other techniques for getting into alpha, such as, let's say meditation or —

LF: Light-sound machines.

MBR: Yes. That the learning process itself or perhaps the challenge involved, or the continued attention to the task actually stimulates a kind of a higher functioning in the brain. Professors Russell and Carter of the University of Houston, for example, claim that "When the task of control of EEG activity is adequately learned and sufficiently practiced, the functioning of the human brain improves measurably, e.g. . . . scores on standardized tests of achievements or intelligence increase by 12 to 20 points."

LF: Okay. Now, if it were simply just paying attention to something and doing something like, say, you can imagine a computer game would catch your attention and you could stay with it a long time. . . . If it were just paying attention to something, then people would be getting better doing other kinds of things that they generally participate in, and physiotherapy and other things might have the same effect. It's something special about brain wave training, okay? And I think the connection for me is that

with EEG training you're *paying attention to how you pay attention. And that changing brain waves is changing attention.*

And that's the real important and significant issue that I have been dealing with for the last 20 years—that brain wave training is attention training. And only now are we putting together the pieces. The reason it is so effective in so many ways is that we're actually getting access to attention, which is a higher order awareness. Paying attention to how we're paying attention is like awareness of awareness, which is, by definition, second order awareness, higher awareness, higher consciousness.

With EEG training you're paying attention to how you pay attention. And changing brain waves is changing attention: brain wave training is attention training.

So I'm saying that the brain is an organ of awareness. It's an organ of attention, and to gain control over awareness is to become aware of how you are aware, how you're paying attention. Those are equivalent terms in my mind. And then once you're aware, you can learn when to do which, when to pay attention this way, when to pay attention that way. You don't go into a personal relationship with a narrow focus objective attention. You fuse and you merge more. You don't solve your accounting problems with diffuse immersed attention, not as a primary attention anyway—maybe in the background. But you'd be better off narrow focusing and objectifying.

Becoming aware of how you're paying attention, becoming aware of when to choose which attentional style, and then having the actual capacity to manifest the appropriate attention, which is then a third step—is, I think, what makes a realized human being.

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EEG ALPHA-THETA NEURO-FEEDBACK:

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Eugene G. Peniston, Ed.D., A.B.M.P.

EARLY DEVELOPMENT OF ALPHA OR THETA BRAINWAVE TRAINING

The use of alpha or theta brainwave neuro-feedback therapy (BWT) in the treatment of various disorders began with research in the sixties and seventies by Joe Kamiya (1968), Barbara Brown (1974), Tom Budzynski and J. Stoyva (1969; 1972), and Elmer Green (1962), Elmer Green, Alice Green and Dale Walters (1970). In brief, alpha brainwaves of frequency 8-12 Hz were said to be connected with feelings of well-being and theta brainwaves of frequency 4-7 Hz were associated with the pre-sleep or day-dreaming state in which spontaneous imagery (or hynagogia) arose (Green, Green, & Walters, 1970). Beta brainwaves of 13-20+ Hz have been associated with concentration or anxiety and confusion. Delta brainwaves indicate sleep. It was speculated that levels of anxiety could be reduced, repressed psychological material could be processed and self-actualization attained if the individual was trained via visual or auditory feedback to produce a higher percentage of higher amplitude, lower frequency (alpha and theta) brainwaves.

With respect to alcoholics and/or drugs, the anticipated therapeutic benefits of alpha and/or theta BWT were not fully realized during that time. For instance, a French-Canadian study (Beausejour & Lamontagne, 1977), found that Electromyograph (EMG) biofeedback training was more successful than alpha BWT with habitual drug users. Bear (1977) also found no significant positive change in mood after alpha BWT. Pafsini and colleagues in the 1980s did alpha feedback training with alcoholics and found positive subjective comments from patients. However, the alpha feedback training was not related to an increase in sustained prevention of relapse.

The popularization and commercialization of alpha and/or theta training led to inadequate protocols and exaggerated claims of effectiveness (Stern & Ray, 1977), and by the eighties the technique was relegated to the fringe of respectable therapies. During the past 20 years, the field of EEG biofeedback has sustained a small circle of devoted researchers and clinicians. Until recently, these devoted followers have endured much criticism from skeptical professional colleagues. While the beneficial use of both traditional electromyography and temperature training has now been established for some time, EEG work always met with much

debate. However, recent research findings and the marketing of increasingly sophisticated EEG equipment may soon permit EEG biofeedback to fulfill its long awaited potential as once promised. EEG biofeedback is being successfully utilized in the treatment of addictions, attention deficit disorder, post-traumatic stress, closed head injury, epilepsy, and performance and learning enhancement. Alpha-theta brainwave training, a form of EEG feedback, provides a promising and effective new treatment for alcohol abuse, clinical depression, crack-cocaine abuse, chronic combat-related post-traumatic stress in Vietnam Veterans, multiple personality disorders, and eating disorders.

Alcoholics receiving alpha-theta training showed significant reductions in depression and (upon a 36-month follow-up) sustained abstinence.

Since 1969 (when the Biofeedback Research Society was formed, now known as the Association for Applied Psychophysiology and Biofeedback, or AAPB) and the present time, cutting-edge interest has moved from preoccupation with the voluntary muscular and autonomic nervous systems (Green, Green, and Walters, 1970; Fahrion, et al, 1986), to the central nervous system, and in particular to alpha-theta brainwave feedback (Green, Green, and Walters, 1974), Green and Green, 1986; Green and Green, 1989). And now it has been found that the self-induced reverie state of alpha-theta neuro-feedback Peniston/Kulkosky protocol makes it possible for patients to get control of and eliminate lower-brain disorders such as: alcoholism and depression (Peniston and Kulkosky, 1989, 1990; Fahrion et al, 1992); Ochs, 1992; Byers, 1992; Wuttke, 1992; Boeving, 1993; Saxby and Peniston, 1994; Kelley, 1991; Kelly, 1993; Sullivan, 1993; Sealy et al, 1991; Peniston et al, 1993; Blackman-Miroff 1993; White, 1993), combat-related post-traumatic stress syndrome (Peniston and Kulkosky, 1991; Peniston et al, 1993; Sullivan, 1993), multiple personality disorders (Manchester et al, 1994), and possibly bulimia nervosa (Greco, 1992). My associate Paul Kulkosky and I have found that combining alpha and theta brainwaves with temperature and visualization training contributed to sustained prevention of relapse in alcoholics and PTSD.

PENISTON/KULKOSKY NEURO-FEEDBACK STUDIES

We developed our novel treatment protocol based on some of the work of a few devoted giants in the field of EEG for addiction, post-traumatic stress, depression, multiple personality disorders, bulimia, other emotional dysfunctions, using biofeedback and visualization techniques to bring about significant behavioral change by actually altering the addiction and emotional dysfunctional personalities (Peniston and Kulkosky, 1989; 1990; 1992; Peniston et al, 1993; Manchester, 1994; Saxton and Peniston, 1994; Greco, 1992; Sullivan, 1993; Byers, 1992; Kelly, 1993; Kelley, 1991; Fahrion et al, 1992; Sealy et al, 1991)..

Alpha-theta brainwave neuro-feedback for alcoholism first appeared in professional literature in 1989, when Kulkosky and I published a research study on alcoholism recovery in Veterans Administration patients. In this research study, following a temperature biofeedback assisted autogenic pre-training phase and a visualization pre-training phase, experimental subjects completed thirty 30-minute sessions of alpha-theta brainwave neuro-feedback training with audible feedback tones provided for different types of brainwaves.

The original experimental study of chronic alcoholics compared 30 subjects in three groups: (a) alcoholic - BWT, (b) alcoholic - traditional therapy, and (c) non-alcoholic controls. Subjects were matched on age and were evaluated for alcoholic history, number of prior hospitalizations, IQ's, and socio-economic status. Before and after treatment, subjects were administered the Beck Depression Inventory (1961) (BDI), the Millon Clinical Multiaxial Inventory (Millon, 1983; Craig et al, 1985), (MCMI), and the 16 Personality Factor Scale (16 PF), and were tested for EEG characteristics, and serum beta-endorphin levels. The beta endorphins are stress related hormones and are elevated during the experience of physical or emotional stress. Successful treatment would stabilize beta-endorphin levels, so that stress related increases would be less likely to occur.

80 percent of those receiving the EEG training were able to quit drinking following a 30-day program. . . after three years the success figure declined by only 10 percent. Such success had never before been achieved.

The findings of this investigation showed enhanced percentages of alpha and theta waves in the EEGs of the alcoholic BWT group after treatment, compared to pre-treatment status. The control groups showed no such increases. Alcoholics receiving BWT also showed a gradual increase in alpha and theta brain rhythms as the thirty (30) experimental sessions progressed. This group also showed significant reductions in self-assessed depression and (upon a 36-month follow-up) sustained abstinence and less relapse than the alcoholic traditional therapy group. Also, the alcoholic traditional therapy group showed a significant elevation in serum beta-endorphin levels at the end of treatment, whereas the other groups did not. Both alcoholic groups had similar pre-treatment levels of beta-endorphins, whereas the non-alcoholic group had lower pre-treatment levels. Since elevations in serum beta-endorphin levels are associated with stress, their elevation in the traditional therapy group may indicate that this group is experiencing the stress associated with abstinence

and fear of relapse. It is interesting that the BWT group did not show an increase in this stress hormone after treatment, but instead showed stabilization.

On the MCMI and 16 PF prior to treatment, both groups of alcoholics showed significantly higher scores (in the pathological ranges) than non-alcoholics on most of the clinical scales and characteristic scales. Administration of BWT was accompanied by significant decreases in all of the MCMI clinical scales and normalization on the 16 PF scales. Alcoholics receiving traditional therapy showed significant decreases only in two MCMI scales (avoidant and psychotic thinking), and an increase on one MCMI scale (compulsive), and showed only a significant increase on the 16 PF in concrete thinking. This provides confirmatory evidence that the application of BWT treatment procedures produce fundamental changes in alcoholic personality variables. These changes may underlie the sustained prevention of relapse and absence of increases in circulating beta-endorphin levels in alcoholics receiving prolonged BWT.

In this study, 80 percent of those receiving the Peniston/Kulkosky neuro-feedback protocol were able to quit drinking following a 30-day program. At the time of a three-year follow-up, the relapse rate was so low that the success figure declined by only 10 percent. Such success had never before been achieved.

Since the initial publication of this work, our results have been replicated at institutions such as the internationally recognized Menninger Clinic in Topeka, Kansas, (Fahrion et al, 1992; Boeving, 1993), and in numerous hospitals (Wuttke, 1992; Kelly, 1993; Sullivan, 1993; Sealy et al, 1991; Kelley, 1991, and private practice settings (Ochs, 1992; White, 1991; 1993; Saxby and Peniston, 1994; Bayers, 1992; Manchester et al, 1994; Blackman-Miroff, 1993). Additional studies on neuro-feedback have been conducted and are currently under way (i.e., Texas Youth Commission, Austin, Texas; Probation Correction Department, Austin, Texas; Riverside Hospital, Houston, Texas; University of North Texas, Psychology Department, Denton, Texas; Several Universities in Owatta, Canada; several VA Medical Centers; University Psychology Departments throughout the United States, and the Academic Medical Science Society, Neuroimmunology Center, Regional Alcohol and Drug Center, Sibarraa, Nosotasnsk, Russia, to mention a few). To date, all the aforementioned replications have resulted in similar success: 70 percent to 80 percent of treated patients are able to give up their addictions, with a minimal relapse rate.

All replications have resulted in similar success: 70 percent to 80 percent of treated patients are able to give up their addictions, with a minimal relapse rate.

Alpha-theta brainwave neuro-feedback was next employed for Vietnam theater veterans with combat-related PTSD. The experimental patients (N = 15) receiving BWT showed significant decreases on the Minnesota Multiphasic Personality Inventory (MMPI) clinical scales within "normal limits". These patients also showed a reduction in recurrent anxiety-provoking nightmares/flashbacks, and a significant reduction in their psychotropic (i.e., anti-depressant and anti-anxiety) medications. In contrast, the traditional control group of patients (N = 14) which received treatment including rap groups, group therapy, psychodynamic therapy, psychotropic meds and individual psychotherapy showed only a significant decrease on the MMPI scale labelled Schizophrenia, and did not show a reduction in recurring anxiety-provoking nightmares/flash-

backs; nor did they show a reduction in their psychotropic medications. Thirty (30) month follow-up data indicated that twelve of the fifteen combat veterans who completed BWT were maintaining normal functioning and sustaining long-term prevention of PTSD relapse, whereas all 14 traditional therapy control patients had relapsed.

After thirty months, twelve of the fifteen combat veterans who completed alpha-theta training were maintaining normal functioning and sustaining long-term prevention of PTSD relapse, whereas all 14 traditional therapy control patients had relapsed.

At the time of twelve months plus follow-up evaluations for all the aforementioned studies (i.e., Peniston and Kulkosky, 1989; 1990; 1992; Peniston et al, 1993; Byers, 1992; Boevig, 1993; Saxby and Peniston, 1994; Kelley, 1991; Sealy et al, 1991; Manchester et al, 1994; Greco, 1992; White, 1991, 1993; Sullivan, 1993; Fahrion et al, 1992, etc.), sustained relapse prevention is very high in this treatment approach. While traditional alcoholism and PTSD treatment shows as much as an 80 percent relapse rate, the relapse rate with alpha-theta neuro-feedback training is usually less than 20 percent.

NEURO-FEEDBACK TRAINING ENHANCES ATHLETIC PERFORMANCE.

The application of alpha-theta brainwave neuro-feedback training also has been used to enhance an athlete's performance by Sport Psychologists, Tim Loehr, Ph.D., LGE Sport Science, Miami, Florida and Scott Pengelly, Ph.D., Eugene, OR. Those athletes that had participated in the neuro-feedback training have become athletic record holders and shown dramatic improvements in performance.

The application of alpha-theta brainwave training to addiction, depression, post-traumatic stress disorder, and other emotional dysfunction is proving to be one of the most efficacious treatment modalities for these disorders. Such neuro-feedback therapy has produced both significant-related

symptom diminution in combat-related PTSD and/or PTSD symptomology, and even significant pre- and post-test psychometric changes on standardized instruments. It has also permitted recall of significant experiences not previously accessible by traditional behavioral and/or psychotherapy. Without such specific brainwave training, many combat veterans have been unable to specifically identify crucial antecedent events. When able to identify and abreact to those experiences, much relief is obtained. Follow-up studies also indicate a markedly reduced recidivism rate, implying at least moderately long-term prevention, and reduced dependence in the use of psychotropic medication. It is noteworthy that concurrent medication appears to be no barrier to the success of treatment and that BWT may eliminate the need for medication.

CRISIS IN MODERN MEDICINE

It is no secret that our conventional medical system in the United States is in a state of terrible disarray. Though conventional medicine excels in the management of medical emergencies, certain bacterial infections, trauma care, and many often heroically complex surgical techniques, it seems to have failed miserably in the areas of disease prevention and the management of the new and chronic illnesses presently filling our hospitals and physicians' offices. In addition, as a nation we pay more for our medical care and accomplish less than most other nations of comparable living standards, while health care costs continue to spiral out of control. Physicians across the country agree that between 50 to 80% of all health problems are psychosomatic. This means that the majority of medical problems are unconsciously self-generated. And it has been found that health problems such as migraine headaches, deficiency of blood flow in the head, tension headache, chronic muscle tension in neck and scalp; hypertension, high blood pressure; chronic pain; alcoholism; drug addiction; attention deficit disorder; and emotional dysfunctions, that is, post-traumatic stress disorders, clinical depression, multiple personality disorder, and eating disorders, can be reversed with proper psychophysiologic training. All of these so called diseases are simply unconscious maladaptive behaviors in the subcortical nervous system. These maladaptive behaviors, which often are unconscious reactions to stress, may be accompanied by severe pain or pathological consequences.

Neuro-feedback training is more cost-effective over the long-term for psychosomatic health problems such as hypertension (Fahrion et al, 1992), clinical depression

(Peniston and Kulkosky, 1989, 1990; 1992; 1993; Bayers, 1992; Sullivan, 1993; Saxby and Peniston, 1994; Sealy et al, 1991; White, 1991; 1993), chronic pain (Peniston and Kao, 1986), learning disabilities and ADD (Tansey, 1983; 1984, 1985; Lubar, 1991) alcoholism (Peniston and Kulkosky, 1986; 1990; 1991; 1993; Fahrion et al, 1992; Bayers, 1992; Sealey et al 1991; Sullivan, 1993; Kelly, 1993; Kelley, 1991; Saxby and Peniston, 1994; Boevig, 1993; Blackman-Miroff, 1993; White, 1991; 1993), post-traumatic stress disorder (Peniston and Kulkosky, 1992; Peniston et al, 1993; Sullivan, 1993; Saxby and Peniston, 1994), multiple personality disorders (Manchester et al, 1994; Pengolly, 1993, and eating disorders (Greco, 1994). Because it emphasizes prevention and goes after causes rather than symptoms, it does

Biofeedback may enable us to identify and use individual brain cells, which in turn, may allow us to control the wide array of internal chemical messengers.

not trap people on the merry-go-round that begins with one drug, and ends up requiring them to take others to compensate for the side effects—often dangerous—each one causes. Neuro-feedback works by assisting one's own mind-body connection to heal itself instead of introducing strong drugs. Alpha-theta brainwave neuro-feedback future holds even greater promise of refining our present knowledge of brainwave training and its utilization in continuing advanced treatment exploration of certain forms of behavioral medicine, cognitive and emotional dysfunction. Additional areas being explored have included endogenous depression, stress reduction, closed head injury, chronic pain, the enhancement of the immune system for cancer and AIDS patients, and facilitation of integrative experiences in psychotherapy.

The recent formation of the Society for the Study of Neuronal Regulation (SSNR) and AAPB's special brainwave section demonstrates that the pragmatic usefulness of neuro-feedback has now achieved a new status and recognition. The development of a National Registry of Neuro-feedback Providers further ensures high standards of competence and training for new practitioners. In addition, the development of a "Code of Ethics" for Board Certified Providers will ensure that those persons

will be competent to administer neuro-feedback services based on a scientific-practitioner foundation.

The implications of alpha-theta brainwave neuro-feedback are limited only by our level of knowledge. As advocated by Dr. Bernard Brucker of Jackson Memorial Hospital at the University of Miami, biofeedback technology may enable us to identify and use individual brain cells, which in turn, may allow us to control the wide array of internal chemical messengers that seem to play such an important role in both health and disease. "As man learns more about the brain, it may be possible to alter many physiological responses now thought to be beyond human control."

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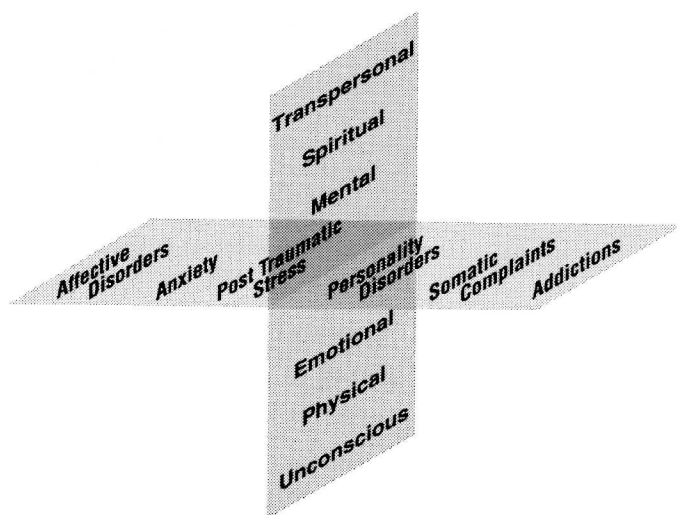
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ALPHA-THETA TRAINING FOR CHRONIC TRAUMA DISORDER, A NEW PERSPECTIVE

Nancy E. White, Ph.D.

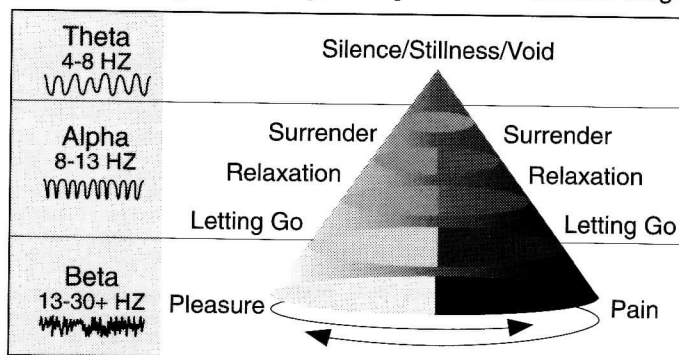
In March of 1989, when Drs. Eugene Peniston and Paul Kulkosky's research was published, it may have heralded a major shift in the future course of psychotherapy. Trained in the techniques of biofeedback by Elmer and Alyce Green at the Menninger Foundation, Peniston's protocol of alpha-theta brainwave training amplified the prior work of many researchers over the past twenty plus years. (For a description of his work, see Dr. Peniston's article elsewhere in this issue of MEGABRAIN REPORT; for a complete outline of the Peniston protocol, see the published research in *Alcoholism: Clinical and Experimental Research* 13:271-279, 1989.) The Peniston Protocol, initially focusing on the reduction or elimination of addiction, created a multilevel matrix approach that could simultaneously treat the multiple diagnoses such as: affective disorders, anxiety, post traumatic stress disorders, personality disorders and some somatic complaints along with the addiction.



I perceive these disorders as comprising a horizontal axis, with the unconscious, the physical, emotional, mental, spiritual and transpersonal aspects of self forming a vertical axis. Computerized EEG feedback, a therapeutic relationship between patient and clinician and the imagery of desired outcome, interfaces technology with compassionate personal contact. This protocol works concurrently on the physical addictions and the underlying psychological state. The Peniston Protocol creates a multilevel matrix of intervention with its horizontal axis of diagnoses and presenting problems and its vertical axis of levels of the Self and Self connected to All That Is.

Many theories for the remarkable success of the alpha-theta brainwave training have been proposed by other researchers and clinicians in the field of Neurotherapy (see the EEG Special Issue of

Megabrain Report, Vol. 2, Number 3). I agree with Dr. Jon Cowan (1994) concerning the protocol's effectiveness in "programming the unconscious" (Green & Green, 1986) with the mental rehearsal of images of desired change. Cowan (1993) states, "From the viewpoint of learning and memory, the repetition of intentional images



or visualizations is quite different from a series of guided imagery experiences. It is much more likely to reinforce learning and produce the overlearning of the particular response that is important in creating personal change." Dr. Deepak Chopra (1993), author and endocrinologist, tells us that imagery creates intention and intention automatically seeks fulfillment. I believe that the imagery is very important but that the strength of this therapy lies in one's ability to enter and be held in a deeply altered state with the intention of desired outcome. We live in a world that rewards the state of consciousness that I will refer to as the "beta state." It is predominately narrowly focused, rational, linear, a world of the five senses. Sole reliance on this method of brain function inherently activates the ego self (adapted self) with its fears, anxious thoughts, its need to be in control and "hold on." We rock between pleasure and pain. Even when we are in the pleasure, we fear the loss of the pleasure, putting us back into the pain. But as we move the predominant brainwave frequency into the lower realms, there is a surrender or "letting go" of control.

In "normal" or waking consciousness, in both our internal perception and our external perception, we experience ourselves as existing within the boundaries of our physical body and are confined by the usual spatial and temporal boundaries. We vividly experience our present situation and our immediate environment. We recall past events and anticipate the future. We live in our life drama. But in the computerized EEG feedback training, as the patient obtains deep alpha and theta states, there appears to be a disidentification with the ego self. It is within this state that many of our clients spontaneously experience flashbacks of earlier forgotten and traumatic times. The client may find himself or herself witnessing a scene in which their younger self, the "inner child" (Cowan, 1994), is being abused. From this detached state, the intensity of the emotional

reaction is greatly lessened. Often a third self, the adult self, the Resource Self, appears in the scene and rescues the child. An inner resource is reclaimed. With this encounter facilitating the inner resolution of the earlier trauma, the personality system seems to move to a higher order of functioning.

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The wide-ranging power of this protocol might be found in the realm of state-dependent learning and memory (Rossi & Cheek, 1988) or state-context learning and retrieval (Cowan, 1993). The predominant waking brainwave frequency of children under the age of six is in the four to eight hertz range associated with theta in adults. As we mature, our average brainwave frequencies get faster (Duffy, Iyer, & Surwillo, 1989). In adulthood these lower frequency waves are usually associated with reverie and hypnogogic imagery. They occur in the transitions from wakefulness to sleep.

"The highly emotional experiences of early childhood, and the (often mistaken) decisions which stem from them, are learned and stored as modification of the slower background frequencies that were activated at that time," Cowan (1993) states. The surfacing of memories from early childhood during the theta training fits observations of "state-dependent memory," i.e. that information learned while in one state of consciousness is more difficult to access when in another state of consciousness. The natural shift in dominant brainwave frequencies during maturation could result in dysfunctional childhood learnings being preserved in the unconscious (Beckwith, 1992). To gain access to most of these "state-bound" memories, one has to be in the state in which they were created, i.e. theta. In utilizing the Peniston protocol of alpha-theta therapy, there is a profound alteration in the state of consciousness of the patient. As the subconscious appears to become more accessible in this deeply altered state, traumatic memories of the past are released and the subconscious seems more readily available to alteration or programming by new images. Dr. Thomas Budzynski, researcher and clinician, has found that theta is an ideal state for "rescripting" or "reimprinting" the brain, eliminating destructive behaviors or attitudes that are a result of "scripts" laid down in childhood (during times when the child is in a theta state) and replacing them with positive scripts (Hutchison, 1992). This is one of the few ways in which an adult can store new information in the subconscious, which can be equated to state-contexts dominated by theta and low alpha rhythms which have well learned but state dependent connections to the limbic system and early emotional memories (Cowan, 1993, 1994).

Chronic Trauma Disorder becomes the source out of which the multiple symptoms and disorders flow.

Several months ago, I surveyed some of the major clinicians of the Neurotherapy field who were offering the alpha-theta training. I found, as had been our experience, that many seemingly disparate diagnoses were being treated successfully. The skeptics of the alpha-theta training often use the reports of the many types of disorders addressed as an attempt to discredit and question this "panacea" approach. Peniston has published research on populations presenting

PERSONALITY BREAKTHROUGHS; USING ALPHA-THETA AS MEASURED BY MMPI AND MCMI

As we go to press, Nancy White has completed a preliminary statistical analysis of changes in the pre- and post- MMPI and MCMI (Millon) scores of clients who have undergone alpha-theta training at her clinic. The results are striking and important, showing statistically significant changes from pre- to post- measures of depression and depression-related disorders. For example, the mean pre-EEG training score of the subjects on the MMPI-2 Depression scale was 63.4. The mean post-training score dropped to 52.7. The percentage of individuals with clinically significant elevations on the MMPI-2 depression scale dropped from 40.9 percent of the total to 4.5 percent. On the MCMI scales, the mean pre-EEG training score for dysthymia was 59.1; the mean post-training score dropped to 33.9. The shift in the Major Depression scale was even more astonishing, moving from a pre-training mean of 55 to a post training mean of 29.3. The percentage of individuals with clinically significant elevations on the MCMI Dysthymia scale dropped from 52.3 (pre-) to 6.8 (post-); the percentage with clinically significant elevations on the MCMI Major Depression scale dropped from 11.4 to a post-training 0. White also notes that there was a statistically significant positive correlation between age and change in MCMI Dysthymia scores (i.e. the younger the participants, the greater the decrease in their MCMI-Dysthymia score). This has important clinical implications.

with alcohol addiction and post traumatic stress disorder (Viet Nam veterans). Dr. Carol Manchester is getting integration in thirty to sixty sessions with Multiple Personality Disorder, a disorder usually requiring years of therapy and with inconsistent results. Psychological disorders, including affective disorders, personality disorders, rage-aholism, eating disorders, addictions and relational dysfunctions including marital conflict and codependency, were being successfully treated. Somatic complaints including hypertension, cardiovascular problems, Chronic Fatigue Immune Dysfunction Syndrome ("Epstein Barr virus"), and headaches were improved with this unusual approach. Several clinicians offered peak performance training. One had even worked with Olympic athletes. As I puzzled over the far reaching effects of this training on so many diagnoses, both physical, mental and emotional, I wondered where the common denominators might lie.

Addictions, along with Multiple Personality Disorders (MPD), usually present with a multiplicity of diagnoses. MPD patients frequently meet the diagnostic criteria for many psychiatric disorders, including depression, borderline personality disorder, somatization disorder, substance abuse, bulimia and anorexia nervosa, panic disorder and others. There has been much written recently about the dual diagnosis (usually multiple diagnoses) in the addict and the effect on recidivism. What did these have in common that made these patients good candidates for this protocol for an altered state therapy?

THE CORE ISSUE

Following the theme of state-context dependent memory, I considered what Colin Ross (1989), an authority on Multiple Personality

Disorder (MPD), states about diagnoses of pathology. He writes that the DSM (Diagnostic and Statistical Manual) should have a category for Chronic Trauma Disorder of Childhood, Childhood Onset, with and without Multiple Personality Disorder. It becomes a hierarchical diagnosis of which currently disparate diagnoses are a part, with the most severely abused and dissociative persons developing MPD. Those who are less severely traumatized or less gifted at dissociation develop somatic symptoms, personality disorders including borderline, panic disorders, depression and addiction, exacerbated by any genetic predispositions (Blum, 1991). Using a metaphor from quantum mechanics, Colin Ross states that Chronic Trauma Disorder is a single field, with distinct regions. These different regions are called affective disorder, eating disorder, substance abuse, and so on. Numerous regions of the field can be activated simultaneously in a given patient. These subregions can occur in different combinations in different patients. From this point of view, we could, perhaps, collapse our horizontal axis to a single diagnostic entity that we term Chronic Trauma Disorder.

The Core Issue (Chronic Trauma Disorder), hiding in the Unconscious, permeates all levels of the Self—Physical, Mental, Emotional and Spiritual. Childhood trauma becomes the source out of which the multiple symptoms and disorders flow. Adult onset of acute trauma disorder would correspond to PTSD. The severity and chronicity of the trauma could account for the severity and multiplicity of the diagnoses. Therefore, our single field (diagnosis) might be labeled Trauma Disorder, acute or chronic, childhood or adult onset, dissociative or non dissociative. A person with childhood woundings, exacerbated by further trauma in adulthood, could have increased symptomology from the further woundings. A person with milder woundings might present with milder symptomology.

We were all born small and helpless and dependent in a world of giants that controlled our lives . . . each of us carries with us core issues and trauma which form the foundation of present and future patterns of beliefs, reactions and emotions.

Entering the deeper state (alpha-theta), with its access to deeper layers of emotional repression, affords us the opportunity to confront the unprocessed energies of past woundings—and we all have woundings. We were all born small and helpless and dependent in a world of giants that controlled our lives and maybe even abused us. How could we escape the woundings and mistaken decisions at an age where we were not permitted to process events or emotions and in most cases were not capable of processing them had we been allowed to? So each of us carries with us core issues and trauma which form the foundation of present and future patterns of beliefs, reactions and emotions. The more deeply wounded carry with them repressions that manifest themselves as many and multiple diagnoses, often with dissociative and addictive disorders to escape their negative feelings. Cowan (1993) mentions the hypothesis that many addicts use drugs not just to feel good, but to forget that they feel badly. Frequently this “feeling badly” is the residue of earlier trauma.

In the deeply altered states, when our patients experience abreactions and flashbacks, we are encountering their psychodynamic realm. The experiences belonging to this category are associated with and derived from biographical material from the subject's life, particularly from emotionally highly-relevant events, situations, and circumstances. They

are related to important memories, problems, and unresolved conflicts from various periods of the individual's life since early childhood. This can take the form of reliving memories of traumas that were accessible in normal states of consciousness or can emerge from the realms of the individual unconscious where the traumas have been repressed. These memories can take the form of a variety of experiences that contain unconscious material in the form of symbolic disguises, distortions and metaphorical allusions, often presenting as hypnagogic imagery, imagery that seems to spring into the mind from unconscious sources. This concept leads us to the writings of Stanislav Grof (1976, 1980, 1985, 1988) and his work with the National Institute of Mental Health in LSD psychotherapy—another consciousness-altering type of therapy used in the 1950's and 1960's until the drug was scheduled by the federal government. Grof offers the principle of specific memory constellations, for which he has used the name COEX systems (systems of condensed experience). I perceive that this principle further expands the diagnosis of Chronic Trauma Disorder.

Traumatic events, particularly in childhood, can have a profound and lasting impact on the emotional, cognitive, behavioral and physiological functioning of an individual.

A COEX system can be defined as a specific constellation of memories from different life periods of the individual. The memories belonging to a particular COEX system have a similar basic theme or contain similar elements, and are accompanied by a strong emotional charge of the same quality. The deepest layers of this system are represented by vivid memories of experiences from the period of birth, infancy and early childhood and seem to represent a summation of the emotions belonging to all the constituent memories of a particular kind. This is in basic agreement with Freud's psychodynamic theory with the new element being the organizing dynamic system. A given individual can have several COEX systems. The psychodynamic level of the unconscious, and thus the role of the COEX systems, is much less significant in individuals whose childhood was not particularly traumatic (Grof, 1985), hence an explanation of why some of our patients have strong life changing experiences of memories and abreactions and others do not.

This therapy's wide range of effectiveness, its ability to diminish or resolve multiple diagnoses and complaints, might lack credibility were it not for the fact that early childhood trauma exerts such broad psychological and physiological effects. Dr. Bruce Perry (1992) states that prolonged “alarm reactions” induced by traumatic events during infancy and childhood can result in altered development of the central nervous system (CNS). He hypothesizes that with this altered development one would predict a host of abnormalities related to catecholamine regulation of affect, anxiety, arousal/concentration, impulse control, sleep, startle, and autonomic nervous system regulation, among others.

He further states that it is likely that the functional capabilities of the CNS systems mediating stress in the adult are determined by the nature of the ‘stress’ experiences during the development of these systems, i.e., in utero, during infancy and childhood. When the stressful event is of a sufficient duration, intensity or frequency, stress induced ‘sensitization’ occurs — the neurochemical systems mediating the stress response change, becoming more ‘sensitive’ to future stressful events.

Many factors appear to be important in the lasting impact of the trauma — the nature of the trauma, the degree to which body integrity is threatened, the family support system following the trauma, whether

the trauma is acute or chronic or both, and whether the pattern of the trauma and/or abuse is continued into adulthood. The family emotional and addictive history affects the symptoms expressed by the patient. If the trauma occurred before age four, there is a much higher probability of pre-psychotic and psychotic symptomatology. On the other hand, children with a stable first three years of life but traumatized later in childhood tended to have more affective and anxiety symptoms. A child who is reared in an unpredictable, abusive or neglectful environment will likely have evoked, in his/her developing CNS, a milieu which will result in a poorly organized, 'dysregulated' CNS catecholamine system. Early life trauma plays an important role

as an expresser of genetically-determined vulnerabilities to a variety of neuropsychiatric disorders and medical conditions. It could be hypothesized that such an individual would be susceptible to the development of more severe signs and symptoms when exposed to psychosocial stressors through the course of their life. The concept of a single diagnosis loses meaning if we consider all of the effects of childhood trauma. In other words, traumatic events, particularly in childhood, can have a profound and lasting impact on the emotional, cognitive, behavioral and physiological functioning of an individual.

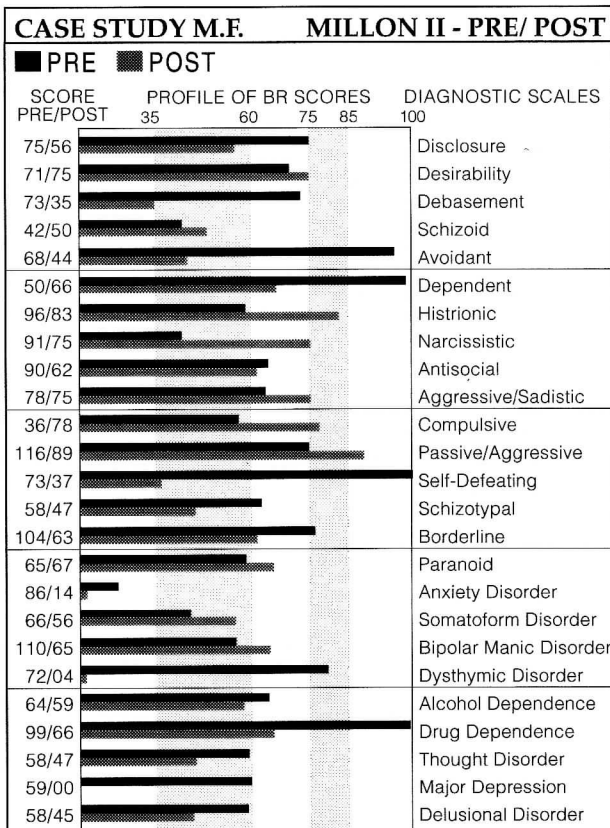
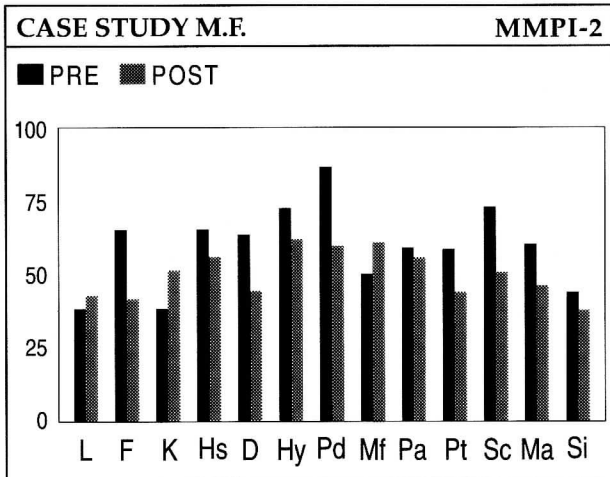
To better understand the concept of the diagnostic category of Chronic Trauma Disorder, it might be helpful to examine cases of persons whose symptoms become more cogent with this form of diagnosis. The case studies of B.K. and M.F. are presented for this purpose.

CASE STUDY: M.F.

This attractive 30 year old female (M.F.), referred by another client who was a friend of hers, came for two individual appointments in August of 1988. She was obviously dysfunctional and could not commit to therapy or anything else in her life. She was in law school but was not going to class and was dropping out. I did not see her again until two months later when she returned upset that there had been a murder in the apartment just above her. She had also wrecked her car and was in a state of high anxiety about the murder and the many apartment break-ins that had occurred. She came in two more times and then disappeared again. In March of 1991, she returned. Her life was in shambles. She was depressed and suicidal and she had recently attempted to overdose on sleeping pills. She had smoked marijuana daily for six years along with frequent use of alcohol. As her mother had been, she was addicted to prescription drugs, particularly speed. She was in a state of anxiety. She was acting out sexually and had had three abortions that year. She had a panic disorder, dissociative disorder and PTSD. She had a bipolar disorder, her depression was interspersed with mania. She had a dysfunctional relationship with her fiancé, which was close to breaking up. She had rage attacks which, among other things, were contributing to the destruction of the relationship. It was the fear of this loss that was the impetus that brought her back to therapy. She was highly intelligent, yet unable either to focus mentally or to concentrate and she had had to drop out of law school (at the school's request). She was having as much difficulty physically as she was emotionally. She had gained weight, was chronically fatigued and had asthma, allergies and anemia. She had a sleep disorder, hypoglycemia, and dizziness. She was taking diet pills in an attempt to lose the thirty pounds she had gained.

M.F. could remember her infancy and remembered a raging and physically violent fight her mother and father had when she was three months old. She was taken away at this time by her father who took her to his parents. Her parents separated and divorced soon thereafter. Her father, a lawyer, was wild and irresponsible and she was raised by her paternal grandparents in a home that was chaotic and dysfunctional. She saw her mother only once more at her first birthday and never saw her again. Her mother, European, was a belly dancer and a political revolutionary in her native country. She returned to her homeland where she was later found dead from an overdose of heroin. There was no sign of a heroin addiction and it was suspected that she was murdered.

M.F. was unfavorably compared to her mother by her critical grandmother. She carried guilt about her brother's (actually her uncle) death when she was eight years old. She had wished him dead. He was sick over a period of time and she thought he was getting too much attention. When he subsequently died, she felt that her thoughts and wishes had killed him. Her MMPI-2 pretest showed her a poor candidate for psychotherapy, stating that this type rarely seeks treatment and is likely to terminate early. A person with this profile pattern is not amenable



MEGABRAIN REPORT

to changing their behavior and may develop substance abuse problems if treated with medication. I have chosen this case study as an example of chronic trauma, both in childhood and adulthood, creating multiple problems on all levels of the self. This study is an example of: addiction, mood disorder, acting out behavior, post traumatic stress (both childhood and adult onset), physical problems, mental/cognitive problems and relational problems.

Using thermal biofeedback, M.F. was quickly able to raise the temperature of her hand to 95 degrees and to maintain it at that level, and she moved to the EEG training by the third session. Her imagery was simple. She imagined herself at the beach as "calm, natural, stronger, rejuvenated, and with a broader perspective of life." She then imagined her work and relationship as "calm, thinking before responding, and expressing feelings appropriately." She then imagined a drug rejection scene and ended with seeing herself as she wished to be. During the training, while in the theta state, she had flashbacks to her chaotic childhood and experienced her crying and terror. Much of this was experienced in the "witness" state of consciousness. Due to an issue of childhood sexual abuse, she requested a change to a female therapist after which she was able to process her abreactions more effectively.

She had a total of 30 sessions, two of thermal biofeedback and 28 sessions of EEG training with alpha/theta feedback. This was over a period of approximately eight weeks. She has since married her fiancé, a medical student who was initially very skeptical of the treatment, but who now thinks it was a miracle. She has gone back to law school and additionally is conducting her own international business. She has no craving for drugs or alcohol. Her post MMPI-2 profile was within normal limits with no clinical diagnosis.

In a six month follow up, M.F.'s comments were, "Being able to enter a deeper state has helped me in a variety of areas. I have lost thirty pounds and have a desire to get back to running. I was previously so lethargic. I am clearer thinking and feel so much more mentally focused. I have a healthier personality. My depression is gone. If I begin to feel down, I get myself relaxed and I handle the situation well. I use the visualization. I can take rejection better (a previous problem for her) and I accept it. I am physically healthier than I have ever been in my life. Previously, I wasn't taking care of my life." She is no longer on any medications.

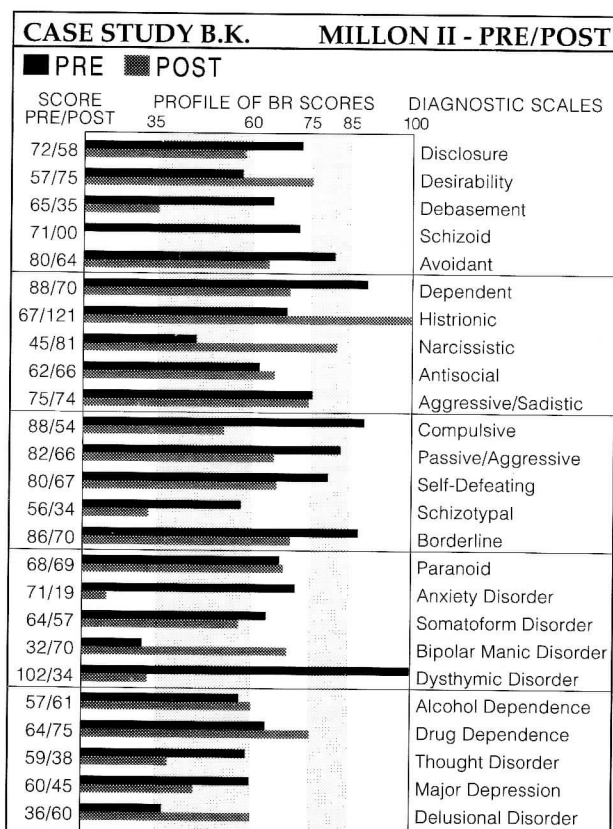
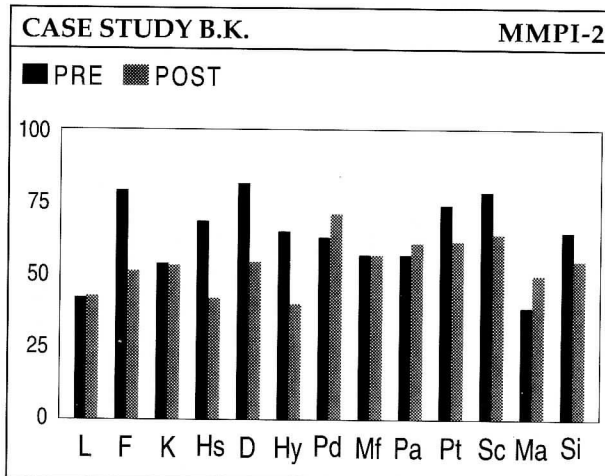
CASE STUDY: B.K.

We have found that nearly all our patients that are treatment resistant and/or high risk present with multiple diagnoses. B.K. is a good example. She was a 43 year old female referred to us by her A.A. sponsor. The sponsor reported to me that this woman had been sober for about two years until she had slipped about two months prior. She was active in AA but was craving alcohol and the sponsor said she had done all she knew to do and hoped that we could help.

When she came in for her first appointment it was obvious that she would be a difficult, if not impossible, case for more traditional psychotherapy. She had an eating disorder and was obese; she was experiencing frequent panic attacks; she was self mutilating, depressed and often had suicidal ideation. She also had migraine headaches. The most difficult aspect of her case was that she was emotionally phobic. She was unable to express any feelings and would panic, become immobilized, dissociate or leave and get drunk when pressed to face any situation that was emotional. She came from an alcoholic family. Her sister is an alcoholic; her mother, a nurse, died of alcoholism; her father, a doctor, now senile, is also an alcoholic. Her mother's brother froze to death on the porch at age 19 when he came home drunk and his family would not let him in the house. She knows that her father's father was alcoholic and believes that her mother's father may have

been an alcoholic also. My assumption is that there is a genetic component to her alcoholism.

Her initial testing with the MMPI-2 revealed an anxiety disorder or dysthymic disorder within a schizoid personality. Both of the diagnoses fit our clinical impression of her. Her testing also showed a possible schizophrenic disorder. The results of the testing with the Millon II revealed her as quite elevated on borderline personality, compulsive and dependent scales, all of which also fit our impression of her. She was certainly an example of polydiagnostic post traumatic stress disorder.



der arising from childhood trauma.

She agreed to treatment using Neurotherapy. After the sixth session, she experienced abreactions during the session and was having auditory hallucinations but desired to continue with the feedback sessions. She began having flashbacks and on the fifteenth session she experienced a flashback and realized that she had been sexually abused in the crib, presumably by her father. She recognized this as the probable core of her lifelong problems (Ross, 1989; Grof, 1985; Perry, 1992). She experienced many flashbacks of incest and physical abuse by her alcoholic mother and father. She had lived her life as a victim (her own and others'), yet when she had the flashback of the crib abuse, her adult self appeared in the room and said in a booming voice, "How dare you!" This was a "Resource Self" that had not appeared in her life before.

Using the Neurotherapy, we have found that this phenomenon of the Resource Self occurs with many female cases who have experienced sexual abuse. The adult self will enter the flashback and say "How dare you!" or "Don't you ever do that again!" and rescue the child. An inner resource is reclaimed. The patient is never fully the victim again. This has been a spontaneous occurrence emerging from some part of the self and not programmed by us.

B.K. completed the treatment with a total of 30 sessions. She was retested. The MMPI-2 showed no clinical diagnosis on Axis I and personality disorder NOS on Axis II. There was a major drop in the depression scale from 81 to 53. She was no longer suicidal. She showed the same shifts on the Millon II with the dysthymia scale dropping from 102 to 34. Borderline dropped from 86 to 70, which also fit our impression of her. Perhaps most noteworthy was her pre Millon II score of 71 on the schizoid scale denoting her unwillingness to process any emotional content. Her post score of 00 on this scale suggested that she could be emotionally available for further therapeutic treatment. The elevation of histrionic on the post treatment Millon II, may be perceived as a positive developmental step also suggesting she was now not so blocked to her emotions. She was still slightly high in psychopathic deviance on the MMPI-2 scale. We often see this scale remaining slightly high after EEG feedback training. When she returned for her exit interview, she was a very different person than had entered my office for the first time less than three months before. She commented that as she entered the building my office is in that she realized that she had not had to stop to get doughnuts to fortify herself for her appointment. "But," she said, "the amazing thing is that I never thought of it." She came in for five booster sessions during the first year when she felt stressed and sensed that she was losing some of her inner peace and connection to herself.

After the completion of the Neurotherapy program, she had no craving for alcohol and was able to face her emotions. She then went through our PAIRS program which is an intense 120 hour group program extending over four to five months, attended by couples and singles. The focus is predominantly on the relationship with one's self. It is a very emotional experience and our belief is that she could not have gone through this if she had not completed the EEG feedback training.

She was called for follow up and after three years she is still doing very well. I recently saw her at a lecture and she came up to speak to me. She looked wonderful. She was still overweight but was no longer bingeing on food and she has remained sober. She has a good relationship with her husband and is doing well on her job.

Both B.K. and M.F. are examples of Chronic Trauma Disorder, both acute and chronic, with childhood onset continuing into adulthood to the time at which they came in for the training. When core experi-

COMING IN MEGABRAIN REPORT

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ences of the system are relived and integrated, the patient's life can be transformed. In the case study of B.K., when, from a "witness consciousness" (Wutke, 1992) and in a deeply altered state, she relived the memory of the crib abuse and was rescued by her adult Resource Self, she collapsed a COEX system and altered her life and her perceptions of herself in the world and her reaction to the world. This can also be said for the experiences M.F. and many other of our patients.

The brain is inherently non-linear and self organizing, which is a process that distinguishes non-living from living material. It is a process by which adaptive reactions to the environment occur. Fundamental to the process of self organization is feedback. This self organization also requires goals or constraints, an end point that the system is moving toward. The feedback shapes the progress toward that goal or end point. With goals, feedback and the non-linearity of the brain/mind system, self regulation occurs.

In the brain, there are cortical/cortical connections interacting with the limbic system, often referred to as the emotional brain (Restak, 1984). The limbic system orchestrates interaction with the frontal lobes. These cortical/cortical connections of this goal directed system (increasing the amplitude of alpha and theta, balancing the neurochemistry and imagery of desired outcome) create a specific state of consciousness. In this state much of the ego (the adapted self with its defenses) is relinquished. The autonomic nervous system's bracing is loosened creating what might metaphorically be called a state of suspended animation. We move into an emptiness of space where we are conscious and aware but not aware of being aware until we return to the thinking mode. It is here that we encounter the nonlocal reality where we transcend ordinary space and time as we know it, a world behind the scenes that is beyond the world of objects and persons. In this state, there is often an experience a sense of ego-lessness, a "pure being state," with no consciousness of a body or life "drama."

As we go deeper, we disassociate from the brain/body system and often move into what might be called the "Void." It is in this silence between the thoughts where one can contact the hidden blueprint of intelligence and change it. Dr. Chopra (1993), author and endocrinologist, tells us that in deep meditation "...the process of transcending, or 'going beyond,' detaches the mind from its fixed level and allows it to exist, if only for a moment, without any level at all. It simply experiences silence, devoid of thought, emotions, drives, wishes, fears, or anything at all. Afterward, when the mind returns to its usual pitch (level of consciousness), it has acquired a little freedom to move."

As we discharge negative emotions and rigidly held beliefs from our past woundings, neurochemistry seems to be altered, our brainwaves are normalized, our ability to move from state to state is enhanced and our psyche alters.

With alpha-theta training, we are working with an interactive system of mind/brain, body, psyche, spirit. As we discharge negative emotions and rigidly held beliefs from our past woundings, neurochemistry seems to be altered, our brainwaves are normalized, our ability to move from state to state is enhanced and our psyche alters. Trauma is released and new more desirous programs are dropped into the deep unconscious.

If we ascribe to the theory of Chronic Trauma Disorder and to the idea that, as children and perhaps as adults, all of us have lived on a continuum of actual or perceived abuse, might not all of us potentially

benefit from the alpha-theta training protocol? What causes us to experience test anxiety or fear of talking before groups? What causes the athlete to clutch in the moment that ultimate performance is called for? Could it not be anxiety of many possible etiologies, most of which may be distorted childhood adaptations? Many peoples' lives show evidence of the fear of not being good enough, the need to prove oneself, the need for approval, the perceived need to perform well, the need to be loved and accepted at any cost, the need to be number one, all growing out of some sense of inadequacy and low self confidence. There can be as many etiological causes as there are people and childhoods. Could we not all benefit from dropping the emotional baggage expressed in some complex interaction with the limbic system and connect with our True Self?

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Tropical fun: the hotel has its own beach and boat dock. The boat captain had been very accommodating, scheduling snorkel/scuba diving trips and bird sanctuary island hikes (where you can pick up shells and coral and sponges) to match our schedules. Snorkeling is fantastic, with living coral reefs loaded with parrot fish, mantas, rays, and thousands of colorful fish. Of course fishing is great too. We'll be helping arrange charter and party fishing, diving, sailing and island hiking trips. Or you can just relax around the pool or in the Jacuzzi. Last year, one couple conceived a baby . That's optional of course.

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WHAT'S IN THE BRAIN THAT INK MAY CHARACTER WHICH HATH NOT FIGURED TO THEE MY TRUE SPIRIT? —SHAKESPEARE

Robert Fried, Ph.D.

In the most recent Megabrain Report, Dennis Campbell wrote a very sympathetic review of my presentation at the February 1994 Key West Conference. I did not, however, as he claims, suggest that EEG is an epiphenomenon of respiration; rather that it is an epiphenomenon of brain cell metabolism—quite an important distinction. But, respiration does control metabolism: its common gauge is the ratio of O₂-in to CO₂-out, and standard nomographs detail the relationship, at rest, between respiratory minute volume (V_{min}) and body weight. As Wordsworth put it:

*And now I see with eye serene
The very pulse of the machine;
A being breathing thoughtful breath,
A traveler between life and death.*

In my presentation at the Key West Conference, I presented the summary of hundreds of conventional publications, over the past 50 years, showing that arterial blood CO₂ concentration (PaCO₂) in the brain is the only factor that affects its blood flow—and therefore its cellular metabolism—because the arterioles in the vascular bed of the brain do not normally respond to autonomic nervous system (ANS) stimulation. It is also true that pulmonary alveolar CO₂ (PCO₂), measured in end-tidal breath, is a reliable predictor of PaCO₂. The correlation is about +0.97. Thus, controlling breath controls blood concentration of CO₂ which, in turn, controls brain blood flow—and therefore, O₂ availability and metabolism. These facts lead to the conclusion that breathing comes first, brain function second. I would remind you of the ancient Tibetan aphorism, "Breath is the horse, mind is the rider." Who does not believe that one should put the horse before Descartes?

PART I: THETA—THE EMPEROR'S NEW BRAIN-WAVE?

I have published my concern that some neurotherapists apparently disregard conventional physiology wisdom about

the theta component of the EEG, and I would like to address that. What is theta? It has been repeatedly shown that when PaCO₂ drops below normal (38 torr, or about 5%), as it does in hyperventilation (HV), arterioles in the vascular bed of the brain constrict markedly, and blood flow decreases by about 2% per torr. When PaCO₂ reaches 30 torr, a common observation in chronic HV, brain blood flow has dropped by almost 20%! As brain blood flow diminishes, O₂ delivery is jeopardized, glucose metabolism is impaired and brain lactate levels rise sharply. Cognitive function deteriorates and the dominant frequency of the EEG now usually consists of high voltage "slow waves" in the theta range. *Individuals predisposed to seizures are at now risk.**

I should like to draw your attention to the two references to the word "brainwave" on the front cover of that MEGABRAIN REPORT. What exactly is a brain wave? Now, you are probably saying to yourself, "Fried, surely you must be kidding? Everybody knows what brain waves are. You can witness them as electromagnetic pen tracings or oscilloscope screen tracings of the frequencies emitted by brain cell aggregates."

Well, is that so? In science, when you make an assertion, the onus is on you to prove it, not on me to disprove it. And, I can easily contradict your claim that (a) the brain emits "frequencies"; and (b) that the signal emitted by the brain represents something more than a measure of its glucose metabolism. Let's see you prove otherwise. Let's agree that there are mental states! So where's the problem? It is that some argue that the so-called "frequencies" encode specific information about thought—cognition—not simply mental states. Good luck, fellas!

Controlling breath controls blood concentration of CO₂ which, in turn, controls brain blood flow—and therefore, O₂ availability and metabolism. . . . breathing comes first, brain function second.

*Because of limitations imposed on text space, I omit conventional reference citation. But, you will find a combination of references and suggested readings at the end of this article. Many points made in this article are also illustrated and cited in my most recent book: *The Psychology and Physiology of Breathing in Behavioral Medicine, Clinical Psychology and Psychiatry*. Fried, R., & J. Grimaldi (1993). New York: Plenum Press.

"Brainwave" is a metaphor describing the appearance of the graphic representation of combined electrobiopotentials from many sources, i.e., wave-like oscillations in their amplitude. There is nothing in the brain that "waves," or emits waves, just a multitude of individual signal-sources emitting pulses—ON/OFF—some in synchrony, others at random. Then, what are we witnessing, and why do we seem able to "condition" them? Are they operant or respondent? Is brain electrophysiology frequency-modulated (FM)? The answer is a resounding no! It is amplitude-modulated (AM) and, what's more, change in amplitude has been shown to be a function of local O₂ uptake and glucose metabolism which, parenthetically corresponds to its activity level.

Brain cells behave like a linear amplifiers which emit a pulse when a threshold value is exceeded. Electrophysiological studies of respiratory brain-center nuclei, for instance, dramatically show the ON/OFF sequence, as each contributes to the breathing cycle. The numerical scale of these oscillations, which we erroneously think of as a frequency spectrum, is not continuous, it is discrete. Each EEG "band," alpha, theta, etc., represents something categorically different

Theta is not simply an arbitrarily labeled "frequency" lower than alpha, it is something entirely different—as different as apples and pears.

from that in any other band. Theta is not simply an arbitrarily labeled "frequency" lower than alpha, it is something entirely different—as different as the proverbial apples and pears. It just so happens that alpha is more rapid than theta, but there is no information contained solely in that difference. It is a nominal scale with limited variation within each nominal category—just as Bill, William, Will, and Willy, mean the same thing, but they don't mean Robert, Rob, Bob, or Bobby. By this analogy, here is what theta and alpha might look like:

... delta [Billy, Bill, William, Will] [Bobby, Bob, Robert, Rob] [beta. .

What is the point to this, you are wondering? In FM signals, information is encoded in frequency changes. High frequency signals can encode messages. Basic physics rejects the belief that a message, other than ON/OFF, can be encoded in the EEG "frequency" range whose upper limit is generally thought not to exceed 50 Hz by much. But doesn't the EEG signal in fact have "frequency?" Doesn't fast-Fourier transform (FFT) show it to be a complex signal, with many frequency components? That depends on how you choose to use the word "frequency."

The EEG is always a complex combination of low-periodicity amplitude changes which, by their presence or absence, seem to provide the sole intelligence in the signal. It is always complex, even if only one frequency seems dominant or, by the use of filters, is encouraged to do so. A loud "voice" drowns out those of lesser loudness.

*Parenthetically, since an operant, by definition, must be a behavior emitted by an organism, frequencies, single or bands in brain electrobiopotentials fail to meet the criterion of "behavior." By analogy, EEG frequencies are like body heat. Sure, the body emits heat and it fluctuates, but that is not a behavior. It is an epiphenomenon of metabolism. Likewise, the sounds made by a pigeon, as it pecks at grain, have frequency composition, amplitude and time-domain distribution characteristics, but they are not behavior and therefore, not operants. The sounds are epiphenomena. If your raw data consists solely of the sounds made by a pigeon pecking at grain, you may arrive at some fanciful conclusions about what gave rise to them, but you could not prove those conclusions in conditioning terms. Likewise, brain electrobiopotentials are also not operants, they are epiphenomena and, therefore, not directly conditionable. However, vasomotor reflexes associated with rCBF, which give rise to biopotentials, appear to be conditionable.

The use of filters to observe brain waves is more problematic than most realize. Hjorth writes that:

Since the generation of the EEG cannot be associated with the sine function concept on which the time-frequency conversion is based, the amplitude/frequency pattern must be considered a purely descriptive system, not necessarily having any direct connection with the generating physical system. (p. 306)

In other words, the EEG scale is essentially nominal. Then, Dumermuth & Molinari detail some basic problems with EEG spectral analysis which most psychophysicists simply ignore, including "aliasing of unwanted higher frequency components, leakage between frequency bands, and instability of spectral estimates." (p. 85) Aliasing means that frequency components higher than the so-called Nyquist frequency are improperly recognized, and are misinterpreted as lower frequencies. And there are many other technical problems of filtering that raise legitimate concerns about what is actually being observed, that are rarely addressed in psychophysiology and, so far, never in neurotherapy.

If theta is filtered out of the complex brain signal, the "frequency" changes in theta, won't tell you anything at all. Just because something has periodicity, and you call that "frequency," does not mean that it is frequency-modulated. Does the difference between 5 Hz and 6 Hz, or between 6 Hz and 6.5 Hz tell you anything? And if it is not an FM signal, then there is no information encoded in frequency changes in that signal, and those changes are epiphenomena of metabolism.

That is not to say that changes in cellular metabolism are not valid neurophysiology information. But it challenges credulity to assert that braincell aggregates have, as their mission, to communicate our thoughts or emotions to us by controlling the pattern of their metabolically driven electrophysiology—and some of us are just too naive, or what's worse, too obstinate to understand the language. If theta amplitude dominates the power spectrum and drowns out alpha, alpha is still present—a polygraph won't show it, and neither will it pass filters, but FFT of the raw signal will show it.

What, then, is the EEG power spectrum? Lykken has shown with factor analysis that it consists of coherent segments, or bands. The best way to use them is as though they were instrument-panel status-indicator lights, with delta on the far left, then theta, alpha, and beta on the far right: high amplitude means ON, low amplitude means OFF. ON and OFF what? you may legitimately ask. To illustrate their use, let's focus on two indicators on that instrument panel:

When alpha (third from the left) is ON, we are typically quiet, and we feel relaxed; and sometimes we experience a strange, welcome, degree of exultation. The indicator to the left of alpha-theta—is usually OFF, although in some instances it may flash briefly. The indicator to the right of alpha, beta, is typically OFF, telling us that the thinking brain is basically OFF. When theta (second indicator from the left) is ON, this usually—but not invariably—flashes a warning that brain metabolism is in jeopardy: cell O₂ and glucose levels are critically low, and arterioles in the vascular bed of the brain are constricting. If the hypoxia is not lifted soon, these vessels may go into paroxysmal spasms. Now, alpha is usually OFF, and beta may be ON in the early stages, dimming on its way to OFF as the process approaches catastrophe.

With experience, we learn to use the panel lights: Not only may each light be ON or OFF on this metaphoric instrument panel, but its relative brightness can tell us something too. There is a subtle difference in the perception of persons named Robert and those named Bob. And we also learn the subtle difference between high and low alpha and theta. And also, if theta is ON, it matters if alpha is ON or OFF, high or low. If theta flashes briefly and brightly, and alpha is, seemingly paradoxically, ON and bright, that's OK: it is a common deep-meditation phenomenon. With experience, we learn that there is good and bad theta. Good theta is meditation theta, bad theta is hypoxia theta. We know all this from studies of brain blood flow and metabolism.

*There is good and bad theta.
Good theta is meditation
theta, bad theta is hypoxia
theta.*

The shift by mainstream neurophysiologists from EEG-frequency to regional cerebral blood flow (rCBF) studies leads them unanimously to conclude that EEG power spectral composition is an index of rCBF and metabolism, O₂ and glucose uptake and utilization. Sulg put it this way: "On the basis of many experimental and clinical studies, it seems justified to conclude that the EEG has to be seen as a paraphenomenon of integrated metabolic activity" (p. 65). But those who study brain states and cognition, with brain electrobiopotentials as their sole source of raw data, and cite no rCBF studies in their references, for the most part, invariably and doggedly insist that cognition and emotion are encoded in the EEG, no evidence to substantiate this assertion notwithstanding. It's like the adage of old, "don't confuse me with the facts, my mind is made up!" If you open your eyes, fellas, here's what you'd see:

- Brain electrobiopotentials observed in the EEG are epiphenomena of regional brain blood flow and metabolism which, parenthetically, CT-scan has shown to have a poor correlation to underlying brain areas.
- Certain EEG frequency band components vary predictably with PaCO₂, rCBF, and O₂ and glucose uptake—in short, metabolism.
- Certain ratios of EEG band signals

reflect regional hyper- or hypoperfusion, and different pathological brain states are characterized by a unique topography of these indices of disturbed perfusion—the luxury-perfusion syndrome in stroke (TIA), being a good example.*

- No brain topographic map, or other rendering of quantitative EEG (qEEG) data has yet revealed any more about "higher brain function," pathological, or exulted "states" of the mind than has a comparable topographical rendering of rCBF and glucose uptake indices.
- The only element common to all changes in vascular caliber, rCBF, perfusion, and metabolism is PaCO₂, and that is controlled by breathing!

At the end of this article, you will find references from which the statements above derive. I emphasize that these are not my theories although, inexplicably, they have been erroneously attributed to me after workshops and lectures. And, believe it or not, I have been criticized for ascribing to them.

PART II: ALPHA/THETA NEURO- THERAPY—NEUROBABBLE?

The preponderance of evidence that EEG is an epiphenomenon does not materially invalidate its use in clinical psychophysiology. What can EEG, qEEG, or topographical mapping contribute to diagnosis and therapy? But first, what can't it contribute? Since there is not a shred of evidence that anyone has ever been able to identify a single "higher brain function" from any EEG component let's be objective about the following assertion by Peniston and colleagues (1993):

The [alpha/theta] state of consciousness has been referred to as the 'EEG window of opportunity of the reverie state' where hypnagogic imageries surface. . . . It is postulated that the increase in the theta amplitude in conjunction with the decrease in the alpha amplitude during the abreactive session seems to be correlated with the strong affective experiences of childhood and/or adulthood—particularly past traumatic anxiety-evoking events (i.e., abreactive imageries) (pp 45-46).

Please translate, in your mind, ". . . increase in theta amplitude in conjunction with the decrease in the alpha amplitude. . ." in the context of my metaphoric instrument-panel light configuration. Most neurophysiologists recognizing this configuration of physiological indices would conclude that this

statement is a crypto-Freudian explanation of the near-asphyxia experience. They might also be tempted to dismiss it as neurobabbles. I am, I regret to say, inclined to side with them.

You may recall that the same phenomenon was heralded by some psychotherapists who reportedly had their clients induce hyper-ventilation syndrome (HVS) by rapid breathing—with exactly the same result. And that was also touted as therapeutic. What happens when you do that? Consciousness fades, alpha amplitude decreases as theta amplitude rises! And, people experience and report weird "twilight" things. (By the way, do you remember your high school geometry theorem, Things equal to other things are equal to each other? Here's an application.)

Peniston's statement is a crypto-Freudian explanation of the near-asphyxia experience.

The effect of HV is so well documented that it is routinely employed in neurological examination to elicit "slow waves," and in some instances, seizures. The phenomenon was first described in detail by Rosett in 1924, and many hundreds of replications have been published since then. Engel, Ferris, & Logan showed unequivocally that after two minutes of HV, theta dominated the EEG (@ 6Hz), and after about three minutes, conscious awareness had essentially vanished. Before them, back in 1938, Lennox, Gibbs and Gibbs demonstrated the near-linear inverse-relationship between CO₂ and brain dominant frequency, with theta rising as PaCO₂ fell. Gradually, that relationship was shown also to correlate with brain blood flow and metabolism.

But why do I say "near-asphyxia?" Neurosurgeons know that low PaCO₂ causes brain arteries and arterioles to constrict—so much so that they routinely hyperventilate patients where it is deemed necessary to stem hemorrhage. One of its side effects is a profound lack of O₂. Would you care to guess the dominant frequency of the EEG? You got it—theta! In the classic EEG textbook by Kooi (1971) we read that: "The main effects [of reduced O₂ supply] are reduction of alpha amplitude and emergence of theta and delta components." (p. 206.) And Rampil (1984) writes that: "The statement. . . that standard EEG recordings are not helpful in the recognition of hypoxic brain insults is difficult to support in the light of the more than five decades of experimental and clinical evi-

dence that the EEG is sensitive to cortical ischemia. It is well accepted that the EEG slows notably when the cortical blood flow falls below 18 liters/min per 100g of tissue." (p. 601.)

Things equal to other things. . . . Given the opprobrious role of theta in brain function, one might wonder what leads some to laud it and to promote it as therapeutic. I think that the answer is imbedded in an unfortunate misinterpretation of early yogic meditation studies. The apparent paradox is most likely due to a misinterpretation of the pioneering findings of Kasamatsu and Hirai; Anand, Chhina, and Singh; and Banquet. What these investigators reported was quite unlike theta encountered in pathological states of regional cerebral hypoperfusion and seizure disorders. Kasamatsu and Hirai described the composition of the EEG during Zen meditation by one of their disciples this way:

After Zen meditation has started, the well-organized alpha waves of 40-50 uV., 11-12/sec. appear within 50 seconds in all the regions and continue for several minutes in spite of opened eyes. . . . After 8 minutes and 20 seconds, the amplitude of alpha waves reached 60 to 70 uV. predominantly in the frontal and central regions. . . . Initially, these alpha waves alternate with the short runs of activating pattern, but a fairly stable period of the persistent alpha waves ensues on the progress of Zen meditation. After 27 minutes and 10 seconds, rhythmical waves of 7-8/sec. appear for 1 or 2 seconds. . . . And 20 minutes later, rhythmical theta train (6-7/sec., 70-100 uV.) begins to appear. (pp. 209-210).

This phenomenon did not invariably occur, but it was replicated in others of their disciple-subjects during meditation. This theta is clearly unlike that evident in most pathological states which they studied, including anoxia, epileptic seizures, and other neurophysiological disorders, and they show in detail that it is also unlike that in sleep, and in hypnosis.

Banquet, in a spectral analysis of the EEG in meditation, likewise observed a shift from alpha to lower frequencies. He reported that:

A dominant theta pattern (unlike that of drowsiness) was observed in the second stage of meditation. Within 5-20 min after the beginning of meditation short bursts of high voltage (up to 100 uV) theta frequency at 5-7c/sec occurred during 1 or 2 sec, simultane-

ous in all channels. . . . (p. 146)

Here again, so far as can be determined, theta did not accompany a brain pathological state. In keeping with my thesis, the EEG frequency spectral composition in the subjects who showed elevated theta (in the Banquet study) had very rapid transient high-voltage theta activity, sometimes singly, sometimes in rhythmic trains, within an overall attenuated theta band, accompanied by elevated alpha.

This cannot be readily observed without on-line FFT capability. There would be no way to know what is happening in the different segments of the EEG frequency spectrum if you do nothing but monitor the occurrence of theta passing through a filter: Counting the horses that run through the gate of a pasture tells you nothing about what's in the one next to it. If there is a lesson to be learned from all this it is that one must ask "What theta? How was it observed. . . by filter, or FFT?" to tell the good from the bad theta.

You may reconsider your skepticism in the light of a study by Cobb, Sargant and Schwab, published in 1939, in the Archives of Neurology & Psychiatry, in which they simultaneously recorded respiration and EEG in seizure sufferers with a view to controlling seizures. Why would they choose this approach? Because it was already well known then that HV, a common feature in seizure disorders, caused brain hypoxia when PaCO₂ fell, resulting, in those so predisposed, to paroxysmal brain arterial vasoconstriction and seizures. And the EEG signature of this state? Theta.

PART III: REINVENTING THE WHEEL

It is really curious that current brain blood flow studies are rediscovering what was known about brain metabolic physiology and the EEG in the late 1930s and 1940s. If you read the literature, as I have for the past ten years, it is "déjà vu all over again." It is not that that body of knowledge was disproved and discarded—it just faded into obscurity, somehow. Evidence that CO₂ controls brain blood flow, and therefore O₂ availability and metabolism in the brain, was mounting from the late 1930s on. So was its connection to EEG theta as the signature of the impairment of brain blood flow and metabolism. In those early days, it was also called the delta index.

The evidence that breathing had something to do with that likewise piled up. For instance, one could reduce brain blood flow

by HV, which lowers PaCO₂, or raise rCBF by inhaling CO₂. Meduna wrote a brilliant book, Carbon Dioxide Therapy, in the late 1950s, on CO₂ inhalation to improve brain metabolism, reduce anxiety and panic, improve mood and affect, and "higher brain function." In fact, he showed conclusively that low brain blood CO₂ was associated with anxiety, and used CO₂ inhalation to reduce it.

It is only recently that we have witnessed, in such communications as those of Klein, and colleagues, describing their theory of panic disorder as "false suffocation alarm," an unacknowledged reiteration of Meduna.

What recent technological advances have highlighted is that it is no longer necessary to study unnatural surgical or animal "preparations" to infer rCBF and metabolism from either brain sections showing vascular caliber, or from arteriovenous blood O₂ differences. Not surprisingly, PET scan and MRI studies of rCBF bear a striking resemblance to EEG power spectral composition topography. This brings us around to the instrument-panel analogy: If rCBF maps parallel EEG spectral composition topography, doesn't it stand to reason that EEG topography plots regional blood flow and metabolism? And, that being the case, it follows that at least the EEG band components, delta, theta, and alpha, correspond to rCBF ON/OFF indicators as I postulated above. Things equal to other things. . . . I, modestly, take credit for the instrument-panel analogy, but nothing else. Now, for those among you who are tempted to dismiss such conclusions as misguided efforts to repudiate enlightenment regarding the revelations to be extracted from EEG frequency analysis, please read on:

As brain blood flow decreases, theta rises, and alpha decreases. . . . No wonder theta brain-speak is weird!

In 1986, Nagata and colleagues published "Topographic EEG correlates of cerebral blood flow and oxygen consumption in patients with neuropsychological disorders," in which they detailed (a) negative correlation between the "delta" index (theta) and rCBF, and (b) positive correlation between alpha and rCBF. In other words, as brain blood flow decreases, theta rises, and alpha decreases; and conversely, as rCBF rises, theta diminishes, and alpha rises. Can you picture the constellation of lights ON and OFF on the "instrument panel?" Is there a note of caution here to

anyone who would enhance theta indiscriminately—as in neuro-therapy? No wonder theta brain-speak is weird!

Numerous investigators have reported predominance of theta frequencies in dementia, and Sulg, in particular, showed in 1984 that one could use the qEEG to differentiate brain neuropathological populations differing in mean rCBF. Their graph plots percentage of activity-time of frequency components of patient groups whose average rCBF is different from normal in varying degrees. Every pathological category showed theta-band power elevation well above that of the normal control including the more extreme cases, those with uncoupling, where rCBF exceeded twice normal value. None of this is new, however. When Meyer and colleagues induced hypoxia in their subjects, they found that:

... the EEG rapidly deteriorated with progressive reduction of amplitude and slowing in the theta, then in the delta range, and finally becoming flat. . . . After anoxia for 2 min, air breathing resumed and the EEG returned to normal rhythms. . . . (1976, p.504)

The point to this: it does not seem to matter by what means brain O₂ and metabolism are reduced, the signature of that state is theta. Which brings us to two all-important questions: First, is there a role in clinical psychophysiology for "frequency analysis?" Second, in the light of the foregoing, how wise is the neurotherapy procedure of enhancing theta, as it is presently practiced? I will address only the first question here. I leave the second to your consideration.

In the context of my instrument-panel analogy, there are a number of ways that EEG can add to the armamentarium of clinical psychophysiology:

- Hyperventilation causes low blood CO₂, i.e., hypocapnia. Hypocapnia is a powerful vasoconstrictor, reducing brain blood flow and metabolism. This condition is signaled by increased EEG theta and decreased alpha. The majority of persons having HV-related symptoms, including panic disorder—even seizures—have been shown to have disordered breathing, and elevated theta. I have found it useful to monitor the EEG during deep-diaphragmatic breathing training because the bad theta will diminish and alpha will rise when proper breathing normalizes blood gasses.
- In counter-anxiety strategies, where deep relaxation is achieved by a combination of breath control and meditation-type exer-

cises, an index of success is the appearance of the good theta.

- EEG may detect organic basis for psychological disorders where brain disease is not ordinarily suspected. Theta in treatment-resistant chronic depression may, for instance, suggest temporal lobe epilepsy (TLE) and facilitate treatment. Evidence for disturbances in rCBF in certain depressions, and in obsessive-compulsive disorder (OCD) has led to a new view of these disorders. *In my experience, and in that of others, bad theta is commonly encountered in migraine, panic disorder, certain depressions, obsessive-compulsive disorder, alcohol abuse, minimal brain dysfunction with so-called "soft signs," and learning disability, attention deficit (child and adult), seizure disorders, compensated metabolic acidosis (as in renal and heart failure, alcohol abuse), among other conditions. This EEG index strongly supports a theory (like Katz's) that some conditions may have a hypoxia etiology. Blass and Gibson showed that hypoxia impairs neurotransmitter biosynthesis. But most important to me is that when I have been able to help clients with such conditions to reduce the frequency and severity of their symptoms, it has usually been as a result of their learning deep-diaphragmatic breathing, which lifts brain hypoxia and is accompanied by attenuation of bad theta.

- The "conditioning" process that leads to normalization of the EEG in attention-deficit and hyperactivity disorder (ADHD), as per Lubar, is entirely consistent with the instrument-panel analogy, regardless of what it may turn out is actually being conditioned.

Finally, according to Ingvar, Sjolund and Ardo, summarizing their results of a study of the correlation between dominant EEG frequency, cerebral oxygen uptake, and brain blood flow, in *EEG & Clinical Neurophysiology* (1976):

We have learned from this work that the EEG is really a paraphenomenon of cerebral metabolism. It cannot, however, be used to measure the metabolic rate of the brain, although this is more or less directly reflected in the EEG. Thus, the EEG as well as the CBF are physiologically coupled to brain metabolism, but there is no direct coupling between blood flow and EEG. The CBF is directly reflected in the EEG as long as there is physiological autoregulation of the CBF. In pathological hyperperfusion (the luxury-perfusion syndrome), the EEG and flow are dissociated,

but even then the pathological state of the brain is still reflected in the EEG. There is, however, also and EEG/CBF dissociation in physiological conditions, i.e. the EEG does not reflect closely those shifts in the CBF that are the result of activation of higher cortical function. . . . Therefore, the EEG is not a perfect tool for measurement of normal function. (p. 81)

So, there you have it folks! If the EEG is coupled to brain blood flow, but not predictive of "higher function," then how can anyone claim that (a) there is an alpha-theta state of consciousness that (b) provides an "EEG window of opportunity of the reverie state where hypnagogic imageries surface," and expect this to be anything other than a manifestation of an oxygen-starved brain figuratively thrashing about in desperation—especially in the light of what we know about elevated theta! Maybe this is therapeutic, who knows.

Nagata concluded in 1988, in an article published in *Brain Topography*, that ". . . EEG parameters are considered to correspond in general to the cortical blood flow and metabolism beneath the scalp electrode." (p. 104). The scientific battlefield is littered with the remains of countless attempts to find a neurophysiological connection to the "insights" of psychoanalytic dogma. It doesn't work, fellas. It's a waste of time. Give it up, and let's move on. We have important work to do.

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THE NEW FRONTIER

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It would appear that extraordinary breakthroughs in a given area of science seem to occur at intervals of no less than 20 years or so. Often these exciting phenomena are triggered by a significant advance in some related technology. The phenomenon of interest in this case has been labeled neurotechnology and the significant advance took place because of developments in three areas: biofeedback, computer design and certain statistical/mathematical applications.

DR. JOE KAMIYA AND THE "ALPHA STATE"

In the early 60s when Joe Kamiya, then of the University of Chicago and later the Langley-Porter Institute in San Francisco, began to explore the possibility of research participants to learn to control their own alpha brainwaves, it signalled a new era of psychophysiology. For the first time people were learning to control physiological responses that were previously thought to be outside conscious control (exceptions of course were certain groups of Asian adepts who had studied for many years to acquire these skills).

In the beginning Dr. Kamiya simply would watch the moving polygraph record that displayed the ongoing brainwaves or EEG as it is called, and when a burst of alpha appeared Dr. Kamiya would say now! thus providing the participant verbal feedback of this type of brainwave. After a certain amount of this information the participant could guess fairly accurately when he was producing alpha EEG. One might say that he had calibrated his internal experience of the alpha state. Later Dr. Kamiya developed an electronic device that would sound a 400 Hz tone whenever alpha appeared. Participants learned to produce more and more of the tone. They reported that the alpha state felt relaxing, peaceful, calming, and, in some cases, euphoric. Soon many research labs were studying the alpha state as produced by the feedback machine.

SKINNERIAN ZEN?"

Keeping in mind that the 60s were a time of freedom of expression and drug experimentation it's not surprising that this alpha feedback was considered to be a sort of electronic Nirvana, or what my colleague Johann Stoyva called "Skinnerian Zen." However, the goal of Nirvana was never realized by these alpha state adepts even though they did find the state incompatible with stress and anxiety. As a graduate student at that time I was interested in applying his calming, relaxed state to the then very popular behavioral technique known as systematic desensitization (SD). Developed by Dr. Joseph Wolpe of Temple University, SD was being applied to an amazing variety of disorders. Basically, the technique involved training the client in deep relaxation, and then using that relaxed state as a counter to the anxiety that typically would be felt as the client visualized herself facing the phobic

stimulus. Through the gradual and progressive application of this procedure the client would show a decrease in anxiety responding which would then transfer to real life situations. The difficulty lay in the fact that the therapist could never be sure whether the relaxed state had indeed been generated by the client who, in most cases wanted to please the therapist. Since the amount of alpha in the EEG could be measured fairly accurately, I reasoned that it could be used as a measure of the degree of relaxation in the context of the SD procedure.

ALPHA FEEDBACK VERSUS THANATAPHOBIA

With the help of John Picchiottino, an aerospace design engineer friend, I developed a laboratory alpha feedback system in 1965. We then searched for an appropriate phobic client. Soon I was teaching the technique to a professional man who suffered from a troublesome thanataphobia or fear of death and death-related stimuli. Ken (not his real name) admitted that he had no recall of what might have caused this condition but noted that his younger brother also experienced the same phobia.

Could Ken learn to use the alpha tone to build up his alpha and then use the alpha state to counter the anxiety as he visualized himself in phobic situations? Indeed he was able to increase his alpha from 20% to 80% in several sessions. Then we began the actual desensitization. Ken was asked to generate maximum alpha at which point I asked him to visualize one scene from the fear hierarchy of gradually increasing fearful phobic scenes. When anxiety began to appear Ken would stop the scene and then use the alpha feedback tone to build up the alpha again. Thus, between each visualization Ken used the alpha state to counter the anxiety. In only four sessions Ken had completed the SD and the transfer to real life was immediate. No longer was Ken afraid to drive home alone after dark or to go into his basement. We can in fact, verify a successful follow-up of some 28 years with him.

BREAKTHROUGH MEMORY?

After the first SD session Ken suddenly remembered that as a young boy he and his brother were made to kiss the corpse of their grandmother as she lay in the open coffin. This spontaneous uncovering of the original traumatic incident may have contributed to the success of the desensitization.

Ken's desensitization using the alpha state was perhaps one of the first clinical applications of EEG feedback and yet the psychology department at the University of Colorado Medical School was not impressed by this new approach. Instead they suggested that we stop trying to relax people by feeding back brainwaves and simply feed back muscle tension instead. In fact that is exactly what we did focus on for the next few years.

THE DEMISE OF THE "ALPHA STATE"?

Following the initial excitement of the discovery that alpha EEG could be increased, there occurred a period of ten or more years during which serious researchers chipped away at the alpha mystique. One prestigious group of researchers found that college sophomores left alone to rest in a darkened room produced as much alpha as they were ever going to produce under any circumstances. These researchers concluded that increased alpha could be generated without the aid of EEG biofeedback. Other biofeedback researchers (ourselves included) began to pursue other forms of application such as muscle tension (EMG) and skin temperature even as we continued to work almost covertly on EEG feedback.

True, the alpha state didn't result in Nirvana, and it could be produced without biofeedback in relaxed sophomores in darkened rooms, but did EEG feedback have any redeeming characteristics? At our research lab in the University of Colorado Medical Center we still thought so; and so did Elmer Green and his associates at the Menninger Biofeedback lab, Les Fehmi at Princeton and, of course, Joe Kamiya in San Francisco. In other words a scattering of researchers still pursued, at least part-time, EEG feedback. Research funds dried up in just a few years although Barry Sterman in Los Angeles remained funded longer than most for his EEG research with epilepsy.

THE UNIVERSITY OF COLORADO MEDICAL CENTER BIOFEEDBACK STUDIES

During the later years of the Viet Nam War our lab, and a number of others, were funded by the DOD (Department of Defense) to develop techniques that would allow the training of officers to sleep under stressful battlefield conditions. We developed a three stage training program: EMG feedback first, to relax muscles, then alpha feedback to calm the mind, and finally, the theta EEG feedback to teach participants to take themselves into stage 1 sleep. To do this we had to design a lab EEG feedback system that would precisely quantify and feedback alpha (8-12 Hz) and theta (4-7 Hz).

Our research showed that we could indeed train people to produce a theta state with the graduated training program but we also found that most people required only low levels of facial EMG (muscle tension) to begin to produce theta EEG. As we continued to study this mysterious theta state we discovered an enormous literature on hypnagogia as it was called by the researchers. Out on the windy plains of Wyoming for example, Foulkes and Vogel studied the cognition of individuals as they fell asleep. It became apparent to these investigators that in the context of the Freudian model the individual's defense mechanisms that guard the gate of consciousness were decreased as he passed into sleep. A critical point however, was that these sleepy people could still absorb verbal information even though they tended to process it without the usual criticalness. A number of researchers had in fact come to the same conclusion including T.X. Barber the famous hypnosis expert who found that he could wake people from a sleep and present them with suggestions to which they would respond as though hypnotized. This finding intrigued me because I was just beginning to employ the early cognitive therapy procedures with depressed individuals without much success. I found that when they were asked to tell themselves positive affirmations they would report that a little voice would say, I like hell you are! One day it occurred to me that we could use the finding that a drowsy state characterized by theta EEG would be one of uncritical acceptance and if the affirmation was presented then the little negative voice wouldn't get in the way. What's more we could use theta EEG biofeedback to capture the hypnagogic state just as

we had in our earlier DOD work.

THE TWILIGHT-STATE LEARNER

Once again assisted by John Picchiotto, president of Bio-Feedback Systems, I developed the first prototype of the T-L device in 1970. It required a long period of experimentation as we adjusted filter characteristics in accordance with reports from various individuals who were willing to allow their brains to be exposed to theta information.

The final system programmed the presentation of one set of tape recorded messages when alpha EEG was generated and a second tape recorded message when theta occurred. We developed a unique sleep guard or bump circuit that would increase the volume of the taped theta message if the theta frequency decreased toward delta and/or increased in amplitude.

Another logic feature: The theta tape recorder would not turn on even in the event of theta EEG energy if there was alpha or beta energy present as well. This characteristic means that all conscious defenses are inactive when the theta message comes through. If alpha or beta frequencies are allowed in the presence of theta (mixed in with the theta) the individual can be aware of the messaging, i.e., he can actually hear it.

Does pure theta mean all defenses are down? The answer is no! In fact there are a few deeper level unconscious defenses which guard the sensitive, uncritical part of the brain.

GUARDIANS OF THE GATE

Freud identified a number of mind defenses that were generated as a result of unpleasant life experiences. Each time an individual suffers a trauma the mind tries to develop some sort of protective program that, once installed, will attempt to avoid, or in some way soften, the unpleasant effects of encountering the feared stimulus again. These protective programs are called defense mechanisms (DMs) and they include such phenomena as a build-up of fear or other aversive emotion or uncomfortable feeling as one begins to encounter something that resembles the original traumatic stimulus situation. Projection ("it isn't me that can't trust, it's you") is very common, as is denial ("No, I didn't say that.")

Some DMs work by distorting the information being processed in the brain. It's as if a distortion lens had been placed over the brain with regard to that particular perception, e.g., "all men are dangerous, can't be trusted," or (a very common DM) "I know I look bad today" (when in fact one looks very good.)

REPRESSION (WHEN IT'S TOO AWFUL TO REMEMBER)

The DM which is called repression is generated by the brain in order for the conscious mind to be unaware of the particularly unpleasant traumatic memory. In the context of covering up or repressing extremely unpleasant memories the body will often code the memory in high tone in a specific muscle or muscles, i.e., certain muscles will be prone to an unusually high level of tension. Often these muscle groups will develop painful conditions over time. Moreover, periods of high stress will increase the level of tension and, therefore, the pain. Another factor that increases the tension and pain is the encountering of a situation or individual that in some way resembles the original traumatizing event.

The more closely this stimulus is related to the original trauma the

more anxiety or physical symptoms will appear. In effect, the Pandora's Box of the unconscious is being opened and the terrifying memories may emerge.

NOTE: Certain traumas experienced by young children objectively could be classified as of little consequence (e.g., temporarily losing one's mother in a supermarket) but to the child it is life-threatening!

PANDORA'S BOX

The repository of our repressed traumatic memories has often been called Pandora's Box. Unfortunately, even though these hurtful memories are not available to our conscious mind and thus do not keep us in a constantly angry or fearful state, they can still influence us in subtle and troublesome ways. As noted above anything that in some way resembles the original trauma can cause one to feel anxious, uncomfortable, depressed or angry (without knowing why). Quite often there is an emotional "shutdown" which can be quite specific or very generalized ("I never feel anything!")

The repressed material also erodes our self-confidence and we may find ourselves sabotaging our own success because on the unconscious level we are "bad" and don't deserve good things (and this includes good relationships). An unusual amount of stress can even precipitate a breakthrough of unconsciously mediated behavior reflecting the underlying conflict.

Psychodynamic theory predicts that if the repressed memories can be brought to consciousness in the therapeutic setting their "charge" can be dissipated as the material is integrated into the adult conscious mind. After this recovery and integration the traumatic memories will no longer bother us. Moreover, a significant amount of energy is no longer required for the repression and is therefore available for adaptive endeavors. We feel better, more energetic, freer with our emotions, and no longer fearful of these stimuli.

TO CHANGE THE "SCRIPTS" IN THE "BOX" DO YOU HAVE TO OPEN IT?

Sometimes, perhaps most of the time, it is not enough to simply replay the original trauma. What is required is what has been labeled *rescripting*.¹ However, in order to rescript one needs to know some detail about the original traumatizing event(s). The trick is to raise the lid just enough to identify the scripts yet not so wide as to permit intolerable feelings or memories to

flood out. This latter situation has caught many a therapist and patient by surprise because few professionals possess the skill to discern the extremely subtle physiological changes

that typically herald the oncoming emotional flood. Neurotechnology however, may have an answer for this dilemma. Not only can these systems open the box but they can titrate the degree of lid opening. Tom Allen and Len Ochs designed a program such that the EEG actually signals when emotionally laden repressed material is beginning to surface, and the neurofeedback system is sensitive enough to detect this. Moreover, the neurofeedback can then adjust the feedback so that the emotional rush is slowed to an optimal and tolerable level.

Once the box has been opened and the formerly repressed material begins to surface and is integrated with the help of the therapist, the appropriate counter script(s) can be designed with both the patient and therapist participating. The client has already been trained to "carry in" the counter scripts to the theta EEG state and the rescripting can begin.

RESCRIPTING

Please note at the outset here that rescripting may not be necessary in the event that the integration of the formerly repressed material is successful in removing the neurotic thinking, feeling and behavior. In fact rescripting is probably maximally effective when the neurosis was generated from a single or several almost identical traumatizing events. For those unfortunate cases in which the trauma occurred in various ways and over a long period of time the rescripting procedure is less effective. Why should this be so? Because, in this case, the original traumatizing stimuli varied widely and therefore the generalization over time was much broader. In other words the client became secondarily sensitized or higher level conditioned by association to a far greater field of stimuli than would have been the case if only a single trauma had occurred. In these cases the technique developed by Peniston may be about as effective as one can get with rescripting.

THE PENISTON PROTOCOL

Drs. Peniston and Kulkowsky, influenced strongly by the work of Drs. Elmer Green and Dale Walters, devised this procedure in order to help alcoholics although it has since been applied to other addictive problems as well. Basically, their approach

involves initial training in deep relaxation by means of hand temperature feedback and autogenic exercises, accompanied by training in the development of a series of visualizations, e.g., seeing oneself at a party avoiding alcohol, and seeing one's ideal self in the future. After the imagery creation the client, who has also been receiving neurotherapy training on alpha EEG and theta EEG enhancement, is instructed to carry the scenes into the theta state. The training requires roughly 6 sessions of handwarming/deep relaxation and 30 or more sessions of alpha/theta training and theta imagery work.

It has been reported by Peniston and his colleagues and a number of clinicians, such as Carole Blackman in Santa Cruz and Dale Walters in Topeka, that the technique is successful in preventing relapse in more than 60% of the cases.

ABREACTION AT THE "CROSSOVER POINT"

Peniston and others have discovered that a percentage of addiction clients have early abuse in their backgrounds. Such individuals are more likely to experience emotional abreaction in theta states and therefore the neurofeedback system must be programmed to keep the lid from opening too suddenly or widely on Pandora's Box. Peniston discovered that unconscious material is most likely to begin to surface when there is an EEG "crossover" i.e., when alpha is diminishing as theta begins to increase, and the two reach the same amplitude. The abreaction is useful in that it can illuminate underlying problems and the client and therapist can then focus their therapy more precisely. The neurofeedback system can ensure that the abreaction proceeds at a more gradual and controlled rate. The main difference between Budzynski's twilight learning technique of the early 70s and today's Peniston protocol is that imagery is used as the change medium in the Peniston approach and verbal affirmations in the case of twilight learning. Although it is somewhat difficult to maintain a given image or visualization as one transitions from alpha into theta it is apparently enough to at least bring the image close to the theta state even though the mind will tend to break off into hypnagogic imagery at that point.

The rationale for the success of the Peniston protocol is essentially the same as that hypothesized by Budzynski in the context of twilight learning in that the theta state provides a relatively undefended mind state in which suggestions or imaged sce-

narios can program or rescript the unconscious resulting in long-term change.

JOEL LUBAR AND THE ADHD KIDS

The most thoroughly researched of the neurofeedback applications has been the work with ADD (attention deficit disorder) children. These young people have hypoaroused brains and it is theorized that their hyperkinetic activity is an unconscious attempt to boost brain arousal. The medication Ritalin, increases the brain's activation or arousal level and therefore the ADHD client quiets down. The medication however has side effects and so interest developed when it appeared that neurofeedback might alleviate the disorder. Dr. Joel Lubar at the University of Tennessee had earlier studied with biofeedback pioneer Dr. Barry Sterman at UCLA. Sterman had developed the EEG feedback technique known as SMR or sensorimotor response training which helped control epileptic seizures. Lubar reasoned that a similar technique might work with the ADHD clients. Indeed it did and Lubar and others are now refining the technique. Essentially the children are taught to decrease the excessive theta and increase their beta energy. It now takes about 30 to 60 EEG BF sessions but after that most clients are able to give up the medications. Lubar reports that the success rates of 60 - 80 % are still holding at followups of 10-14 years.

MARGARET AYERS AND THE BRUISED BRAINS

Surprisingly there is one clinician who has treated more brain injured clients with neurotherapy than all of the other neurotherapy clinicians put together. This amazing woman is Margaret Ayers of Beverly Hills, California. Ayers, who also studied with Sterman, has used the EEG feedback system of her own design. This system allows her to look at the energy in specific frequency bands and feedback whatever band information she feels will help. Most of her brain injured patients, like the ADHD kids, are trained to decrease theta and increase beta. In one study of 250 patients Ayers found:

1. An increase in energy, a decrease in depression and temper outbursts in the first 6 sessions.
2. Decrease in light/sound hypersensitivity and an increase in attention span in the next 6 session period.
3. Decrease in dizziness and vascular headaches in the third 6 session period.
4. Increased libido, less reversal of letters

and words in final 6 session period.

There were EEG changes as well:

1. Phasic spikes decreased in first six sessions.
2. All spikes gone but theta slowing still present in second six session period.
3. In the third 6 session period a reduction in theta.
4. Final 6 session period most theta eliminated.

Margaret Ayers' work over the last 20 years or so has certainly documented in clinical fashion the successes of neurofeedback in the area of brain injury. Others, such as Siegfried and Susan Othmer in California, Tom Allen in Orlando, Florida, Jim Smith and Ken Tachiki in Los Angeles, Len Ochs in Concord, California and Daniel Hoffman and Steve Stockdale in Denver are now contributing to this growing pool of successes with brain injured individuals.

MODERN NEUROTECHNOLOGY

The EEG biofeedback unit of 25 years ago was an analog stand-alone system. Today's neurofeedback system is basically a fast computer programmed with superb FFT (Fast Fourier Transform) and spectral analysis capability with beautiful graphic displays. These systems typically can collect data from up to 20 or so EEG sites on the scalp and process the brainwave signals by calculating with great speed the power in each EEG frequency band. The computer display can present color bars representing each EEG band. The energy in the various EEG bands can also be displayed as a game or, in the case of some systems, as an on-line spectral analysis display. Various forms of audio feedback are available as well. Since the EEG data are stored in raw form as well it can be "read" as is normally done with traditional paper recordings of the EEG. Quantified EEG or QEEG as this computerized form is called, can be conveniently examined in a great detail in raw form or as averaged power or spectrally analyzed data. A number of graphs can be generated and statistics can be applied.

THE MANY FACES OF NEUROTECHNOLOGY

The best known of the neurotechnology devices is the feedback QEEG however, there are other machines which one could include in the category of neurotechnology. These include CES (cranial electric stimulation) and light/sound or AVS (audio/visual stimulation) devices. Some might also include a number of the cyberpunk software programs whose primary purpose it is to stimulate the brain through unusual and sometimes interactive computer graphics. I

would also place some of the new "Hi-Tech" audiotapes under the rubric of neurotechnology because most of them incorporate various binaural or other kinds of audiotones which have some entrainment capability. A tape we developed for highly stressed individuals called "The Revitalizer" was tested with with 36 volunteers and found to produce biofeedback-measured significant decreases in muscle tension, heart rate and electrodermal response, as well as increases in hand temperature. A brainmap of a client listening to the tape dramatically illustrated how the EEG "followed" the soft tone in the background. Thus this tape appears to produce a brain state which is optimal for incorporation of the triple voice track affirmations. Tapes such as these may not affect the EEG as powerfully as neurofeedback, or even AVS (audio/visual stimulation), but they appear to be quite effective.

CES (CRANIAL ELECTRIC STIMULATION)

In ancient Greece those who served as physicians made use of the electric torpedo fish to cure headaches and other bodily pains. The shocking fish was somehow applied to the painful area with a subsequent reduction or elimination of the pain. Centuries later, just after the turn of this century Russian scientists began to experiment with electrical current applied to the human body. They found that small currents (less than one milliamp) passed through the head helped with insomnia problems. The Russian device was known primarily for this application and even today in Europe it remains thus, although recent Russian research with 78 Hz CES shows it to be very effective in pain reduction.

Scientists in the USA however more fully explored this small, cigarette pack size device that impresses a square wave of approximately 100 Hz on the brain primarily from mastoid to mastoid. Dr. Childs, a Houston physician working with head injured patients, found that recovery was accelerated by a significant factor by the addition of daily CES to the treatment regime. Other scientists, primarily Ray Smith who directed a large number of controlled studies, discovered that CES was extremely helpful with alcohol recovery. A Scottish physician, Dr. Margaret Patterson, became famous for successfully treating a number of famous drug-addicted rock stars with CES.

More recently CES has been found to decrease anxiety, depression and stress. One of the newer studies indicated that

CES was helpful in reducing the symptoms of ADD (Attention Deficit Disorder). Even sufferers of chronic fatigue syndrome and chronic pain are reported to benefit from daily CES use.

The well-known neurosurgeon, Norman Shealy and his colleagues, actually took cerebral spinal fluid samples before and after volunteers used the CES for approximately 20 minutes. Significant increases were seen in certain of the brain's neurochemicals, specifically serotonin and beta endorphin. No wonder that CES seems to restore balance after the brain is disturbed by the above disorders. Both of these neurochemicals are depleted under conditions of stress, anxiety and chronic pain! By the way, CES doesn't hurt, in fact, you can barely feel it. What's more while using it you can be doing other things like watching TV, reading, even desk work. Please note however, that in most states a CES device requires a doctor's prescription.

AVS: THE MODERN VERSION OF STARING INTO A CAMPFIRE

What is it about a flickering light source that fascinates us? The sunlight shimmering off a mountain stream or reflecting from the trembling golden aspens in the fall seems able to produce in humans a pleasant, relaxed, almost transcendent feeling. Very long ago somebody found that a surface with slits cut in it and passed in front of the face would result in a flickering light sensation that was somehow pleasurable. Until the era of electronics humans found a myriad of ways to self-stimulate with flickering light. What is it about the brain that longs for stimulation?

DOES THE EEG "FOLLOW?"

Stimulation in the form of AVS has been researched by Drs. Harold Russell and John Carter of Houston. These investigators found that EEG biofeedback and AVS both produced increased scores in IQ in learning-disordered (LD) students. Russell and Carter noted that the AVS unit has the ability to produce entrainment of higher or lower frequency activity. They also found that when the left frontal is stimulated at 10 Hz the alpha activity in the left frontal EEG is more than 50% greater than when the same area is stimulated at 18 Hz. Similarly, the percentage of beta present is approximately 40% greater when the same area is stimulated at 18 Hz.

When Russell and Carter used the AVS to stimulate LD and ADD children here is what they found:

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1. Systematic regular use of the AVS entrainment procedures appeared to result in measurable improvements in brain functioning in whichever was the lowest functioning hemisphere.
2. Equalization of functioning may be of particular relevance to LD and possibly to ADD children.
3. WISC-R Verbal-Performance IQ discrepancy scores greater than 15 points (one standard deviation) are reported in over 50% of all children diagnosed as learning disabled.
4. The amount of change in IQ scores with the AVS ranged from 5 to 7 points over 40 to 80 sessions. But the AVS can be done at home and is relatively inexpensive.
5. The EEG feedback, more expensive and done only at the clinic, produced 15 to 20 point gains over 30-75 sessions.

Russell and Carter have also investigated the effects of EEG feedback and AVS with stroke clients. One such case (unpublished and anecdotal) involved a woman who had suffered a stroke that caused her IQ to decrease from a pre-stroke 140 to about 70 - 80 nine months after the stroke and after plateauing. In the opinion of her neuropsychologist (commenting on her pre-training condition), the patient had made as much recovery as she was likely to make from either passage of time or from further treatment. (The IQ tests by the way were administered by the same psychologist). As training progressed involuntary and spontaneous movement was observed in the paralyzed left arm and leg after 15-20 minutes of neurofeedback of 10-14 HZ activity. Combining neurotherapy in the clinic with AVS at home Russell and Carter noted that her cognitive functioning increased to a bright normal level over a period of months. She now holds down a medical/legal computer job and has attained certification in biofeedback. It is possible that a spontaneous recovery occurred, but the gradual improvements seen over time as the number of EEG and AVS training sessions increased make that possibility less likely as an explanation.

OLD RATS LEARN NEW TRICKS

Well yes, aged rodents can learn new things and even become healthier in the process. Dr. Diamond, a very youthful sixty-some year-old Berkeley professor who plays basketball with her students, found that when she added more stimulation to the environment of her lab animals they became younger acting and seemed to learn better. Not only that but they lived longer as well. When, as such scientists do, Dr. Diamond sacrificed her stimulated oldsters and compared their brain structures with the brains from a control group, she determined that

the stimulated ones had grown new dendrites and their brains were actually heavier and larger than those of the control group. More dendrites mean more possible connections or associations and thus enhanced information processing. But there is more — these old rats also appeared to develop stronger immune systems. Given that providing aged rats with extra stimulation in their environment seems to cause positive changes in neuronal growth, and their brains function better with stronger immune responding and a longer life, will this generalize to the human species? Here research is much more difficult because we do not ordinarily sacrifice human participants after the experiment. However, R.G. Jacobs, in an unusual dissertation, examined the brains of 20 cadavers and discovered that dendritic length was positively correlated with years of education. The more above-average the educational and occupational level, the more above-average the length of the dendrites which is a measure of brain growth and development. Does regular AVS and neurotherapy training actually stimulate dendritic growth in the human brain? That question has not yet been definitely answered, but anecdotal clinical data would suggest that the answer will be in the affirmative. Dr. Russell has found significant improvements in short-term memory among other things as his clients, many of them elderly, progress through EDF and/or neurofeedback training (private communication). The animal researchers of course could answer the question more easily than could be accomplished with human participant research.

EDF (EEG DISENTRAINMENT FEEDBACK)

The AVS unit can entrain the EEG or brainwaves and EEG feedback allows the client to learn to produce certain EEG patterns. In the case of EEG feedback the learner may be required to work at the task of establishing this control over a period of 5 to 15 sessions before changes are felt. Len Ochs and Harold Russell, both experienced biofeedback therapists with a knack for invention wondered what would happen if the brain's EEG could actually drive the AVS frequency thus placing the brain in a direct feedback loop with the flickering light and sound unit. Robert Austin, the founder of Syntetic Systems supplied his expert knowledge of the light/sound phenomena in the developing of this system.

LEADING AND LAGGING

One of the unique findings of the initial experimentation was that by leading and

lagging the AVS signal, the EEG would try to follow, and this seemed to produce a result greater than simply in-phase signals. Leading refers to the presentation of the light/sound stimuli at a frequency slightly higher than the brain's dominant EEG frequency at any given time. Thus, the EEG tries to "follow" or catch up to the frequency of stimulation. A lag condition is just the reverse - the AVS frequency stays just below the EEG, therefore the dominant brainwave decreases in frequency as it follows the AVS downward. Another finding was that a program of alternating a minute of lag followed by one minute of lead seemed to produce optimal results. The EEG tends to drive itself over a fairly wide range of frequencies. The light show is spectacular and the experience can be quite emotionally stimulating as well. However, some individuals, particularly those with head injury, are very sensitive to light. With these clients the brightness level must be started at very low levels and then gradually increased across sessions. As the brain heals the client can tolerate brighter and brighter illumination. NOTE: abreactions may occur and appear to be very therapeutic if handled properly.

A MODEL (OR SEVERAL) FOR EDF

Even the experts are not sure of what occurs in the brain as EDF training proceeds. We know that when the brain is injured physically or even psychologically some sort of process, a sort of "rigidification" takes place. The brain becomes less adaptable, flexible, less able to allocate resources to changing tasks or multitasking. The EDF seems to break up these "rigid patterns" and allow a more adaptive reorganization of the cognitive process. Others have said the EDF training produces chaos in the brain which then in turn re-forms into more flexible, adaptable patterns.

THE CHAOS MODEL

Another closely related explanation is that EDF produces a more chaotic state in the brain (in the new sense of the word "CHAOS") thus breaking up the rigid pattern of processing and allowing a new, more flexible, adaptable order to appear within the chaos. Paul Swingle, a Harvard Medical School professor, is using EDF with obsessive-compulsive disorder patients. One could imagine the Chaos model working well here.

THE STATE DEPENDENT "DESENSITIZATION" MODEL

In our early years the dominant EEG frequency is in the theta range (4-7 Hz), and as we develop toward puberty the dominant frequency gradually increases until it stabilizes in the alpha range usually about 10-11 Hz at just about 9-14 years. These dominant EEG frequencies become associated (conditioned) with all the events we experience and thus become part of the matrix of stimuli that are said to establish the state dependency of a given traumatic event. If, at some later time, the individual were to encounter one or more of these stimuli (a smell, a sound, etc.) or reestablish the dominant frequency present at that time, e.g., 6 Hz, some or all of the emotion of the original event will be re-experienced (anxiety, disgust, anger, dissociation, etc.). The EDF tends to drive the EEG over a wide range of frequencies including very low frequencies and thus this stimulus (the 6 Hz entrained EEG) may pick up some of the trauma memory or at least some of the emotion. Since the EDF keeps moving through a wide range of frequencies there isn't time to bring up much of the trauma, but the little that does surface can be easily integrated. Thus, this repeated mini-desensitization is occurring all during the EDF session. The result should be a gradual reduction in fear or anxiety and a freeing up of emotions and behavior in general.

THE RELEASE OF THE TRUE SELF OR "INNER CHILD" MODEL

When we are injured physically or psychologically as a child we tend to develop mind defenses which try to protect the child from further hurt. Each hurt changes the brain/mind and the defenses become stronger. With enough trauma the inner child can be psychologically suffocated with layer after layer of defenses. The true child (self) can no longer be seen - it is buried under all the trauma defenses. The EDF in this model finds its way through the defenses by reestablishing the brain state (read EEG dominant frequency) present at the time of the trauma thus releasing or freeing up the inner child (self) that was frozen like the tin man in the Wizard of Oz. Slowly but surely, in fits and starts, the EDF procedure releases the child. The result is an integration of early traumatic events in the present day psyche of the adult. Whichever model of EDF you prefer, something very positive happens, and it happens rather quickly in the context of the usual amount of time required for thera-

peutic change with other approaches. This may explain why therapists using EDF with PTSD (Post traumatic Shock Syndrome) and certain head injury cases seem to be getting fast results.

THE DENDRITIC GROWTH THROUGH STIMULATION MODEL

As noted above Dr. Diamond's research indicates that novel stimulation produces increased dendritic growth with a resulting increase in the brain's functioning. This probably does occur but there are also higher order organizing processes taking place, i.e., new, more efficient reprogramming is taking advantage of the new "circuitry" of increased dendritic growth.

TANSEY AND THE 14 HZ PHENOMENON

Of all the creative applications of neurofeedback one of the most unusual is the enhancing of a single one Hz EEG signal. Dr. Tansey, a clinician from New Jersey, has found that when clients suffering from a variety of problems ranging from learning disorder to Chronic Fatigue Syndrome (CFS) learn to increase the level of the 14 Hz band energy their symptoms decrease dramatically. Among his publications is an account of four migraine clients with 5-7 years of headache duration, who received the 14 Hz neurofeedback over 4-7 sessions, lost their migraines and hadn't experienced them up to the one year follow-up. Tansey finds that when clients learn to increase the 14 Hz energy the bands near that frequency also increase. Importantly, the lower frequency energy, which is often a signature of brain disorders, decreases with this training. More and more neurofeedback clinicians are trying Tansey's protocol at this time.

THE EEG SIGNATURE OF DEPRESSION

The QEEG has allowed researchers to map the patterns of certain psychiatric disorders including unipolar depression. The work of Davidson and his colleagues at the University of Wisconsin has shown that this disorder is characterized by relative hyperactivity of the right frontal area and the left posterior region. The EEG shows a lower alpha amplitude and more beta energy in these areas. Neurofeedback has been used to attempt to shape these patterns back to normal. For example, some researchers like Peter Rosenfeld are teaching depressed clients to make the left alpha smaller and

the right alpha larger. At the Center for Behavioral Medicine at the University of West Florida we are applying ratio feedback and AVS. Further research will document whether these approaches really work but preliminary results look promising.

CAN NEUROFEEDBACK HELP INTEGRATE MULTIPLE PERSONALITIES?

Carol Manchester and Tom Allen have developed a neurofeedback program which appears to significantly shorten therapy time with MPD (Multiple Personality Disorder) clients. These individuals have to be eased carefully into tolerating theta states near the crossover point because they have a great fear of experiencing the original traumas that produced the splitting into the different personalities. By monitoring responses of the autonomic and somatic systems with EMG, temp. and EDR (electrodermal response) biofeedback monitors as the client attempts to transition into an alpha/theta state, these clinicians can tell if the client is beginning to experience anxiety. They can talk gently to the client lending her support as she begins to open Pandora's Box. The theta/beta ratio "alarm" can also signal a descent into a theta state and a possible abreactive experience. Thus Manchester and Allen are able to carefully titrate the emergence of the traumatic material. These experts have documented, in a clinical research fashion, over 20 successful cases and have prepared a report for publication.

PEAK PERFORMANCE TRAINING AND NEUROFEEDBACK

Everyone has heard of peak performance, that rare, magical period of time, usually brief, when an athlete produces a feat of near perfect form. Psychologists have generated a number of procedures that appear to help the athlete approach this goal. In 1967 at our lab at the University of Colorado Medical Center we helped a downhill racer improve by using EMG biofeedback while he visualized scenes of blasting out of the starting gate and skiing perfectly down the hill. This basic technique was improved on by our twilight learning technique and has now been evolved by Richard Patton in Colorado Springs as a neurofeedback procedure. Patton reads aloud a peak performance description written by the athlete as the client maintains a neurofeedback produced theta state. Homework involves daily visualizing of the peak performance. He has worked with elite athletes in the fields of karate, weightlifting and ice skating.

NEUROTECHNOLOGY FOR THE HARRIED EXECUTIVE?

A number of symptom-free normal individuals have tried EDF training as well as the alpha/theta training with guided imagery. What does it do for these people? Recall that with the Peniston protocol the individual is trained to produce alpha and the theta before carrying an idealized future image into the theta state where it programs the unconscious. If this technique can work with a serious problem like addiction what might it do for a salesman who is trying to increase his job performance or the executive who wants to overcome a fear of speaking in front of superiors, or even the CEO who feels that he is losing his short-term memory and can't compete with younger executives. If these procedures seem to do anything, it is to allow the brain to more fully realize its potential.

THE ULTIMATE: VIRTUAL REALITY NEUROFEEDBACK

What if your EEG signals could drive a virtual reality display? Imagine "walking through" a 3-D virtual world where the symbols were driven by your brainwaves. Do you think you could learn to manipulate the V-R symbols with more interest, excitement and motivation than with a flat computer screen graphic? This wedding of biofeedback in general and neurofeedback in particular to Virtual Reality will be a marriage made in neurocyberspace heaven! Perhaps in the not too distant future, neurotechnology will take its place as the Neurofitness Program for the Brain/Mind.

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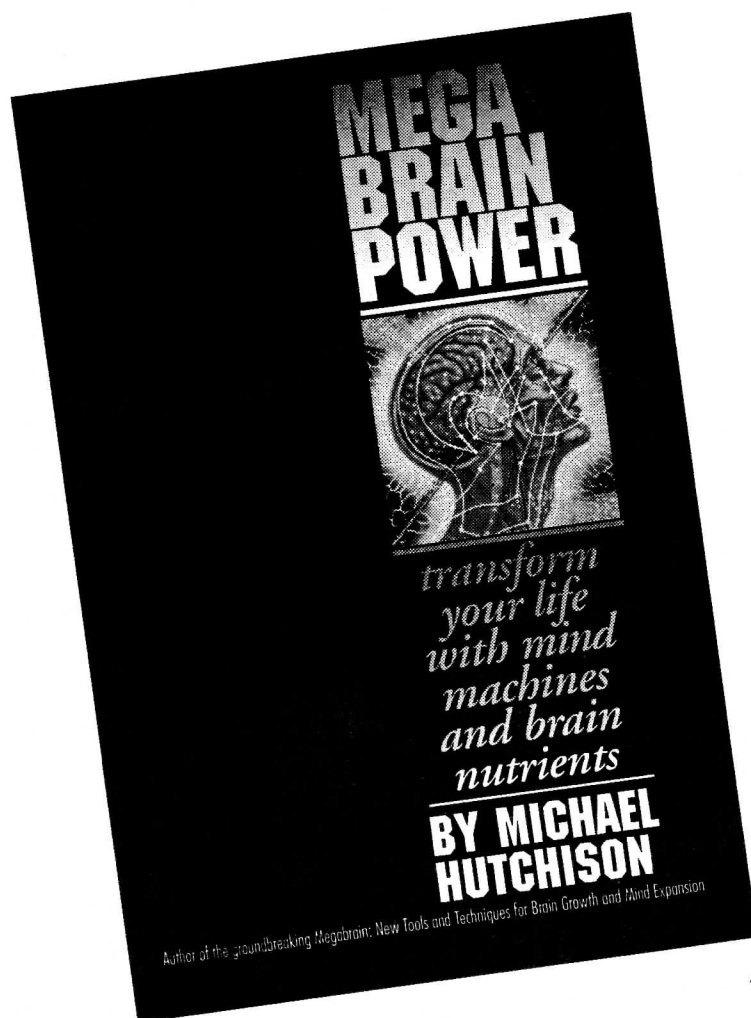
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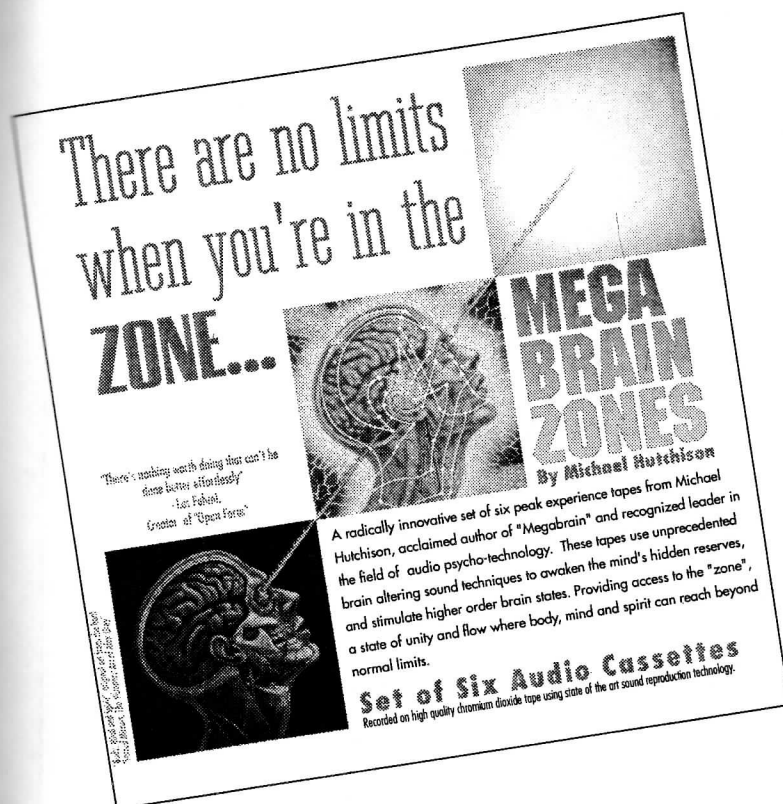
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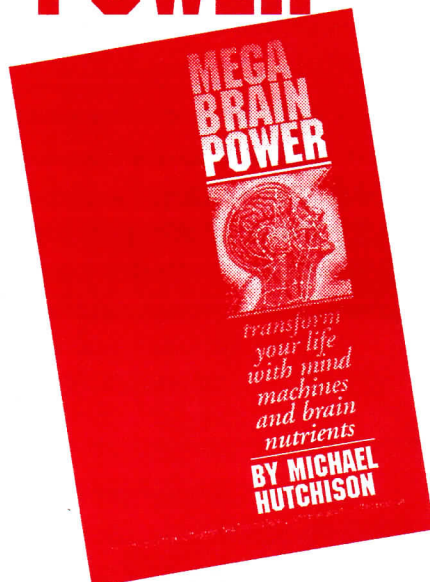
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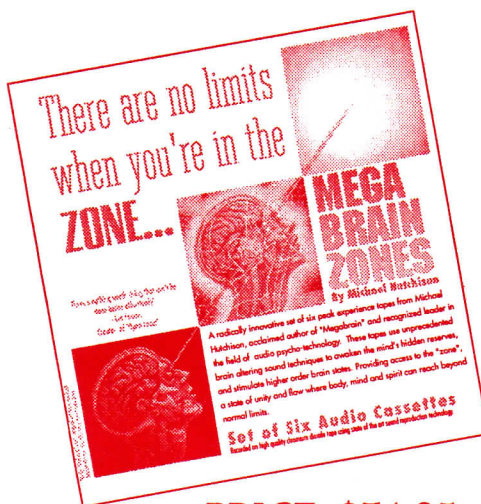
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