

A version of this manuscript was published in "Attention to Attention" in Applied Neurophysiology and EEG Biofeedback. Publisher, Future Health, Inc. Editor, Joe Kamiya. The author, Dr. Lester G. Fehmi, retains all rights and privileges to this paper and associated materials. 317 Mt. Lucas Rd., Princeton, NJ 08540, 609-924-0782, FAX 609-924-0782, Email lesfehmi@ix.netcom.com, http://www.openfocus.com

ATTENTION TO ATTENTION

Lester G. Fehmi

ABSTRACT

To realize fully our human potential is to learn to be aware of, to choose flexibly, and to implement effortlessly an expanding, dynamic range of attentional styles for the optimum allocation of our resources.

A fundamental observation is presented in this paper: Attentional styles and brain wave activity are reflected in each other. Attention styles are defined. Attention biases are described and their impact on physiology and experience is suggested. Optimum attention style combinations are suggested. Research data are presented. Talk therapy and attention training are contrasted. How we use styles of attention to manage our experience is discussed. An umbrella identity is recommended as a portal to flexible attention. A neural mechanism for separation and integration of awareness, attention and their contents is proposed. The potential benefits for exploring and practicing attention styles and OPEN FOCUS are described.

INTRODUCTION

Thoreau wrote "Things don't change, we change." It is my contention that the most important aspect of this change is in the "way" we pay attention. It is important to view humankind as a species with the latent potential to witness and quickly choose a preferred style of attention, from a range of possible styles, in any circumstance. Thus, we may consciously learn to self-regulate our own physiology, perception of experience and performance.

Epictetus said it best, "It is not what happens to you, but how you relate to what happens that matters." Few of us ever fully realize our potential to govern the process of attention by which we relate to our experience of the world, in and around us. We are generally unaware of the wide range of possible styles of relating, styles of attention and of the link between attention and experience, physiology and consequent behavior. Attentional styles and their sequelae are simply not obvious to most of us because of our acculturated habits, fixations and biases of attention. In addition, awareness of the clinical efficacy of neurofeedback as a means to access attentional options and to implement choices is not widely disseminated.

Nevertheless, these attentional behaviors are fundamental to what makes us human. Our awareness of attentional styles, attentional options, appropriate attentional deployment and, when necessary, attentional stability, can all be enhanced with biofeedback and other forms of training. These most basic of human skills and related matters are the central concern of this summary of my work.

I was asked to write a summary article about my experience as a researcher and provider of biofeedback, neurofeedback and Open Focus training in a clinical setting.. My experience in these matters spans thirty years beginning with the findings of my doctoral dissertation and continuing with many confirming experiments and clinical observations. My most constant motivation over the years has been the realization of personal change as a result of my own use of neurofeedback and the satisfaction in witnessing similar positive changes in my clients and others.

During 1963 to 1966, I undertook a study of visual information processing in monkeys (1). Because only a relatively few milliseconds of visually-evoked response was necessary for correct behavioral response, I concluded that the neural code for visual shape information is based upon spatial or parallel processing of neuronal activity, not temporal processing (cf 2). In the few milliseconds of visual information represented in the leading edge of the visual evoked response there was too little time for any temporal code to contain sufficient information to reflect the complexity of possible visual forms. Parallel processing takes the form of packets or waves of action potentials traveling together in time, in synchrony, from the retina of the eye, along specific parallel neurons of the optic nerve and tract, through visual relay nuclei to the neocortex of the brain. For this type of parallel processing code, synchrony of neural activity, i.e., almost simultaneous action potentials in parallel neurons, is a necessary condition for reliable information transmission through the visual system, and ultimately for recognition. This visual information processing research was completed at the Brain Research Institute at UCLA and was published in collaboration with Joel Adkins and Donald B. Lindsley, a pioneer in electroencephalography (cf 3, 4, 5).

These research observations ignited my interest in the possibility of increasing the synchrony of brain wave activity as a means of enhancing the general subtlety, clarity, speed and scope of information processing and perception in humans. Alpha wave activity represents the most prominent expression of synchrony in the waking brain. At an earlier social gathering, circa 1960, Joe Kamiya described his research which indicated that some people could distinguish the occurrence of, and even control, local alpha wave activity in their own brains (cf 7). At that time, I recall wondering why a mature researcher would want to concern himself with such matters. Little did I know then that I would soon spend almost three decades of my professional and personal life researching and training myself and clients in a similar manner (cf 6, 8-16).

In 1967, as a new Assistant Professor of Psychology at the State University of New York at Stony Brook, I embarked upon a series of experiments concerning the enhancement of brain wave synchrony in humans, by training myself. Learning alpha wave control was very difficult for me. After 12, two-hour unsuccessful training sessions, I gave up and surrendered my will to effort fully produce increased alpha activity. At the moment of surrender I experienced a deep and profound feeling of disappointment. Fortunately, I surrendered while still connected to my EEG and while still receiving feedback. It was surprising to observe that I now produced five times the amount of alpha than before the act of surrendering. I was producing more alpha than before, even while I was still feeling disappointed! After repeated and failed efforts at trying to "give-up" more completely, I spontaneously let go of my attentional grip on achieving the goal and surrendered more fully "into" the process. Accordingly, even greater whole brain (five channel) amplitude and inter-lobe synchrony was produced.

These increases in alpha synchrony were accompanied by many releases and positive changes in personal experience, perception and behavior. In the early days of producing increased alpha waves, I began noticing unbidden changes. I felt more open, lighter, freer, more energetic and spontaneous. I felt less urgency, grasped things more easily and experienced more verbal fluidity. A broader perspective ensued which allowed me to experience a more whole and subtle understanding. As the letting go unfolded, I felt more intimate with sensory experience, more intuitive, and more emotionally expressive than my previous over-controlled and scientific posturing allowed. My interpersonal style changed and became lighter so that people of various ages seemed more inclined to gravitate toward, and even be playful, with me. My relationship with my children became softer and more personal. At times I literally felt as if I were moving, walking-gliding more effortlessly than ever before. These experiences were unexpected and occurred without damaging, but rather, enhancing my ability to teach the *Hard-nosed* physiological psychology courses and neurophysiological techniques laboratory courses that my position at the University demanded. My chronic rheumatoid arthritis, which had peaked in severity in graduate school, disappeared and I felt generally healthier. It was impossible for me to deny that I was experiencing something very significant and personally revolutionary, both in a physiological and experiential sense.

Perhaps the most important long term effect of training was that I experienced significantly less tension, heaviness, seriousness and stress than I had prior to having increased my ambient level of multi-lobe alpha synchrony. I laughed a lot more than before. The mystery to me was that I had not known that tension was present before it was released. Why didn't I know of this tension before it let go? How much more tension is still present that I do not know about? Why did tension levels occur or accumulate? To what degree can I ever trust my personal experience to accurately reflect my tension level, or to reflect any other feeling, or emotion or any other displacement from homeostasis, from zero system bias. Since my personal experience of tension does not accurately and precisely reflect physical system status, except at extreme levels, do attention strategies exist which could help increase direct awareness of system functioning? If a lack of awareness can occur for a powerful and whole body tension, then must not the attentional process underlying denial and avoidance also be powerful and general?

This method of tension reduction requires training the increased production of in phase alpha abundance and amplitude. In other words, tension reduction, which is generally trained by reflecting back to the client a peripheral nervous process, was brought about in myself by training of the central nervous system (CNS). Isn't this result, the significant reduction of whole body tension, convincing evidence for the greater efficacy of central as opposed to peripheral biofeedback training? Doesn't this observation suggest that generalized tension depends upon CNS processes and may be effectively controlled by neurotherapy, perhaps even more effectively than by peripheral EMG training (24). These observations, thoughts and questions led me to view the effectiveness of peripheral modalities of biofeedback as possibly due also to their reflected impact upon CNS response biases. This view was not shared by most of my colleagues in the biofeedback community during the 60's, 70's and 80's. Many do not share this view even now, at this writing.

EARLY EXPERIMENTS WITH BRAIN WAVE SYNCHRONY

In an effort to help others achieve this systemic release of bias, this experiential realization of mental, physical, and more pervasive well-being, many formal and informal experiments were performed during the ensuing years, many of which remain unpublished. With the help of undergraduate and graduate students of the State University of New York at Stony Brook (most notably Fern Selzer, Sonja Ancoli, Patricia Cowen, and others), we experimented with many conditions thought to be connected to the production of alpha amplitude and abundance. We studied the effects of relaxation and imagery protocols, instructions and learning goals, music, lighting, colors, darkness, silence, incense, light strobing, the efficacy of visual vs. auditory vs. tactile stimulation as the feedback signal, analog vs. digital versions of the feedback signal, hemispheric dominance and feedback delay regarding learning to control the production of brain

wave synchrony. All of these variables, and others, appeared to have at least mild learning effects, for a time, upon a small percentage of individuals. Effects were generally positive to a small degree, but some were, to our surprise, negative. For example, almost any detailed instructions about how to produce more alpha amplitude or abundance had immediately negative effects, even when the instructions were well understood. Comparatively large positive effects were observed with strobing, appropriate feedback delay, matching the sense modality of the biofeedback signal to the individual's perceptual capacity and preferences, and the use of an analog (continuously variable) rather than a digital feedback signal (cf 12, 14). Throughout these experiments only referential, as opposed to bipolar, recording was employed (cf 16). (See below section entitled "LOCAL AND GLOBAL SYNCHRONY.")

The greatest general and most reliable production of alpha synchrony occurred in response to what I have come to call "object less imagery" (cf 12, 14). Questions that refer to the multisensory experience of "space," nothingness, emptiness or "absence" often elicit large amplitude and prolonged periods of alpha activity. I wanted to understand why this object less imagery is more generally powerful than well-known relaxation and imagery protocols in producing alpha synchrony and how it comes to impact us.

ATTENTION AND OBJECT LESS IMAGERY

The results of these experiments, my own personal experience of neurofeedback, and other considerations previously described helped to focus my own attention upon the ways we pay attention to our own sense experience in daily life, and upon the impact of various types or styles of attention upon our physiology, perception and behavior. Attention is defined here as those behavioral and mental (and underlying neural) processes which control the style and direction of awareness, in distinction to any of the contents of awareness. (See section entitled "DEFINITION OF STYLES OF ATTENTION" and Figure 1.)

As the experiments progressed it became clear that, in addition to increasing alpha activity, attention to space enhanced the process of cognitive and emotional release. In my view, enhancement of release occurred because space is not a referent which one's attention can readily apprehend or grip onto since space is without form or substance and ultimately empty, devoid of

all qualities and limitless. It is relatively easy for those of us who have been "civilized" to narrowly focus upon and grasp a finite thing, a sense object, such as a thought, sound, feeling, taste, smell, or visual image. Each in its own way has form and other characteristics. However, when our habit of objective focus of attention is applied to space, there is nothing (no-thing) to apprehend. Without something (some-thing) to grip, to which we can direct our habitual effortful apprehension, and without something to which we can narrow focus upon, to the exclusion of everything else, we observe that experiential and physical release deepens in the context of space.

By giving attention to this ungrippable space we eventually become aware of the previously unnoticed chronic act of gripping or physical tension, which is associated with our habitual bias toward narrow and objective forms of attention. Awareness of gripping is a precondition for the motivation to intentionally release this same gripping tension. When this habitual attention-related tension is released, attentional scope broadens and supports an awareness of also being immersed in a perceived vast and pervasive surround. This surround, or ground of experience, had so far been excluded from awareness by our narrowly objective attentional bias toward gripping the contents of limited fields of experience, i.e., a limited scope of sense objects. After opening our attention, while including our already present narrow objective attention to sensations in the center of our new open awareness, we experience a surround of immersed attention, of a vast three dimensional space, nothingness, absence, silence and timelessness. The perceived surround, the scope of our attention is not only expanded, but is experienced with greater immersion. Thus, the ground of our experience is reified, realized as a more pronounced sense of presence, a centered and unified awareness, an identity with a vast quality less awareness in which all objects of sensation float, as myself.

As we continue to experience space and sensation more intimately, more simultaneously and equally, we deepen the absorption of our attention in the totality of present experience. (Another form of integrated attention is discussed on pages 29 and 30.) All that is necessary to destroy the balance of these integrated forms of attention is to effort fully apprehend an object, to over-focus upon a sensation or upon space as an object or concept. However, we can learn to quickly re-establish balanced forms of attention. For most people, alternating styles of attention, i.e., between narrow and diffuse and between objective and immersed, reflect the experience associated with alternately decreasing and increasing abundance and amplitude of phase synchronous brain wave activity.

The reader may wish to experiment with previous and subsequent paragraphs, giving attention to and consciously altering how and to what one is attending. A reduction of gripping and effort may be observed, for example when one includes the visual and feeling experience of space between the reader and the page, the space around the reader, and the space between the words while the reader continues to center his attention upon the words and their meaning.

THE EFFECTS OF BECOMING CIVILIZED: ATTENTIONAL BIASES

Very few people escape the attention rigidifying impact of our immediate familial and broadly social education. This educational process is heavily weighted toward specific attention biases. A preponderance of our educational resource is spent on intellectual development. This entails, with gradually greater subtlety and specificity, the singling out, or in my language,

narrow focussing upon and objectification of sensations and concepts (concepts are also objects of sensation). We learn repeatedly to narrow our focus upon and grasp onto experiences as objects. That is, we learn to grasp with our attention the thousands of distinctions between almost every sense experience available to us. In addition, we are rewarded, cajoled, applauded, respected, despised, criticized, loved and punished, accepted and rejected based upon our ability to focus upon, objectify, recall and verbalize our experience throughout our lives.

In most societies, an individual is rewarded when one is able to communicate objective, commonly accepted, life-world experience. To be unable to do so is to feel left out, alienated, to be experienced and labeled as different, or to be ignored or ostracized by one's peers. Therefore, even people who would not be considered intellectuals by any relative standards are also subject to these judgments and suffer the consequences. We are constantly reaffirming the level of our interpersonal connection through the repeated establishment of re-constructions and verbalizations of narrowly focused, objective common experience. This shared narrow-objective intellectual process, particularly shared views and shared meaning, is seen as a major component of socialization, of what we humans continually reiterate that we have in common, as social beings, a mutual ability to objectify each other and everything else, usually one small bit at a time.

This ubiquitous use of narrowly focused objective attention also represents an attempt to achieve a useful, and satisfying level and scope of connection, closeness and intimacy with others, and with experience itself. Ironically, however, in reality, this intimacy, immersion or familiar union with experience can be accomplished to truly satisfying depths only with other more immersed forms of attention.

Doomed to limited success we, nevertheless, hone our narrow and objective attention skills with the result of ever increasing use and fixation of narrow-objective attention. Thus, it seems to me that the major reason that the relationship between attentional change and brain wave activity has not been more widely appreciated, is that most of us do not vary our style of attention very much. We are more or less fixated in a predominantly narrow-objective style of attention. Other reasons for this attentional bias will be mentioned later. In any case, it requires rather special circumstances and motivation to lead us to return to alternative attention styles and greater degrees of attention flexibility. The special circumstance that led me to this realization was my own personal explorations and other formal and informal neurofeedback experimentation.

A FUNDAMENTAL HYPOTHESIS

By learning how to turn whole brain alpha synchrony on and off, as mediated by changing attentional style, I was led to the correlation between specific styles of attention and parameters of brain wave activity. Generating hypotheses from my own experience led to testing these connections with specially selected populations of attentionally flexible individuals, usually artists, athletes and meditators. These experiments further convinced me that attention and EEG parameters are related, as suggested from some of the earlier scientific literature (cf Lindsley 17). Hans Berger (18) reported in the thirties on the connection between alpha synchrony and relaxed attention, between beta desynchrony and the orienting-response, between beta and the focused attention associated with problem solving. Corollary observations in our

laboratory-clinic support these reports (cf 12).

Indeed, it is commonly observed that just opening one's eyes is enough to desynchronize brain wave activity in almost everyone monitored. There were a few individuals, however, who could continue to produce alpha synchrony with their eyes open. This suggested that synchrony was related to variables other than those specifically associated with the contents or the process of vision itself. Furthermore, for those who would invariably desynchronize upon opening their eyes, this would continue to occur even when they opened their eyes in complete darkness. With ON-OFF alpha neurofeedback training, this change in alpha synchrony with eyes opening and closing can be uncoupled. Some individuals could even produce an abundance of alpha while reading. Taken together, this lent further support to the contention that a central process, like attention or arousal, rather than a specific visual process or visual content, was related to changes in alpha activity.

Perhaps most supportive of the broad relevance of attention and arousal to EEG change is the invariable observation that alpha production increases and decreases from many parts of the brain, simultaneously, upon eyes closing and opening. If only the visual system was involved, one might expect that alpha activity would change only in the visual system, e.g., occiput. This common observation of global EEG change also suggests that a general process, such as attention or arousal, is involved and correlated with changes in alpha activity. In any case, with continued neurofeedback practice, a point is reached where this connection between EEG activity, arousal and attention becomes a personal realization. It is perhaps because there is such a widely acknowledged relationship between arousal level and brain wave activity that I believe the mediating effects of attention upon both arousal and brain activity have been largely unexplored. As shall be further described in later sections of this paper (cf discussions related to figures 2 and 3) and in a companion paper (28), arousal, brain wave activity and attention are also mutually influential. Since attention is the one variable most potentially under voluntary control, its' training would have considerable potential impact upon brain activity, arousal, perception and performance.

Observations published elsewhere (cf 12) showed that when a painter-artist was asked to view the visual surroundings of our laboratory with critical attention to detail, his whole brain activity desynchronized. Then when asked to accept or appreciate this external visual environment with a wider scope and less critically, his brain wave activity became more synchronized. Again, when asked with eyes still open to direct his attention generally inward, to visualize a specific painting he had created and enjoyed, his whole brain activity was again relatively more synchronized than when compared to the brain activity associated with critical attention to detail. Repeated observations in other sense modalities also confirm the presence of a connection between different attention styles and brain wave activity (see also 14). No mention was made concerning arousal level or relaxation during these and many other experiments. Moreover, it is suggested that these observed connections between brain wave activity and attention are in fact dependent on the methods of recording brain wave activity, which are discussed in the following section.

LOCAL AND GLOBAL SYNCHRONY

One complete cycle of a delta, theta, alpha or beta wave itself, measured from any one

location of the brain, may be typified by a positive wave followed by a negative wave. This positive-negative cycle is the result of the synchronization of excitatory activity followed by the synchronous relaxation or inhibition of the activity of the same brain cells in the vicinity of the sensors. The greater the area and amplitude of cell membrane activity and the greater the number of cells simultaneously active and then simultaneously quiet, the greater is the peak-to-peak amplitude of the wave. When "referential" or so-called "monopolar" recording techniques are utilized (cf 16), it is possible to observe synchrony in the vicinity of each sensor at one or more brain locations simultaneously. Feedback signals can be provided which represent the local synchrony of one recording channel, or the intra-brain or inter-brain synchrony of two or more recording channels. Two or more channels of activity are said to be synchronous or in-phase when their respective peaks and troughs occur at the same time. Significant and positive therapeutic effects have been reported recently from single channel feedback training (cf 19-22). However, most of the observations of synchrony described in this paper are the result of five-channel, or what I term global (whole brain), phase sensitive neurofeedback. The sensor placements for this research are represented by the locations known as FPZ, CZ, OZ and T3 and T4 in the international 10/20 system of EEG electrode placement (23), with one ear lobe as reference and other ear lobe as ground.

TRANSITIONS

On some days we flow easily through the performance of our tasks, while on others we feel forced and our performance requires effort. We feel loving, generous and absorbed in some moments, and critical, unfeeling and separate in others. Problems feel overwhelming and unsolvable one moment, and the same problems feel not at all or less difficult the next moment. Even when there is no apparent reason for the change, aches and pains vary in intensity from moment to moment, day to day. These day-to-day, moment-to-moment changes in our awareness of our own behavior and experience bring into question changes in who we are, and in what range of experience do we have access, as if we are made up of multiple entities, each with its own limited access to awareness. What accounts for such changes or differences?

A number of factors may be responsible for the vast differences in how we experience, how we think and how we behave over time. Many prudent therapists-researchers attribute such changes to a myriad of subtle factors and particularly to stressors too complex and varied to enumerate at one time. However, based on many personal and clinical observations over 30 years, I have proposed that however it is caused to change, one variable, the process of attention itself, accounts for most of the variance associated with the transitions mentioned here. These major transitions are predominantly affected by, and result from, changes in how we pay attention. Conversely these transitions result less than we would ordinarily think from what we pay attention to, that is, to the content of attention.

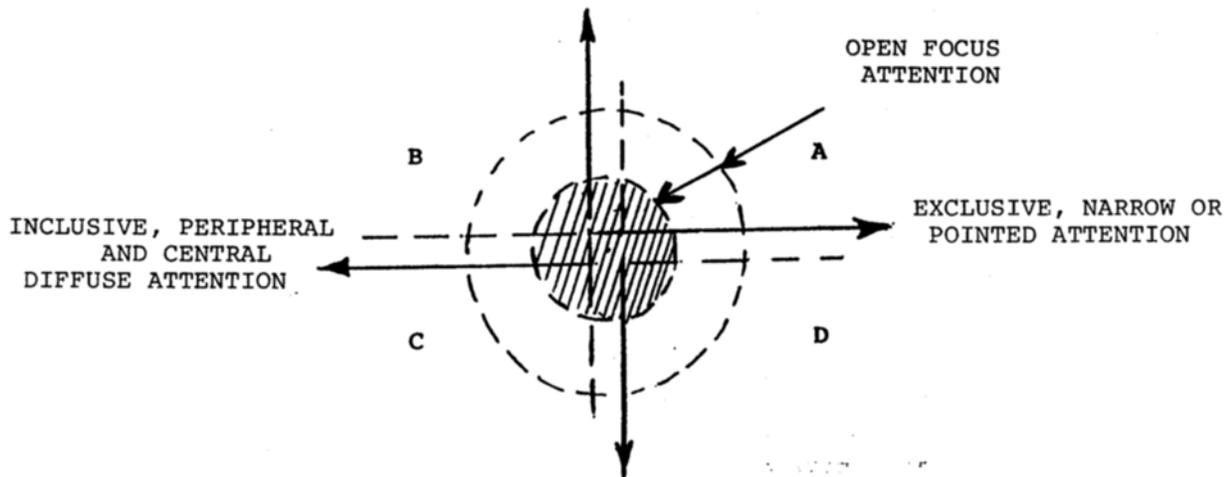
DEFINITION OF STYLES OF ATTENTION

As Figure 1 illustrates, the attentional model of awareness includes two overlapping sets of axes and four parameters. The horizontal set of axes depicts the scope of attention, which extends from a spherical and unlimited diffuse attention at one end to a narrow scope and focus

of attention at the other. The vertical set of axes depicts proximity to experience, which extends from absorbed or immersed attention at the top to attention which is objective or separate from the contents of attention at the bottom of the vertical axis.

Each of these parameters, as their descriptors suggest, represent individual characteristics of attention. The extreme of "diffuse or broad" attention is associated with an all-around, three dimensional, simultaneous and equal attention to all available external and internal stimuli and the space in which they occur. "Narrow or pointed" attention refers to an

OBJECTIVE OR SEPARATE ATTENTION;
SEPARATION OF ATTENTION FROM FIGURE AND GROUND



IMMERSED OR ABSORBED ATTENTION:
UNION OF ATTENTION WITH FIGURE AND GROUND

FIGURE 1: OPEN FOCUS, A MODEL OF AWARENESS
WHICH INTERGRATES STYLES OF ATTENTION

awareness of a limited

sub-set of available stimuli to the exclusion of the other stimuli. The extreme of "narrow focused" attention is one-pointed attention. The extreme of "immersed or absorbed" attention refers to a way of relating to available experience such that the person paying attention enters into union with or becomes totally absorbed in the experience. The extreme of "objective or separate" attention occurs when the self is completely remote from the contents of attention, disconnected from single or multisensory experience of the attender, without empathy or intuition (into-it-ness). Extremes of "objective or separate" attention are associated with coldness where as extreme "immersed or absorbed" attention may be associated with warmth and

closeness, full immersion in ongoing single or multisensory experience.

Quadrant A of Figure 1 above represents a narrow focus-objective type of attention, the attentional style which is most dominant in our society, a civilization disposed to the over-use of linear-objective information processing skills of the left hemisphere. While rapid and complete attentional narrowing and objective focus is at times necessary for optimal behavior, there is, in our day, an unfortunate tendency toward overuse and consequent chronic rigidity of narrow-objective attentional processing. The extreme case of temporary attention fixation occurs in conditions of panic where the act of narrow focusing upon and objectifying the feared object may bring about a catatonic-like rigidity of focus and directional orientation. A less extreme, but more enduring example of chronic narrow-objective focus is obsessive worry and preoccupation with recurrent thought. The discussion presented previously describes our predilection to narrow focused-objective attention and our consequent obsession with and fixation upon its use.

The attentional opposite of narrow-objective attention (represented by Quadrant A) is a diffuse focus-immersed attention (represented by Quadrant C of Figure 1). This type of attention represents the release from a narrow and objective attentional focus, a release which is intermittently therapeutic for attentional effectiveness and flexibility. Normalization of function, healing, and diffusion of accumulated stress are the result of diffuse-immersed attention. Increased unity or immersion leads to the lapse of self-consciously directed attention, and is exemplified in the effortless performance of well-learned or instinctive behavior. The effortless, creative performance of an art form or athletic feat are examples. Indeed, in our biofeedback clinic-laboratory, accomplished artists, athletes and meditators demonstrate flexible control over the dimensions of attention and their associated EEG parameters. They are uniquely adept at merging with a wide array of sensory experiences simultaneously.

The diffuse focus-objective mode of attention (represented by Quadrant B, Figure 1) is one in which multisensory experience is simultaneously and objectively present, a potentially vast multidimensional objective awareness. An array of objective sensations hang suspended in the midst of a more general diffuse awareness of space. Playing in a band, appreciating a panoramic sunset, going for a walk or driving a car - these are among the activities for which an appropriate relational strategy may emphasize diffuse focus-objective attention.

The immersed narrow focus type of attention (represented by Quadrant D of Figure 1) includes absorptive modes such as intellectually interesting or emotionally and physically pleasant and stimulating activities. These are activities which one wishes to amplify with narrow focus and to which one wishes to move experientially closer to, in order to intensify and savor the event. One may observe the narrow focus absorbed look on the face of an enraptured thinker, fantasizer, concertgoer, game player or someone experiencing deep muscle massage or other sensuous physical activities. Part of the attraction of certain cultural, artistic and athletic or physical events may be to provide an occasion for becoming absorbed and immersed with minimum self-consciousness. This also makes understandable the common example of the inertia and irritation experienced when distracted or interrupted from a task in which you are narrowly and deeply involved. One is forced to become self-conscious again and to experience the self-other split again. Preconscious performance of a well learned task is a most common example of when one is narrowly immersed in functioning. Mihaly Csikszentmihalyi (cf 24) appears to describe this quadrant's attention as responsible for sustaining of the "flow"

experience.

OPEN FOCUS ATTENTION

Full OPEN FOCUS attention, illustrated in Figure 1 by the broken circles, includes diffuse, narrow, objective, and immersed forms of attention - all occurring more or less equally and simultaneously, with a concurrent awareness of their presence. The ultimate goal of Open Focus training is to attain the attentional flexibility adequate for moving freely by degrees among and within attentional styles, including all, at times, simultaneously and equally. From what is known about each of the independent parameters of attention, one is tempted to ascribe narrow and objective attention to left hemisphere organized processes and diffuse and immersed attention to right hemisphere organized processes. In any case, because of the physical and functional independence of each of the mechanisms which give rise to each of the parameters of attention, it is possible for all of them to be present simultaneously. Thus, we possess the potential to attend to any given content of attention in a variety of styles, individually, in combination, and by degrees. However, with socialization training and by habit, we usually attend to familiar and similar situations in essentially the same way, that is, habitually. There is little doubt that all successful learning and optimal performance involves directing appropriate styles of attention toward relevant stimuli in an effectively choreographed sequence. Styles of attention, fluid and relevant figure and ground processing, and the timing of their occurrence are obviously critical factors for all learning.

IMPACT OF STYLES OF ATTENTION

Our society has taught us many biases for adopting and maintaining certain styles of attention. Attentional biases are a fundamental component of the socialization process. The societal bias I am referring to here is related to how we pay attention and not to the direction of our beam of attentional focus, or to the particular sensory contents of attention, although societal biases apply to them also.

I propose that how we pay attention determines significantly and immediately our experience, physiology, and behavior. How we pay attention determines our subjective experience of our own identity and our objective experience of internal and external sensation and perception. With the aid of neurofeedback training and with other direct approaches to attention training we can become aware of how we pay attention.

Also, we can learn to flexibly choose and determine how we attend. Certainly most of us have the ability to choose the direction of our narrow attention, in order to choose to experience any subset of available stimuli at any given time. With training, we can also choose to broaden the scope of our attention to include a more diffuse and integrated background awareness of available stimuli, even in multiple sense modalities simultaneously. Moreover, we can choose to flexibly pay attention in other ways which help us function more or less well in specific conditions.

In addition to the attentional pressures of socialization, there is a personal tendency to become addicted to, stuck in, or identified with those ways of paying attention that are personally pleasant or strategically important or useful to us. We tend to become attached or

conditioned to styles of attention which pay off in some immediate ways. These conditioned styles may also have hidden long term costs, through actively neglecting other attention styles which, if flexibly included, may in fact have long term benefits.

For example, resistance, avoidance and denial depend upon directing our narrow focus of attention away from noxious content. The ongoing effort associated with the maintenance of narrow focus for the purposes of avoidance, and other reasons, becomes a stress producing habit. Then, of course, we inevitably pay the perceptual, behavioral and physiological consequences of such strategic and chronic effortful attentional biases. These consequences are represented by the symptoms which are caused or aggravated by stress and its accumulation.

We are always paying attention in some way. Remember when your parents criticized you for not paying attention? What they really meant was that you weren't paying strict enough (e.g., narrow-objective) attention to them, or to what they felt was important. After all, you were, in fact, paying attention, even if it was to something else and in a different way than they thought was appropriate. In general, people react positively to us when we let them guide us to attend to what they value and in the mode of attention they feel is appropriate. Generally, the more completely we mirror the attention styles and strategies of our companions the greater is our potential rapport and acceptance.

Right now you are paying attention to this paper. You may be attending with effortful and narrow-objective concentration or you may be attending effortlessly and broadly immersed, or in some combination of the two. Hopefully you can recognize how you are paying attention but, in any case, you are paying attention. Attention is something we all do all the time, but we do it in various ways, as previously outlined. It is these various ways of attending that have uniquely differing and significant impacts on our moods, minds, behavior and physiology. It is the style or combination of styles of our attention that prepares us more or less appropriately for specific situations and optimum performance.

FIGURE-GROUND RELATIONS

Figure-ground, or foreground-background, relations are intrinsic to effective function and activity in all human pursuits. Goal oriented behavior is widely considered to be dependent upon centering and narrow focussing or concentrating one's attention preferentially upon those stimuli which are most relevant to achieving the goal. While one concentrates or focuses, one gives extra foreground attention to relevant stimuli, called the figure, and allows less relevant stimuli fade into the background, or ground of awareness. At the extreme, only the foreground exists with total extinction of the background. At the other extreme, all is background without figure.

Figure-ground relations most usually involve a narrow focus of attention of a figure in the center of awareness, and a diffuse surround attention to the ground, not unlike the relationship between foveal and peripheral vision. Normally, the figure is objectified. Less frequently is the figure entered into, thus yielding an experience of unity with the figure. So for most people, fluidity of attention is limited to shifting narrowly focused central foreground attention sequentially from one portion of the relevant stimulus field to another, as may be appropriate to ones goals. The diffuse background is ignored. Alternatively, and less commonly, one may give extra attention to the whole background, thus bringing it into a diffuse foreground. Such a diffuse foreground lends itself to an integrated perception of wholeness and

equanimity.

Indeed, at middle levels of arousal, all individual styles of attention are always present, even during goal oriented activity, and they are distributed among foreground and background, according to learning, conditioning and habit. The major benefit of regular Open Focus practice is the periodic suspension of the effort to establish and maintain an exclusive bias of attention, for example, the effort to chronically maintain an objective figure in the foreground of awareness. This suspension of effort to control attention is the release of attentional bias, and results in a natural by product, a pervasive rapid balancing and normalization of physiological function and associated healing.

THE EFFECTS OF ATTENTION UPON PHYSIOLOGY

Let me suggest an example of how attention affects physiology. If you watch nature films you probably have seen predatory animals hunting and running down their prey. Let's say a lioness spies a group of gazelles. First the lioness becomes fixatedly and narrowly focused on a single object of prey, in this example, a single gazelle, among many. The lioness will continue to stalk and then chase the chosen gazelle, and no other. The lioness attends in a narrowly focused objective way, in the foreground, even though other gazelles may at times, come physically closer than the one she is chasing. This is because the closer gazelles are in the background of attention.

This kind of narrowly focused and fixated objective foreground attention serves a purpose for the lioness. Narrow focused-objective foreground attention is a key component in organizing her body for the "fight" (or "flight") mode of responding. This form of attention creates the permissive conditions for shifts in emergency-appropriate hormones (such as adrenaline), increased blood flow to the big muscles and emergency-related body organs, and in other physiological changes which will help support effective stalking and chasing behavior.

Win or lose, when the chase has ended, the lioness' attention will move toward diffuse absorbed and integrated figure-ground attention. Following this change in the balance of her attention styles are a series of physiological adjustments away from emergency and in the direction of normalization of function and release of stress. We have also seen films of the lioness resting in the shade as she yawns lazy-eyed, occasionally licking herself. No longer is she paying attention in that narrowly-focussed, objective, fixated on the foreground way. There is a shift to a more diffused, flexible and less objective, more absorbed, attention which is again key to the reorganization of the physiology of the lioness. This form of attention is associated with the end of emergency functioning and with the parasympathetic shift which accompanies homeostasis and normalization of physiology: relaxing the muscles, readjusting hormonal flows and returning function and blood flow distribution to pre-emergency levels which we call normal. For the lioness, and other animals, how they pay attention is a key component in producing the many arousal and other body changes which are appropriate to support specific behaviors.

I propose the same relationship of attention to function is true for humankind. How we pay attention directly affects our arousal and other body functions, which, in turn, directly affects our perceptions, emotions and behavior. However, we do not usually pay attention to how we pay attention because of habits, cultural biases, and difficulty in apprehending this subtle skill.

Thus, we have little immediate knowledge and awareness of this connection of attention style to perception, behavior and homeostasis (25). Nevertheless, we can learn to pay attention to how we pay attention. There are times, however, when we are given glimpses of this ability. Recognizing how narrow and immersed we were during an exciting movie, or how narrow and alternately diffuse we were when organizing a group function such as a fire drill or trip are examples of such glimpses, but these are rare.

Most likely, animals do not have the option to pay attention to their own attention process, at least not as fully as humans can. Their attention is probably much more directly genetically proscribed and conditioned than is ours to states of physiology and external circumstance and is less available to voluntary choice. In my opinion, what makes us fully evolved humans is the realized ability to attend to how we pay attention and then choose and adopt how we pay attention. When we learn to pay attention to the range of styles of our own attention, we are then able to make the attention-function connection and choose our attentional style intelligently. EEG synchrony training and neurofeedback therapy in all its forms, is uniquely suited to facilitate the recognition, appropriate choice, and flexibility of attention style.

RIGIDITY OF ATTENTION AND ITS RELATION TO STRESS

Only with a renewed interest in and awareness of our own attention styles can we be liberated from old habits of attention which may no longer serve us well. As was mentioned earlier, the capacity to narrow and objectify is perhaps the most developed attention style in our society. However, many still need some prop in the form of a cigarette or cup of coffee in order to muster the attentional energy necessary to establish and maintain narrow focus-objectivity. The capacity for sensate focus, as in sexual experience, presents difficulties for many individuals. Enhancement of narrow focus-absorbed attention is needed in such cases. Conversely, both diffuse focus-separateness and diffuse focus-absorption are also necessary for the optimization of functioning in certain circumstances, as an antidote to the over-used narrow focus states. This need is demonstrated and remedied by well attended retreats and workshops for "burned out" members of the business, therapeutic, educational and larger community.

Chronic over focus or, more precisely, intense foreground narrow focus, which creates and is subsequently supported by chronically raised arousal levels and which leads to the chronic exclusion of the background peripheral attentional field of awareness, is a source of tension that accumulates over time. This tension is from the habitual use of a narrowed focus of attention to obsess or, oppositely, to avert one's narrow focus as part of a strategy of avoidance or denial. Thus, the chronic act of narrowing our focus and the chronic use of narrow focus as a mechanism for managing experience represents a significant source of physiological stress and physical tension. In fact, the chronic maintenance of narrow-objective attention interferes with the diffusion of accumulated stress and the process of homeostasis (25). The remission of many stress related symptoms is a side effect of an increase in flexibility of attention and in the optimization of attentional function through simultaneous integration of the various styles of attention. Indeed, we have found that diffuse focus training promotes 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 a period of diffuse focus practice (25). By first releasing the effort and stress

associated with chronic narrow focus, narrow focused activities can then be renewed with clarity, enthusiasm, and diminished stress. Thus, such attention training, along with other attention related neurofeedback therapy, can speed recovery from a range of attention deficit disorders.

With awareness and practice of attentional flexibility one can have increasingly greater choice and ease of implementation of attention style and consequently greater choice over how one feels, perceives, thinks, behaves and functions physiologically. This attention-physiology connection can be confirmed by attaching biofeedback sensors to one's own body - any biofeedback modality will do. Then, the style of attention can be varied from narrow-objective to diffuse immersed attention and to simultaneous integrations of these while observing the feedback signal. It may take some practice to bring about genuine attention change, and to become aware of this change, but when it happens correlations can be observed in galvanic skin resistance (GSR), temperature, muscle tension and brain wave activity. Conversely, with neurofeedback one can learn to bring about alternate increases and decreases in synchrony at various frequencies and observe corresponding changes in attention. However, it is observed that changes in GSR, temperature and muscle tension individually do not necessarily produce changes in brain wave activity or attention.

Recent evidence suggests that an average of more than 40% of the daily waking time of the animals of our planet is spent resting (not sleeping), i.e., not engaging in the type of goal-oriented behavior which is associated with narrowly objective forms of attention. Unlike animals, most humans spend almost no time, on a daily basis, in diffuse and immersed forms of attention, just being, non-goal oriented, not doing. Is this why we fail to diffuse and normalize our stress and tension? Is this why stress and tension accumulate? No one seeks chronic tension intentionally. Therefore, tension must accumulate as a side effect of some other on-going process. It is hypothesized that this other process appears to be largely related to the chronic and limited ways we pay attention, which support chronic goal related activity.

As I have stated repeatedly, stress accumulation appears to be the result of our overuse of our effortful, objective and narrowly focused concentration. Our habit of exclusive narrow focused objective attention itself prevents the natural process of normalization of physiological function and release of stress. Bias toward certain forms of attention interferes with a birthright, a balanced attention associated with an ongoing release or diffusion of stress-tension. Attentional rigidity is related to the retardation or prevention of physiological and mental homeostasis. Such rigidity and its opposite, attentional flexibility, are reflected by corresponding brain wave activities.

ELECTROPHYSIOLOGICAL CORRELATES OF ATTENTION

Certain types of neurofeedback are particularly potent since they more directly reflect parameters of attention. When we learn to change brain wave amplitude, frequency and phase synchrony in and among the various lobes of the brain, we are directly impacting the types of attention available to us (and not necessarily dependent upon the content of our attention). In my view, this impact on attention style is responsible for the power of neurofeedback to effect a broad range of clinical symptoms and human function. Neurofeedback has the potential to re-establish or enhance the attentional balance and flexibility that is crucial for wellness (25).

In the normal socialized individual, increased arousal, associated with increased brain wave frequency, reduced amplitude, and diminished whole brain synchrony are connected with increased objectivity - separateness and narrowed scope of attention. Oppositely, decreased arousal, associated with decreased frequency, increased brain wave amplitude, and whole brain synchrony are connected with increased immersion and a widened scope of attention. Open Focus attention is defined here as the simultaneous integration of all the described styles (Quadrants A, B, C and D, Figure 1) of attention, e.g., a narrow absorption embedded in a diffuse objectivity. This represents an integrated form of attention, in which we perceive the whole field of available experience while centering upon what is relevant or most important. This form of attention is associated with different combinations of amplitude, frequency and synchrony of brain wave activity than were described above regarding strong biases for individual attention styles. In general, high frequency activity is more equally and simultaneously present and riding on, or modulating, low frequency activity as we move toward Open Focus attention and away from more singular biases of attention. Greater attentional and brain wave flexibility or stability, as alternately appropriate, are associated with exceptional performance and function.

Figure 2 presents the relationship of attention styles to arousal and physiological, perceptual and behavioral function-performance. A narrow region on the X-axis, marked "arousal portal," denotes the optimum level of arousal at which the various styles of attention are most integrated, i.e., simultaneously and equally present, resulting in higher levels of overall function-performance.

Perhaps other techniques, such as Kamiya's phenomena-mind mapping procedures (cf 7), may show that diffuse and immersed styles of attention are not appropriately represented by the same curve. Similar small divergences may also be shown for narrow and objective styles of attention. However, perhaps due to socialization or to genetically determined physiological factors, it is my observation that for people of Western culture the x-axis placement of the curves for narrow and objective styles are more like each other than they are to either diffuse or immersed styles. Similarly, the curves for diffused and immersed styles are more like each other than they are to either narrow or objective styles. For the sake of simplicity, therefore, similar attention styles are represented in Figure 2 by the same curve.

STYLES OF ATTENTION

Diffuse-Immersed

Example: Meditation with mind unself-conscious & body at rest. Most rapid normalization. Sleep. Most relaxed.

Effects: Para-sympathetic nervous system dominance. Low arousal. Right brain dominate.. Drifting into sleep.

EEG: Low frequencies dominant at high amplitude. Most whole brain synchrony.

Diffuse-Objective

Example: Panoramic view in a "symphony of sensory experience." Objective sensations hang suspended in the midst of a diffuse awareness of space. Playing in a band.

Effects: Relative sympathetic & para-sympathetic balance. Moderate arousal. Relative left-right hemisphere balance. Relaxed alert.

EEG: Middle frequencies dominant in amplitude. Moderate whole brain synchrony.

Narrow-Immersed

Example: Immersed in enjoyment, amplified by a narrow focus to intensify & savor experience. Enraptured thinker. Deep massage recipient.

Effects: Relative sympathetic - parasympathetic balance. Moderate arousal. Left-right hemisphere balance. Alert relaxed.

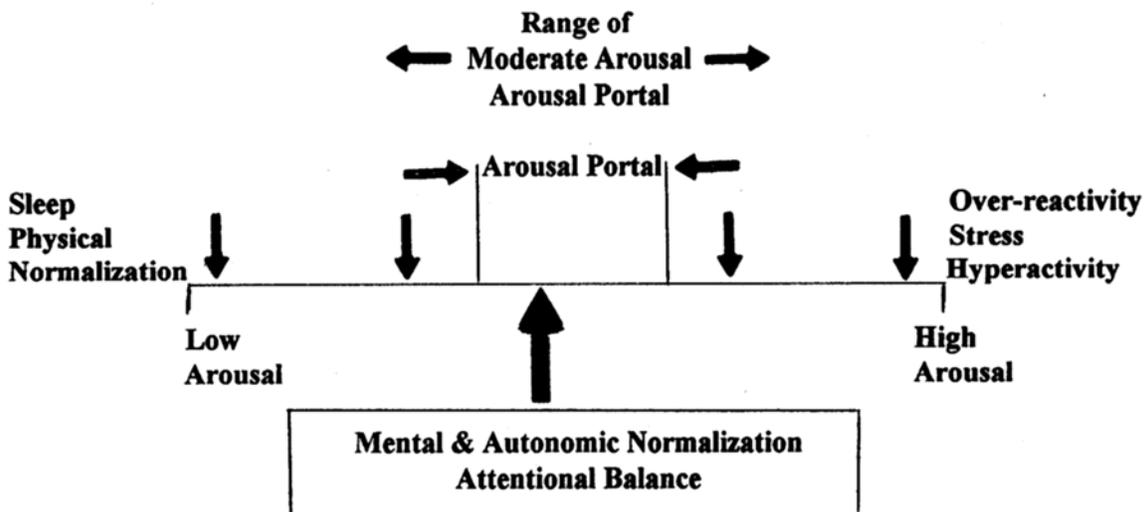
EEG: Middle frequencies dominant in amplitude. Moderate whole brain synchrony.

Narrow-Objective

Example: Lion stalking prey. Emergency. College exam. Obsessing on work to narrow focus away from (deny) an emotional problem. Self-conscious mind & body highly toned.

Effects: Sympathetic nervous system dominance. High arousal and adrenaline. Left brain dominant. Flight or fight.

EEG: High frequencies dominant at low amplitude over-all. Least whole brain synchrony.



The relationship between attention style and physiological and experiential arousal is reciprocal. By emphasizing narrow and objective styles one is propelled toward higher levels of arousal. As narrow and objective dimensions of attention increase in proportion and persist, one approaches emergency-panic levels of arousal. On the other hand, by emphasizing diffuse and immersed dimensions of attention one's arousal level declines, ultimately approaching sleep. Thus, by intentionally balancing or emphasizing attention styles one may consciously learn to control and stabilize arousal level to a significant degree. Conversely, by various means, such as physical activity, meditation, rest, diet, caffeine, breathing rate, drugs, etc., changing arousal level may influence the relative presence or emphasis of attentional styles. Thus, the relative emphasis of attentional styles impacts arousal, and arousal level may affect the relative proportion or emphasis of attentional styles.

AROUSAL PORTAL

In the region marked "arousal portal" in Figure 2, there exists the potential for an important rearrangement of combinations of attention styles. The balance of narrow-objective versus diffuse-immersed attention styles shifts back and forth, usually determined by momentary attention biases, external and internal sensory and diet factors impacting arousal described above, and the need for diffusion of tension and other physical reflections of stress. In the "arousal portal" region, where the narrow and objective attention dimensions are present in approximate equal balance with the diffuse and immersed attention dimensions, there is the potential for a restructuring of attention dimensions that is inherently more integrated and stable in arousal than before. In the restructured form, one may become aware of a narrow-immersed attention in the center of awareness which is simultaneously surrounded and permeated by a diffuse-objective attention.

This transformed attention is effortless and allows the diffusion of stress as it occurs, and, therefore, is self-balancing and stabilizing in physiologic arousal by its nature. This transformed attention structure is not driven out of balance because stress does not and can not accumulate since narrow-objective attention is not emphasized at the expense of diffuse-immersed attention. Each restructured pair of attention styles, narrow-immersed or diffuse-objective attention, appears to represent the simultaneous functioning of combined sympathetic and parasympathetic processes along with equal activation of left and right brain hemisphere processes. On the contrary, the more ubiquitous forms of paired styles of attention, narrow-objective or diffuse-immersed, appear to be represented by a predominance of only sympathetic and left hemisphere or, alternately, only parasympathetic and right hemispheric processes, respectively. That is, narrow and objective attention appear to be both sympathetic and left hemisphere dominated processes, and like a seesaw, alternate in predominance with diffuse and immersed attention which are parasympathetic and right hemisphere dominated processes. Thus, the transformed version of attention result in more stable mid-range arousal and is associated with more stable and optimum function and performance. It represents greater integration of the activity of both hemispheres in simultaneously reflecting sequential and parallel processing. The transformed combinations of attention supports a wide range of positive effects, from remediation and prevention of symptoms to the optimization of function. It also supports an on-going sense of well being, energy and acceptance of experience. The arousal portal

represents the gateway to more subtle and integrated realities which are mediated by the above described transformed attention style combinations. (See companion article for further details, 29.)

Figure 2 summarizes the four major styles of attention, and their various influences upon the nervous system, arousal level and EEG characteristics. The center moderate range of the arousal continuum supports attentional balance and Open Focus attention. A most significant distinction between transformed attention and more ordinary forms is the presence in the former of a conscious over-witness of limitless sensory experience existing in space. This broadly grounding and balancing experience supports its own continuance and general mental and autonomic balance. The reader may become aware of, and realize a personal experience of each of the described attentional styles.

THE RELATIVE IMPORTANCE OF ATTENTION VERSUS ITS CONTENT

As I have stated previously, using various forms of EEG biofeedback one learns alternative ways of relating to experience, alternate ways of processing information; that is, one learns different ways of paying attention, regardless of what the content of attention may be. This observation is one of the most important points of this paper. It is this emphasis upon the role of attention that I diverge significantly from mainstream views already described. Once having re-learned attentional flexibility, appropriate attention styles of our own choosing can lead to normalization and relaxation as a side effect, again, no matter what the contents of attention may be. On the contrary, other opposite and rigidly fixated attention styles of our own choosing can lead to the creation and accumulation of stress and tension and prevent their diffusion, again no matter what the contents of attention may be. Most significantly, freedom from the tyranny of any or all content of our attention, physical, cognitive, emotional, is a significant benefit of training attentional flexibility.

This point, that the way we attend to experience is at least as important as the experience itself, represents a significant departure from predominantly content oriented therapies which presently abound. In the traditional view, catharsis and health requires the release into conscious awareness of previously hidden content. The emphasis is upon the content. Sigmund Freud asserted that inhibitions or blockages, which create strong feelings of anxiety and other crippling behavior (collectively labeled neuroses), could be removed only by uncovering and understanding repressed content through intensive analysis of accidental slips of the tongue, memory lapses, dreams and especially experiences from early childhood.

In the view espoused in this paper, the content of attention is not all-important. Consideration of attention, itself, both in therapy and in daily life, is at least as important as content. In fact, both the repression and subsequent release of trauma-related content, result from the use, and later suspension of use, of specific attention styles. That is, the release of content into awareness depends upon the release or disuse of those specific attention styles which had previously served as the mechanism of repression. It is precisely through changing our attention, i.e., an increase in attentional flexibility, that we are able to access repressed content. It is through the chronic compulsive use of specific attention styles (especially narrow-objective attention) applied to specific content, that the mental and physical problems

connected with neurotic and more dramatically dissociative dysfunctions are created.

To briefly take the extreme opposite position to the traditional view, after appropriate attention training one might regain a functional capacity which depends wholly upon newly regained attentional flexibility. Remarkably, this may occur even without the release into awareness of that specific content which initially sparked the attentional rigidity associated with avoidance or repression and consequent functional incapacity. This observation points to the dependence of repression and related inhibitions, including resultant depression and anxiety, upon specific styles of attention.

This dependence is further highlighted by the fact that it is not unusual for content to be released or remembered without resultant integration and increase of attentional flexibility. Remembering may, in fact, occur and produce re-sensitization and increased fragmentation due to the repression of released material, as in the traumatic flashbacks of war veterans and assault victims. Daily recollections of less extreme events, such as insults and disappointments, may also result in re-sensitization and fragmentation when repressed. One of my early clients, a woman in her forties, would relapse for protracted periods each time the visual memory of her father's shotgun suicide surfaced in her awareness. However, as previously described, appropriate attention skills will support integration and desensitization of released material (see also section entitled DISSOLVING PHYSICAL AND EMOTIONAL PAIN for attentional methods of integration of released material).

The position recommended here represents a synthesis between the above stated extreme views. As every experienced and effective talk therapist knows, a purely intellectual exploration of newly emerged content issues is inadequate and usually represents another form of defense against full release into awareness. Full release would and could only occur when a narrow-objective form of attention to thoughts or to other experience is temporarily de-emphasized. Insight, unaccompanied by a broad spectrum multi-sensory (including emotional) and intimate awareness is discouraged, as the therapist encourages a more complete and fully integrated experience. Such expanded experience of content is only achieved when all attention styles are accessible individually and simultaneously. This flexibility is more likely to result from deliberate attention training than from unaided, daily experience.

The shifting of attention styles, when intentionally used as part of the patient and therapist strategic armamentarium, facilitates the occurrence and subsequent integration of insights-releases associated with the combined use of attentional and content oriented therapy. An armamentarium that combines content exploration with the voluntary employment of learned attention skills is more effective than either alone. Neither content nor process is sacrificed, but rather, both are dynamically engaged to support full release and subsequent optimization of function. Fixation, rigidity, obsession, repression, depression, resistance, attachment, detachment, loneliness, addiction, inhibition, neurosis, anxiety and other reactions to the contents of attention, which are triggered and supported by bio-psycho-social-spiritual factors, are not supported in an environment of flexible attention. They are effects of over-used or rigid attentional styles.

A famous quotation of Descartes suggests an attentional and content bias of his and our time. He said "I think, therefore I am." Paraphrasing his words and using the language of this paper he might have said "I pay attention to my thoughts, therefore I am." Again paraphrasing, to reflect his position he might also have said, "I am aware that I pay attention with a narrow

objective awareness to my various thoughts, therefore I am." In this definition of "self" notice that Descartes did not include reference to the other senses, seeing, hearing, feeling, etc. He only referred to thinking.

This paper suggests a definition of self which is more inclusive than that of Descartes and others, and which does include his single sense definition. Our more inclusive definition is to wit, "I am an awareness of how I pay attention to all the contents of all modes of my attention, therefore I am." That is, "I am aware equally well and often simultaneously of the various ways I pay attention and their various contents (sights, sounds, feelings, tastes, smells, thoughts, sense of time and the awareness of space into which they come into being, float and subsequently diffuse), and therefore I am."

CONTENT - ATTENTION INTERACTIONS

Up to this point I have emphasized those cases in which the process I have termed attention style impacts our physiology, perception and behavior. The question remains "What is the impact of content, the content of attention, upon the attention process itself, and vice versa?"

In this context, the content of attention includes apparently static (e.g., awareness, space) and dynamic (e.g., ever changing sense objects) experience within the scope of attention.

The process of attention and its content can and do, in fact, influence each other. One impact of this mutual influence is that attention can be poor (i.e., poor control of direction, breadth of scope, absorption, objectivity or stability of attention) for specific content. It may be poor for one content, process or range of behaviors and better for others. This inequity may be the result of genetic and historical factors such as the abundance or lack of adequate training, incidental classical conditioning, diet, local brain injury, genetic factors, local neural maturation differences, or other mechanisms. The over-learning of performance is usually necessary for seemingly effortless flow of behavior associated with excellence in the performing arts, high level athletics, or exceptional activity in any other area. What is less obvious is that this over-learning is necessary to bring about critical attention changes and associated local physiological changes, which make possible the support of ongoing peak performance. One local region of the brain may, more than another, readily permit or engender the styles of attention that accompany peak performance of a specific type or in a specific area of study. In that case, we might say that a person is "a natural," or has a gift for attending or relating to and using content such as math or music or words or golf.

I have observed that certain general effects of the content of attention are quite powerful. For example, high spirits, laughter and humor can be associated with large changes in brain wave activity. They can have a powerful effect on amplitude, frequency and synchrony. Humor is associated with surprise and a sudden shift from a narrowly focused, objective, gripping attention to content, to a more broad and absorbed attention and a concomitant release of attention related tension. Humor, and particularly spontaneous laughter, invariably accompany sudden changes in attentional style. The act of being surprised, a sudden release of attention-related tension and pleasant energy, goes along with an increase in amplitude of alpha and higher frequencies. In this view, laughter and humor indicate the existence of a certain capacity for attentional flexibility, a prime correlate of mental, physical and spiritual health.

On other occasions I have recorded the brain wave activity of persons during reaction

time studies when the specific content of the triggering stimulus was loud and exceptionally brief click. One karate instructor, a 4th degree black belt, stands out in my recollection. The stimulus he responded to was a loud click that often triggered an orienting response and an experience of surprise, which was associated with a sudden shift of attention styles and concomitant brain wave changes from five brain recording loci. The karate instructor was poised to close a switch, while maintaining an abdomen-centered and open focused readiness. In reaction to content (the click), the dominant frequency of brain wave activity almost always occurred at multiples of 10 Hz, beginning in as little as 87 milliseconds after the occurrence of the stimulus. The faster the reaction time, the higher the amplitude and frequency (from 10 to 40 or more Hz) of the EEG for 2 to 4 waves. In each case of rapid reaction time, a brief shift of attention emphasis was reported, from generally diffuse and objective, to quite narrow and immersed and then rapidly back again, like a broad beam of light converging on a transparent lens and then spreading out again on the other side.

This same karate instructor touched on a particular interest of mine. He spoke of being able to observe the rhythm of his opponent. His goal, as he put it, was to open his awareness to include his opponent's rhythm, by not being focused upon specific stimuli, that is, by staying in open focus. At the instant his opponent commits to an action, he uses that energy and action, that content of his own attention, to trigger his own attentional and physical response, at least at twice the speed of his opponent's rhythm. This was a well practiced response. It might explain why the "good guy" in the movies always waits for the bad guy to draw first. The karate instructor and the movie good guy have in common that they let specific stimuli, generated by their opponent, trigger a change in their own attention with resultant "twice as fast" physical reactions. This faster reaction wins the day. He called it "cutting his opponent's rhythm."

Work with this karate black belt and numerous observations of others and many personal experiences have solidified my interest in what I have come to call the "frame or packet rate hypotheses." When activity is filmed at 16 frames per second (fps) and then played back at 16 fps, then action appears normal. When played back at a slower speed, e.g. 12 fps, action appears slower and when played back at a faster speed, e.g., 20 fps, action appears faster. The same is true of a normal voice recording played back at slower and faster speeds. This playback analogy presents a limited field of possibilities regarding speed of information transmission, perception and action since both the acquisition package rate per second (APRS) of information or data, the rate of awareness per second (RAS) and the rate of response of physical action (RPAS) may have the potential to vary independently.

Many individuals have reported occasions when attention has effected the speed of perceived activity, when time seems fast or slow, when there is extra or not enough time to react. I am reminded of a collision with a New York City taxi cab early one spring evening. Our vehicle was struck in the driver's door, shattering the window. As the small pieces of safety glass, shining like diamonds in the glare of many headlights, passed me slowly in the passenger seat, it appeared to me that I had all the time in the world to seize any individual piece of glass I desired. It is interesting to ask which external conditions trigger these perceptions. But it is even more interesting to ask which internal and attentional processes support the onset and maintenance of these phenomena.

Earlier research (3, 4, 5) supports the possibility that the acquisition packet rate per second (APRS) of visual information can approximate a frequency of 100 Hz or more.

Traditional research suggests that the rate of awareness/cognition (RAS) is about ten per second (32, 33, 34). The above observations taken together suggest that electrophysiological activity may exist independently for attention, its content and for the witnessing self which is aware of attention and its content. (See discussion associated with Figure 3 and companion article for further development, 28.)

In general, content of attention, whether it is a pleasant or unpleasant image or thought or a feeling or an emotion, or a sound or a taste or a smell, or a limited combination of sense experiences, does not inherently produce, or require a change in attention. With appropriate training, it may be possible to bring any of the available attentional styles to relate to, or process any content of attention, pleasant or unpleasant. While specific past conditioning or training may have brought into being specific habitual forms of attention in response to familiar content, one may learn to bring other forms of attention into being. This is an important point.

The fact is that even when certain feelings, emotions or other sensory experience tend to be present with the adoption of specific attentional styles, this connection need not be permanent and may be de-conditioned or un-learned. A feeling, emotion or other specific content need not necessarily bring about or signify the presence of a specific attentional style, although it may presently do so. An attentional style also need not necessarily bring about or signify the presence of a specific content of attention, although it may initially do so. Any extreme of such invariability is the stuff of neuroticism and dysfunction. In my view, a significant peculiarity of various current therapies is the limited awareness of attentional processes, and specifically the limited awareness of the rigidity or inflexibility of existing attention-content relationship. This lack of awareness leads to a loss of opportunity for catharsis and resulting improvement of function. Further, since there is a significant attention component to most diseases or disorders, diagnostic and statistical manuals would do well to address and include the role of attention in causing and maintaining symptoms. We invariably observe this when we teach clients to open their focus and normalize their physiology while thinking previously disturbing thoughts.

THE ELECTROPHYSIOLOGICAL AND ANATOMICAL CORRELATES OF ATTENTION, ITS CONTENT AND A SENSE OF SELF

While whole brain EEG parameters reflect general attentional style, the interactive effects at contiguous loci of EEG activity may be quite relevant to the function of specific processes of attention and contents of attention. Practicing whole or local brain synchrony (see earlier section), for example, can release into awareness recent or long forgotten memories and other vivid material. In our experience, the attentional content of this material is related to the cortical location of individual monopolar recording sensors. This observation led to a consideration of possible physiological mechanisms for how flexibly we are able to grasp and release the various sense objects of our attention. Previous observations in our laboratory of the ubiquity of specific phase relations in raw EEG and of the ease of training of phase relations have suggested and supported the following proposed mechanism (12, 16). It is proposed that attention itself is represented by one phase of coherent brain wave activity in a brain region and its content is represented by another phase of coherent activity in a connected or contiguous brain region. Two waves are defined as coherent when they maintain a stable phase relationship with each other. In general, certain distributions of brain synchrony represent the process of

attention, and the contents of attention are represented by other interacting distributions of synchronous coherent activity, which are however asynchronous (but still coherent) with the first distribution. Moreover, these two distributions of asynchronous brain activity interact with each other to produce a third derived activity. Figure 3 presents a simplified version of this postulate.

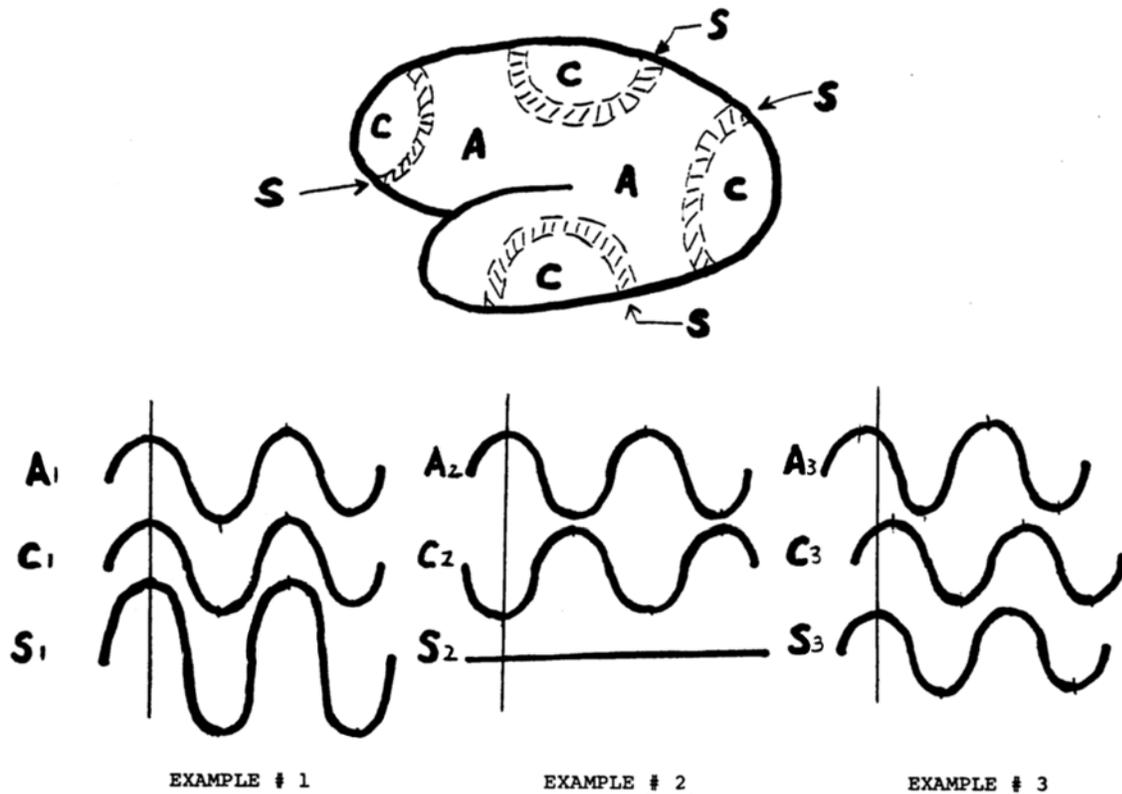


Figure3: The proposed phase mechanism for flexible creation, maintenance and dissolution of the functional separation between three processes: the contents of attention (the object, C), attention itself (the subject, A) and their relationship to a sense of self (S).

The process of attention and the contents of attention, are represented in Figure 3 by functionally separate parts of the brain (A and C respectively). This functional, rather than anatomic, process of separation of adjacent brain sites is served by the mechanism of phase asynchrony between the coherent (i.e., by equal frequency and phase locked) activity of sites which interact with each other. This bordering process need not only involve actual spatial contiguity and need not only involve volume conduction as the present simplified example may seem to portray. Contiguity may be represented in a mediating structure to which both A and C project (30). In this view, the brain regions or cell assemblies which represent the attention process (A, hereafter also referred to as the subject), must operate at least somewhat out-of-phase with the brain regions or cell assemblies which represent the contents of attention (C, hereafter also called the object) in order for objective attention to occur. Within the separate regions of the subject and the object, their individual functional integrity as a unified entity is supported and maintained by in-phase

activity (a special form of coherence) in all of its parts. As shown in the wave patterns of Figure 3, the activity of all regions of the object marked "C" are in-phase with each other. The activity of all regions marked "A" are also in-phase with each other. However, the activity of "A" may be in-phase or out-of-phase with the activity of "C." The mechanism for the temporary establishment and clarity of conscious objective attention involves a form of out-of-phase coherence between the activity of the brain areas associated with the subject (A) and object (C). In the visually simplified versions depicted in Figure 3, the sense of self "S" (or witness or witnessing awareness) is shown as an interference pattern arising out of the interaction of out-of-phase activity at the borders of the two regions, at the subject-object interface. In the illustrative special case, labeled Example #2, the activities of "A" and "C" (see A-2 and C-2) are shown equal in amplitude and exactly 180° out-of-phase, thus perfectly cancelling each other at their interface "S" (see flat line at S-2). As a result of the absence of an interference activity pattern, the sense of self disappears. A more profound integration of subject, object and self (and thus, dissolution of self) occurs when the activity in all cortical regions have the same phase, i.e., are all in-phase or synchronous with each other (see Example #1 of Figure 3. In this case, the distinctions fade, the in-phase structures function as a whole and again no sense of subject, object or self is manifested in conscious awareness. Other not quite 180° out-of-phase relations of "A" and "C" activity as depicted in Example #3 of Figure 3, would not cancel and, thus, would support a conscious sense of self, the mechanism for which is represented by an interference pattern at the interface between "A" and "C". (See A-3, C-3 and interface pattern S-3.) The flexibility of attention to individual and combinations of changing content is associated with the alternate stabilization and subsequent destabilization of various degrees of in and out of phase coherence. This mechanism is proposed as the foundation for timely ever changing objective knowledge, creativity, performance and, in general, life as we know it, along the subject-object interface. In fact, it is inconsistent with common sense to expect flexibility of attention or flexibility of the contents of attention from a system of activity which is permanently wired or phase locked. Similarly, it is difficult to imagine the development of effective attention or appropriate continuity of objects of attention or sense of self without some ability to briefly fix and maintain coherence for a time.

With whole brain multichannel synchrony neurofeedback, heretofore buried content released into awareness are aided in becoming integrated. They become embedded in a progressively larger field, one of synchronous brain activity associated with one sense modality and then are progressively included into a broader field of activity and awareness of different sense modalities, with the background of perception becoming more equally and vividly available with the foreground. With training, more instances of released vivid recollections occur. Learning how to bring these experiences into ever larger fields of present experience is valuable in order to diffuse any associated emotion, tension, pain or other change. Thus, EEG and attention training can be used to enhance forms of attention that support catharsis and subsequently to enhance forms of attention that support the integration and diffusion of cathartic material.

DISSOLVING PHYSICAL AND EMOTIONAL PAIN

When our attention field is narrow, some limited sensory content fills the narrow field of

our attention. But if this limited content is all that is present, then it will have a stronger effect than when this limited content is imbedded in a larger content. For example, a personal remark may have a stronger effect upon us, both mentally and physically, in narrow focus than in diffuse focus. In other words, due to a narrow style of paying attention any experience is a small part of our potential experience and it is the totality of our awareness of our experience. In contrast, when our overall experience is broader in scope, the same limited sensory content (e.g., a personal remark, heat, cold or pain) is only a small portion of our simultaneously and equally available multi-sensory experience. Thus, identical limited content, which is embedded in a wide attentional field, has much less impact than when it was narrowly focused upon. This is one of many examples of how attentional style affects the sense of importance we attribute to limited aspects of our experience, how it affects our behavioral reactivity and how attentional style may impact the physiology of the beholder.

One of the most surprisingly successful clinical uses of attentional flexibility is in the dissolution of various types of pain. Tissue damage-related pain, tension-stress related pain, and emotional pain all may be dissolved using alternating attention styles. Appropriately shifting emphasis from narrow to diffuse and from objective to absorbed styles of attention, to the feelings of pain and body and space simultaneously, dissolves even the most extreme pains (25, 26, 27, 28). Most notable among pains that have dissolved in response to this technique are those in relation to birthing, kidney stones, interstitial cystitis, endometriosis, ulcers, irritable bowel syndrome, back pain, headaches, colitis and phantom limb pain (29). It is not unusual for this pain dissolving attention technique to bring about long term remission of symptoms. In addition, emotional pains such as anxiety, panic, depression, feelings of guilt, loss and failure also have dissolved. While narrow focused distraction strategies have been described by other researchers and clinicians, as a useful attention technique for managing pain and other experience narrow focused distraction plays no part in the pain dissolution process described here. More importantly, the same attention strategies used to dissolve pain may be used to manage and dissolve any and all sensory experiences with greater ease and much less cost in stress accumulation than the chronic use of certain attention styles for distraction, avoidance, repression or denial.

BRIEF SUMMARIES OF OUTCOMES

The research support for the efficacy of EEG phase synchrony training and verbally guided attention training spans many years (cf 12, 14, 16). It began with my own personal successes in 1967, which were reproduced with selected individuals, most notably performing artists, athletes and advanced meditators (cf 12). The earliest controlled research in our laboratory at SUNY in Stonybrook suggested that "How to" instructions of any kind, even if well understood, significantly hinder synchrony training until these instructions are integrated and employed effortlessly (cf 12, 14). A later controlled biofeedback study provided evidence that phase synchrony between the right and left occipital recording sites could be learned, under appropriate conditions, in less than ten two-minute trials (cf 12, 14). A controlled biofeedback study of middle managers provided additional evidence that five channel phase synchrony could be learned with sustained increases in amplitude and on-off control, with and without feedback (cf 12). These changes were accompanied by a number of behavioral and experiential changes,

which directly pointed to attention as a primary variable associated with successful on-off control of phase synchrony. Parenthetically, since phase synchrony is a special case of coherence, it is possible that the attributes and correlations which I have found to relate to phase synchrony are also proposed to apply more generally to coherence between recording loci (c.f. Figures 3 and 4).

Brain mapping or QEEG in conjunction with the Thatcher referential data base yields information regarding the presence of statistically significant greater or lesser than normal coherence between various brain sites in certain frequency bands. In preliminary experiments, multi-channel brain wave training of phase increase and decrease impacts abnormal coherence in the various affected brain sites in the desired normalizing direction. A strong personal sense of well being has accompanied both the reduction of hyper coherence or the increase of coherence when it was abnormally low (30). This finding supports the proposition that enhanced flexibility or the dissolution of rigidity or fixedness of brain wave activity leads directly to a sense of well being. High or low coherence is a major detractor of well being. Other research described previously (cf 12, 14-16) further supports the thesis that attention and brain wave phase activity are directly related. A recent study supports the position that attention training in conjunction with phase related neurofeedback and other biofeedback training is a most powerful variable in the remediation of a wide variety of clinical symptoms (cf 25). A recent success with a mildly autistic child further supports the connection between brain coherence and performance and well-being (32).

In a series of experiments with college freshmen, Maria Valdez (cf 26-28) reported significant improvement in eight training sessions by combining neurofeedback, other forms of biofeedback, and Open Focus

TABLE 1
IMPROVEMENT IN PHYSIOLOGICAL VARIABLES
PRE-POST TREATMENT COMPARISON OF THE EXPERIMENTAL
VERSUS THE COMBINED CONTROL & RAP GROUPS

| <u>VARIABLES</u> | FALL 1983 SEMESTER | | | |
|----------------------------|--------------------|-------|-----------------------------------|-------|
| | CONTROL VS. RAP | | CONTROL & RAP VS. EXPERIMENTAL | |
| | F | P | F | P |
| HEART RATE | 0.04 | .8400 | 34.17 | .0001 |
| GSR | 0.52 | .4744 | 46.50 | .0001 |
| TEMPERATURE | 2.03 | .1637 | 51.92 | .0001 |
| BLOOD PRESSURE (SYSTOLIC) | 1.32 | .2581 | 50.32 | .0001 |
| BLOOD PRESSURE (DYASTOLIC) | 0.75 | .3924 | 47.49 | .0001 |
| EMG (FOREHEAD) | 0.53 | .4704 | 73.94 | .0001 |
| EMG (TEMPORALIS) | 1.11 | .2988 | 23.11 | .0001 |
| EMG (FOREARMS) | 0.23 | .6332 | 71.25 | .0001 |

TABLE 2
IMPROVEMENT IN STRESS-RELATED VARIABLES
PRE-POST TREATMENT COMPARISON OF THE EXPERIMENTAL
VERSUS THE COMBINED CONTROL & RAP GROUPS

| VARIABLES | FALL 1983 SEMESTER | | CONTROL & RAP | |
|--|---------------------------|----------|--------------------------|----------|
| | F | P | F | P |
| <u>ANGER</u> TEMPER OUTBURSTS YOU COULD NOT CONTROL | 1.60 | .2148 | 38.36 | .0001 |
| <u>ANXIETY: PERFORMANCE</u> FEELING ANXIOUS WHEN TAKING TESTS | 0.82 | .3723 | 8.88 | .0053 |
| <u>ANXIETY: SOMATIC EXPRESSION</u> SWEATING | 0.00 | .9631 | 18.55 | .0001 |
| <u>ANXIETY: SPEECH</u> FEELING ANXIOUS WHEN ASKING A QUESTION | 0.74 | .3969 | 24.53 | .0001 |
| <u>ANXIETY: SUBJECTIVE FEELING</u> FEELING ANXIOUS WHEN IN A NEW SOCIAL SITUATION | 0.14 | .7126 | 13.82 | .0007 |
| <u>CARDIOVASC. OR RESP. PROBLEMS</u> HEART RACING | 1.01 | .3220 | 9.84 | .0035 |
| <u>CONCENTRATION - MEMORY</u> TROUBLE REMEMBERING THINGS IN GENERAL | 0.85 | .3644 | 23.64 | .0001 |
| <u>EATING PROBLEMS</u> OVEREATING | 0.26 | .6152 | 10.22 | .003 |
| <u>EMOTIONAL PROBLEMS</u> FEELINGS OTHERS DO NOT UNDERSTAND YOU OR ARE UNSYMPATHETIC | 0.53 | .4707 | 31.64 | .0001 |
| <u>GASTROINTESTINAL PROBLEMS</u> NAUSEA, UPSET STOMACH, VOMITING | 1.40 | .2452 | 8.59 | .006 |
| <u>HEADACHES</u> | 0.03 | .8715 | 14.29 | .0006 |
| <u>MUSCLE TENSION</u> GRINDING OF TEETH | 2.04 | .1628 | 18.07 | .0002 |
| <u>SLEEPING PROBLEMS</u> DIFFICULTY IN FALLING OR STAYING ASLEEP | 1.64 | .2089 | 25.40 | .0001 |

TABLE 3

**A COMPARISON OF PRE-TREATMENT VS. POST-TREATMENT SEMESTER
GRADE POINT AVERAGE MEANS FOR EXPERIMENTAL AND CONTROL GROUPS**

| | <u>EXPERIMENTAL</u> | | <u>CONTROL</u> | |
|-------------------------|---------------------|--------------|----------------|--------------|
| | <u>BEFORE</u> | <u>AFTER</u> | <u>BEFORE</u> | <u>AFTER</u> |
| SPRING & FALL '82 | 2.27 | 2.45 | 2.44 | 1.92 |
| SPRING '83 | 2.56 | 2.52 | 2.49 | 2.06 |
| FALL '83 | 2.33 | 2.55 | 2.46 | 1.95 |
| SPRING & FALL '83 | 2.43 | 2.54 | 2.38 | 2.00 |
| SPRING & FALL '82 & '83 | 2.36 | 2.50 | 2.46 | 1.98 |

attention training. Tables 1 and 2 present the results of a controlled study of college freshmen divided into three groups. The experimental group received brain synchrony training and standard biofeedback training with Open Focus training for eight sessions. The "rap" control group met as a group for eight sessions and members were encouraged to discuss their emotional stress and academic problems. The control group received no treatment.

Table 1 shows that, for the experimental group, all physiological measures improved significantly ($P < .001$) more than combined control and rap groups. The control and rap groups were not significantly different ($P > .05$).

Table 2 shows that, for the experimental group, stress related symptoms are improved significantly ($P < .01$) more than control and rap groups. Table 3 shows a comparison of pre- and post-training semester grade point averages for experimental and control groups. All of the experiments resulted in significantly ($P < .05$) higher post treatment grade point averages for the experimental group than for the control group. These data show that the experimental group grade point average doesn't increase as much as the grade point average of the control group declines. This suggests that the combined neurofeedback, biofeedback and Open Focus attention training program provides an inoculation against, or a means to prevent, the deterioration in grades associated with the accumulation of stress.

Interesting and valuable clinical outcomes occur with intra-brain synchrony training. Many of my own earlier reported experiences have been repeated in persons successfully undergoing intra-brain synchrony training. With increased synchrony, reports of effortlessness, increased self compatibility and acceptance of others and the environment, enhanced absorption, union and unselfconsciousness are not uncommon. Both attention (subject) and its content

(object), and the space in which they occur may be reflected separately in a super-ordinate awareness, and all may merge in union to manifest what I call "No-Time" and "No-Thing" (cf 13).

INTER-PERSONAL TRAINING

Interesting outcomes also arise from in-phase whole brain synchrony training of peak alpha frequencies between two or more people. The feedback signals, usually light and sound, reflect the degree and amplitude of inter-person in-phase EEG activity. Informal two person neurofeedback studies support the observation that enhanced awareness of common sensory experiences develops with inter-person synchrony training.

Long term friends may marvel about the identity of their visual-thought-images. This enhanced awareness of common experience is evident when couples face each other, face in opposite directions or are located in separate rooms, with or without knowledge of the interpersonal nature of the training. When they are simply aware of who their training partner is, they may report that they feel an unusually strong sense of oneness with their partner, or that they feel as if they have known their partner well in the past, or were already close friends. Married couples during synchrony training often describe their experience as a rapport similar to the intimacy of their honeymoon. Strangers may sense each others presence, even in the absence of the knowledge that inter-personal synchrony training is in progress. In the latter case, partners can sense each others presence and sometimes reject it in favor of aloneness, and at other times take pleasure in such presence and togetherness.

More rigorous experimentation is needed in this area to confirm these preliminary findings. At this time, one can only speculate about the potential value of the harmony which arises out of inter-personal synchrony training for sports teams, spiritual, political and economic organizational unity, negotiation, the performing arts, psychotherapy, personal relationships and peace.

OPTIMIZATION OF FUNCTION

Stress reduction, healing, emotional and mental health and optimization of function are critically dependent upon the development of an awareness of how we attend and the exercise of appropriate choices of attention style. In my view, the development of such an awareness and resultant intelligent use of attentional skills directly reflects and even represents the most important dimensions of evolution of human consciousness. Because of its many potential benefits, I look forward to the day when significant energy and financial support is devoted to research on the theoretical implications and the practical applications of attention training. Specifically, research is needed on the use of neurofeedback interventions for attentional flexibility and resulting higher levels of integration of our senses, intellect, body functions (especially the all important immune system) and the expansion of consciousness. I look forward to a time when school children are guided to improve the described attention skills, and their flexible use, as an important part of the educational curriculum.

The reader who has diligently reached this point in the paper may be wondering about the identity of the writer and the degree to which the latter has utilized the various styles of attention

described in this paper. In fact, the writer, in reporting his more objective observations about attention, has also been guided by objectifying his own experience of attention. While it is necessary, when writing, to adopt an objective stance, sometimes narrow and sometimes diffuse, during the preceding research periods, one must dissolve briefly, wholly or in part, into this separateness in order to realize first hand, by entering into one's own experience. For the duration of full union with experience, of course, the objective self would dissolve completely, in which case there would be no capability or need to study attention objectively and report about it. However, instantly upon re-emergence from oneness one may retrospectively reflect and become aware of, briefly make an object of, one's previous condition. The reader is invited to re-read this paper with the goal of directly experiencing each of the described styles of attention. Can you imagine measuring the aptness or accuracy of statements about attention against your own experience? Everything is hypothesis until it is experienced directly. This is even so for so-called accepted scientific truths.

SUMMARY AND CONCLUSION

A fundamental hypothesis is presented in this paper: Attention styles and brain wave activity are reflected in each other. Attention is the means by which we relate to experience. Attention styles are defined as those processes that control the proximity, scope, speed, stability and direction of awareness. Attention style and physiology have reciprocal impact. Flexible attentional behavior can be learned using neurofeedback and other non-physiological perceptual techniques. Emphasis of attentional style can be used as both an unconscious and conscious vehicle or strategy for managing our own physiology and experience in our awareness. For example, we may broaden the scope of our attention in order to diffuse the power of some subset of experience or we may narrow focus on experience in order to enhance the intensity of its impact. Or we may narrow focus away and so avoid or deny the existence of experience. All of these and other differing attentional strategies affect our physiology and experience.

As a result of habitual overuse, we inevitably fall prey to some single attentional style, or a limited range of attention styles, as representing our dominant habitual identity. An example identity is reflected by the statement "I am the director of a narrow objective beam of awareness." This paper presents a view which encourages an identity with awareness itself, and specifically, an awareness of how we pay attention to what we pay attention to, including the awareness of the space in which awareness and attention and sensation occur. This is a more inclusive, resourceful, flexible and effective umbrella identity than are those currently in vogue. Awareness of attention and attentional balance, stability and flexibility are fundamental, though not widely nor fully realized characteristics of humanness. However, with the explosive growth of the information age, which emphasizes narrowly focussed visualization and intellect and their objectification and which cuts us off from our other senses, modern people are gradually losing their natural ability to realize attentional flexibility. This is because narrow focused objectivity has become a habitual fixation of everyday life.

As a species we are suffering a multitude of unfortunate consequences predominantly related to the accumulation of stress. This is because we fail to provide the attentional conditions necessary for the diffusion of stress and the consequent normalization of a wide range of physiological and behavioral functions. The behavioral, physiological, functional and health

limitations associated with identifying with one or a limited subset of attentional styles is considerable. It is only with attention training that emphasizes an awareness of how we pay attention and which emphasizes flexibility of attention that one's identity can be liberated from rigidly held attention biases and from chronic maladaptive central nervous system processes associated with the accumulation of stress. Attention to attention and attentional flexibility, in and of themselves, thus, are remedial and preventative of dysfunction, and extend beyond to optimization in its finest sense. Attention to attention, the implementation of attention skills, and the integration and balancing of attention styles can significantly enhance the quality of life. A specific example of such a transformed attention is presented in this paper. Its initial formation is dependent upon middle levels of arousal, called the "arousal portal." This portal represents the gateway to the experience of more subtle realities associated with more subtle and balanced ways of paying attention.

This paper discusses a view which is radically divergent from mainstream content-oriented therapies which work toward a catharsis of content. They aim to produce a release of memories of sensations, emotions, thoughts, etc. into awareness. The view presented here is that the attentional change by which the releasing process occurs and the combination of attentional styles into which the release occurs is at least as important to subsequent attentional flexibility and health as is the released content.

An electrophysiological mechanism for the neural functions of attention, its content, and the witnessing-self is presented. Represented by temporary coherent activity at changing brain loci, out-of-phase activity supports the functional and anatomical separation of attention from its objective content. In electrophysiological terms, the self may be described as an interference pattern created by the functional juxtaposition of two interacting coherent waves.

Dissolving pain strategies utilizing alternating attention styles as opposed to distraction or avoidance approaches were mentioned. Brief outcome observations were presented. These and other matters will be discussed in more detail in a companion paper (to be published 29) which emphasizes training of attentional flexibility.

Attention or Open Focus training is not merely a body of ideas. It is a program of training exercises with and without neurofeedback instrumentation. The goal is to facilitate attention-to-attention and subsequent voluntary control of attention styles as they process the content of our attention (29). It is not of much practical use just to understand about attention. One must practice attention training exercises, with and without the aid of neurofeedback, to reliably overcome the attention biases or habits grooved by years of overuse.

Attention to attention and attention training represent a simultaneously experiential (subjective) and neurofeedback (objective) voyage through an uncharted and vast awareness-space, an awareness-space limited only by walls of attentional bias and habit. This voyage is far more momentous and fraught with unprecedented potential for human-kind than any exploration that has gone before. Never did a brighter ray of promise light our way to human optimization and consciousness evolution than does practicing and researching the characteristics of attention and attention to attention. The fruits of attention practice and personal research have staggering potential for the optimization of every phase of human life. As a consequence, attention training deserves the highest priority in the child rearing process and on into and throughout adulthood and, therefore, deserves a prominent place in our public and private school systems at every level. Learning to pay attention to how one pays attention is

synonymous with learning to learn. Learning to pay attention in an effortless interested style and learning to attend to and apply such effortless interested attention in every appropriate situation is an example of the process of learning to learn efficiently.

(R) Open Focus is a registered trademark of Biofeedback Computer, Inc.

I wish to acknowledge with gratitude the many helpful comments provided by colleagues, students and clients and particularly Yvonne Bleiman, Leonard Cohen, John Cowan, Bill Curzie, David Goldstein, Ann Lieberwitz, Donald Lindsley, Susan Ray, Arthur Sichel, Richard Sobel, Robert Thatcher, David Toll and Frank Vannerson. Special thanks go to Susan Shor who has contributed many constructive and substantive suggestions and endured many revisions of this paper. Special appreciation also goes to Linda Amagasu who, without sign of exasperation, edited and retyped this manuscript many times.

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