

SELECTED PAPERS ON USING HEMI-SYNC AND BINAURAL PHASING TO FACILITATE LEARNING, INDIVIDUALLY AND IN CLASSROOMS

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A PALLIATIVE FOR WANDERING ATTENTION

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I. The Ailment

Experienced teachers know that the chief impediment to learning is inattention. The most influential thinker in American Psychology, William James, put it succinctly:

The faculty of voluntarily bringing back a wandering attention over and over again is the very root of judgment, character, and will. No one is compos sui if he have it not. An education which should improve this faculty would be the education par excellence.¹

Wandering attention afflicts young and old, rich and poor, bright and dull. It is the bane of education. Acknowledging the gravity of the problem, educators have proposed many solutions, most of them being either humane variations on the farmer-club-mule theme or thinly disguised bribes. But not all efforts to help people focus attention are crude. Now that the blatant smugness with which we brushed aside ancient wisdom has become obvious to all but the most myopic, we are beginning to see that some ancient techniques (both Eastern and Western) for training attention do work. However, they require a large measure of patience, persistence, dedication, and above all, humility. Thus they are quite unsuitable for the well-adjusted Westerner who virtuously panders to an insatiable ego. The classic cures are simply too demanding for people who are so important that they claim an inalienable right to an instant fix.

Research into the nature of human consciousness during the last half-century has yielded remarkable insights which both confirm and amplify much traditional wisdom.² That educators have largely ignored the pedagogical significance of these recent advances in consciousness and brain research is scandalous.³ Brendan O'Regan, of the Institute of Noetic Sciences, puts it less bluntly in an article entitled "The Puzzle of Untapped Potentials":

How often do we read that we are using only some small fraction of our potential? In texts from the various disciplines studying some aspect or another of the human mind, we find virtually complete agreement with the notion that we all sell ourselves short by using only a minute portion of our capacities.

Many would admit that perhaps someday we will know how to educate people more completely, but for the present we must "make do" with what we have and are sure of as "tried and true." Most people tend to assume that the Information required for this more complete and effective kind of education doesn't exist, and that is why we are not seeing it applied. Well, we couldn't agree less! Over the past couple of decades, in a wide variety of fields, numerous techniques and methods have been quietly devised, applied, and tested -- techniques that at the very least promise to give the population at large significantly increased access to their own potentials and capacities. The puzzle remains: Why are we not applying these techniques more extensively, and how does it happen that

mainstream educational institutions have largely ignored even the most conservative pieces of information regarding these matters? ⁴

Why indeed? We ignore things not only because they seem valueless; we also ignore things because we see them as a threat.

We fear our possibilities (as well as our lowest ones). We are generally afraid to become that which we can glimpse in our most perfect moments, under the most perfect conditions, under conditions of greatest courage. We enjoy and even thrill to the godlike possibilities we see in ourselves in such peak moments. And yet we simultaneously shiver with weakness, awe, and fear before these very same possibilities. ⁵

Courage is the power to let go of the familiar, and we are not over-endowed with courage. Educators are no less prone than others to cling tenaciously to the safe, the established, the accepted. After all, if I innovate, I draw attention to my actions and will be held responsible for them. But if I stick to the tried and true, it is not I who bears responsibility -- responsibility falls upon the established method, so no one is responsible. How comforting! How easy! How irresponsible!

Sages from all of humanity's major traditions have for millennia agreed that the typical, well-adjusted, sane member of any society lives in a trance:

So habitual is the trance of ordinary life that one could say that human beings are a race that sleeps and awakens, but does not awaken fully. Because half-awake is sufficient for the tasks we customarily do, few of us are aware of the dysfunction of our conditions. ⁶

People seem to awaken fully only as the result of some great trauma ⁷. Many thinkers have viewed birth as a trauma which awakens us from the trance of intrauterine life, followed by years of accommodating (adjusting, maturing, developing, growing up) to a new trance state, consensus reality. Those who are successful at accommodating -- the well-adjusted -- do not suffer another trauma until death, whereupon they are faced with accommodating to yet another reality, etc. From whatever reality we happen to occupy, the previous one seems dreamlike⁸, if we can recall it at all.

A long-range view of the history of humanity reveals that every major tradition has included the view that the quality of human life is a function of the kind of consciousness which characterizes the individual. In most traditions the notion that I am responsible for the quality of my consciousness has been a minority view -- it is far more comforting to blame my condition on the Devil, or the Republicans, or the Jews, or the Blacks, or Human Nature, or ... We are fortunate to live in an era when the state religion of Western culture (popular science, or Scientism) is beginning to acknowledge individual responsibility for the quality of consciousness. Our best scientific minds now agree with the sages of antiquity that voluntary control of consciousness is possible -- that we are not simply innocent victims of Fate. Roger Walsh, a noted psychiatrist, has summarized this ancient view which is now re-emerging in the West:

- (1). The source of all pleasure and suffering is the mind.

- (2). The untrained mind is vastly less under our voluntary control than we imagine. In fact, it is so out of control that we do not recognize that it is out of control.
- (3). Because the mind is out of control, our awareness is constricted and distorted to the extent that we are unaware of our true nature, identity, and potential, and are unaware that we are unaware. From this ignorance comes all the ultimately self-defeating behaviors that result in suffering.
- (4). It is possible to bring the mind under greater voluntary control, and thereby to reduce suffering, and discover our true nature and identity.
- (5). The consciousness disciplines provide guidelines for training the mind and bringing it under greater voluntary control.
- (6). Bringing the mind under greater voluntary control may be the optimal means for enhancing our well-being and for enabling us to contribute effectively to the well-being of others. ⁹

In retrospect it is easy to see that the type of consciousness appropriate in feudal Europe was dysfunctional after the industrial revolution. No great insight is needed to see that the type of consciousness befitting industrialized society will not work in the post-industrial era into which we are rapidly moving. The industrial pedagogical paradigm emphasizing content, the acquisition of a body of correct information, learning as a product, learning as lockstep progress in a rigidly established structure, conformity, acquiescence to a fixed body of truths, convergent thinking, etc., must yield to a post-industrial paradigm (yet in the making) emphasizing creativity (rather than mere invention), how to learn, learning as a process, dissent, candor, autonomy, seeing oneself as an instrument of change (rather than as a victim), divergent thinking, holistic thinking, greater reliance upon intuition, and the recognition that education is a lifelong process, to mention a few of its more important characteristics. ¹⁰

Voluntary control of attention is fundamental to the free (uncoerced) development of the types of consciousness best suited to a rapidly (and often unpredictably) changing milieu. Attentional spasticity (the antithesis of voluntary control) is an ailment which has survived changing social structures for millennia; it either paralyzes attention, yielding the rigidly narrow focus of bigotry, or results in desultory spasms. The classic cure has always been within the reach of only a minuscule proportion of any populace. It seems highly unlikely that there will be a dramatic change in this regard within the foreseeable future. When a malady resists cure, we resort to palliatives.

II. The Palliatives

How does one set about altering students' consciousness? ¹¹ Surely no argument is needed to establish that it is rarely accomplished by fiat, divine or otherwise. Demanding that humans develop a different sort of consciousness is like ordering them to love. They may comply overtly, but only the superficial among us would confuse loving behavior with love. To believe that there is a one-to-one correspondence between a human's performance and his/her state of consciousness requires an

extreme degree of naiveté. That such naiveté is not unusual is painfully evident in educational circles, where training is so often identified with education.

Socrates is revered as one of the world's great teachers not because he had each day's activities carefully set forth in lesson plans, nor because he followed prescriptions learned in a teaching methods course, nor because he had answers. Scavengers, intent upon finding the secret ingredient responsible for the successes of great teachers, poke around in the didactic effluvium until they find likely morsel, subject it to statistical analysis, then triumphantly announce a high correlation between the "secret" characteristic and successful teaching. Their disciples, swooping in for the kill, hastily confuse statistical correlation with causation and declare that use of the secret ingredient will cure education's ills. If circumstances contrive to produce a wave of enthusiasm for the new recipe, then good results ensue -- for a while. But note that as enthusiasm wanes, positive results wane! After a few years the recipe is consigned to archives.

Is it not time that we learned something from this pattern? Perhaps we are looking in the wrong place for the key to pedagogical success. Looking where the light happens to be best may be an approach worthy of the drunken man in the famous Sufi tale ¹², but sober educators ought to have learned from half a century of simplistic errors by behaviorists. The presupposition that technique can solve all of our problems involves a posture most unbecoming to anyone posing as an educator, and is, furthermore, passé, being a crude form of materialistic mechanism, out of favor now for almost a century in physics and for two decades in psychology (but the schools are nearly as slow to reflect such changes as is the general public).

Perhaps the most enduring and pervasive principle in education is that students learn by emulation. Socrates induced a fundamental alteration of consciousness in his students by serving as a model of enquiry unfettered by the popular prejudices of his time. Children, confronted with teachers who know all of the answers (i.e., who are not themselves learners), who insist that there is only one correct way, who are unimaginative, whose sole criterion of worth is performance, etc., can learn to be creative, open, self-reliant, responsible learners only by default, that is, by not being "good" students in their teachers' eyes. But encouraging students to defy their teachers would be throwing out the baby with the bath water. If the bath water needs changing, then change it while exercising care to preserve the baby. It is the teachers' consciousness which needs "cleansing" so that students come forth from the educational bath with that fresh set of principles, insights, skills, and knowledge necessary for the kind of world which the students will inhabit.

But setting out to change teachers' consciousness is a perilous venture, so the prudent persist in devising recipes directed to students (which makes good sense to school boards and the public, and they control funding). Of the recent palliatives for fragmented attention, that of Georgi Lozanov ¹³ is best known. The Lozanov method utilizes the metrical pattern of adagio movements (approximately one Hertz) in Baroque music to induce bodily relaxation while maintaining mental alertness. The effectiveness of Lozanov's method is clearly dependent upon the teacher's skill, and the careful attention to rhythm, intonation, drama, appropriate suggestions, rapport, etc. required would strain the talents of most professional actors.

The Lozanov method, Sophrology, the Tomatis method, Optimallearning, Superlearning, and numerous other methods which have appeared in the past two decades have merit. One of the

reasons they have not gained greater currency is that they require a special sort of teacher -- not simply a teacher who has been trained to perform prescribed actions, but one who either already possesses the gift of intellectual honesty or has the courage and humility to acquire that rare gift. We lack the large number of teachers with that gift which would be necessary to transform the consciousness of great masses of students. Something must be done. The future of humanity is at stake.

Good teaching educes learners from their confining trance into a broader and more profound reality. Most of what takes place in our schools is not teaching at all, but instruction¹⁴. The distinction is vital, though seldom drawn. Instruction acquaints the learner with details of the Cave (trance state), whereas teaching shows the way out of the Cave; instruction trains the subject to perform, whereas teaching educates, freeing us from the tyranny of the performance principle. That this distinction has been muddied beyond recognition in recent times is evidence of the extent of our infatuation with the mundane and the consequent bankruptcy of education. Training enjoys great prosperity in our society. A society of highly trained people is easy prey for a Hitler, as great thinkers since Plato have pointed out:

If, in the troubled times which may be before us, you wish appreciably to increase the chance of some savage upheaval, introduce widespread technical [training] and ignore the [intellectual and moral] ideal ...Geometry and poetry are as essential as turning lathes.¹⁵

But have no fear, we have avoided that danger by the simple expedient of calling the training done by governments of which we approve 'education' and the training done by our enemies 'brain-washing'!

III. Resonance: The Generic Palliative

Not only do we live in a sea of vibrations, we are vibrations. As a physical being each of us is an incredibly complex pattern of rhythms (iterations, frequencies, vibrations, oscillations)¹⁶, distinguished from the even more complex patterns of vibrations we call 'the universe' by conventions of attention. For eons man has appreciated the importance of controlling attention, and has devised techniques to that end. According to biologists, man did not originate the idea of directing attention -- it is a "natural" phenomenon, as we can easily see in the mating behavior of animals, symbiosis, phototropism, etc. But there is general agreement that humans have done far more than any other organism to exploit the possibilities of attention control, both for good and for evil ends.

When humans began to make deliberate use of iterated motions, sights, sounds, and touches to capture the attention of others probably will never be known. A significant part of the problem hinges upon the issue of how we are to construe 'deliberate': Human mothers have probably rocked their babies to sleep since the dawn of homo sapiens, but is this deliberate or instinctive behavior? Fortunately, for the purposes of this essay, the issue can remain moot. It is sufficient to note that at least for the extent of recorded history humans have used all manner of rhythms to direct attention, and the neurophysiological basis for this is the phenomenon of psychophysical entrainment.

'Entrainment' is simply an active term for resonance, but since some people allow their emotions to overwhelm their intellect at the slightest suggestion of control, 'resonance' is the prudent term to use. It is common knowledge that radio and television receivers are electromechanical devices which can be "tuned" to resonate with specific frequencies of the electromagnetic spectrum. A typical radio receiver has a range of frequencies to which it can resonate, and the user makes adjustments to the receiver to select the desired resonant frequency. But electronic devices are not the only things that resonate. The reason we can hear a conversation emanating from the adjoining room in a cheap hotel is that the wall resonates to our neighbors' voices, then our ear drums resonate to the vibrations of the wall. We are bombarded constantly with countless frequencies, the vast majority of which must be "tuned out" to prevent severe sensory overload. Early in life we become very adept at selecting only those frequencies which we believe to be important to us, while tuning out all others. Although this selective awareness has numerous obvious advantages, it is a double-edged sword. By diligently adhering to the range of awareness certified by our society as "safe", "proper", "sane", etc., we lock ourselves into a fixed reality-structure, thereby eliminating self-initiated growth. Then the only growth available to us is of the coercive variety (that is, it must come as an external force too powerful for us to tune out) -- beyond our control.

A recently popularized example of resonance among animals is known as "The Hundredth Monkey". The eminent biologist, Lyall Watson, relates the story:

Off the coast of Japan are a number of tiny islands where resident populations of macaques have been under continuous observation for more than twenty years. The scientists provide supplementary food, but the monkeys also feed themselves by digging up sweet potatoes and eating them dirt and all. This uncomfortable practice continued unchanged for many years until one day a young male monkey broke with tradition and carried his potato down to the sea where he washed it before eating it. He taught the trick to his mother, who showed it to her current mate and so the culture spread through the colony until most of them, let us say 99 monkeys, were doing it. Then one Tuesday morning at eleven, the hundredth individual acquired the habit and, within an hour, it appeared on two other islands in two physically unconnected populations of monkeys who until that moment had shown no inclination to wash their food.¹⁷

An elaborate and carefully supported extrapolation of this phenomenon has been put-forth by plant physiologist and biochemist Rupert Sheldrake¹⁸, who calls it 'morphic resonance'. Grossly oversimplified, Sheldrake's hypothesis is that a pattern of behavior (whether at the molecular level or the macroscopic level) creates a field to which anything appropriately tuned will resonate, and the strength of this field is partially a function of the number of instances of that pattern, thus as more and more people (for example) perform a certain action, the pattern of that action exerts ever-greater "pressure" upon others to adopt it.

It should be obvious to anyone with even a fragmentary knowledge of history that Sheldrake's hypothesis has much confirming evidence in the area of human affairs. The commonplace way of putting it is that humans are slaves to fashion; social animals are constantly under pressure to "go along with the crowd." This human proclivity can be exploited for good and for evil, so we must be careful to avoid adoption of a cavalier attitude either for or against it. We are pleased to see honesty in adults engender honesty in children; we are displeased to see the operation of the same principle

with regard to violence. The principle is value-free; values arise in connection with the use to which we put it. ¹⁹

A little thought will reveal that the aspect of Sheldrake's hypothesis presented above (there are other, less conventional, aspects of it) is a generalized version of the pedagogical principle of emulation. We normally think of emulation in gross terms: teenagers aping the behavior of a folk hero; people adopting the style of dress dictated by some "fashion leaders;" public barbarization of the language by copying the speech of popular radio and television announcers.

Sheldrake draws our attention to the fact that there are much subtler forms of emulation, that emulation takes place below as well as above the limen of conscious awareness, at the cellular and molecular level as well as at the microscopic level.

Psychophysical entrainment is the human nervous system's emulation of (resonance with) a pattern. The primary human modes of access to patterns are sight and sound. Due to the relative ease with which we can manipulate sound, we have expended more effort on the control of consciousness by aural entrainment than through any other sensory medium. All of the world's music and the elaborate inflections of the human voice are examples of our ceaseless efforts to control consciousness by means of sound patterns. Humanity's success in this venture hardly needs touting. Viewing the thousands of years of successful employment of aural entrainment causes one to wonder why Western educational practices no longer emphasize it. Pedagogy in other parts of the world continues to appreciate its efficacy, and Westerners would do well to re-evaluate their stand.

IV. Applications of the Generic Palliative

In May of 1975 the United States Patent Office granted Robert A. Monroe patent number 3,884,218 for an application of psychophysical entrainment via sound patterns. Through the Monroe Institute of Applied Sciences, of which he is founder and director, Robert Monroe has conducted extensive experimentation with sound and light patterns in an attempt to determine not only the optimum frequencies, amplitudes, and patterns, but also the most promising areas of application. Although education is an obvious area for utilization, numerous constraints dictated that the majority of the institute's efforts be directed to the areas of personal growth and therapy.

The development of pedagogical applications for the type of aural resonance investigated by the Monroe Institute has been an abiding concern for the author of this paper since 1978. I have employed it for five years with college students in four major areas:

1. enhancement of cognitive learning;
2. enhancement of mental imagery;
3. promoting creativity;
4. allaying anxiety.

All of these uses depend upon focusing attention, which is accomplished by providing auditory stimuli at frequencies which induce the brain into an appropriate state while simultaneously synchronizing the hemispheres (whence the term 'Hemi-Sync') to eliminate hemispheric rivalry. By 'appropriate state' I mean that state best suited to the intended activity: the brain-state most conducive to cognitive learning differs from the state most conducive to creativity, for example.

My colleagues and I have used this method at Tacoma Community College in a variety of courses, including Introduction to Philosophy, Ethics, Philosophy of Religion, Death and Dying, Interpersonal Speech, Alternate States of Consciousness, Introduction to Psychology, Drawing (art), Creative Writing, Spanish, and The Art of Being Human. For those courses utilizing cognitive learning enhancement tapes assessment of effectiveness is relatively simple, although time-consuming. There has been time to perform only one carefully-controlled assessment. It was accomplished during Spring Quarter 1981, using two sections of Introduction to Psychology, both sections taught by the same person. There were twenty-four students in the experimental group and twenty-four in the control group. Composition of the groups was determined by use of the last digit of the students' Social Security numbers. At no time did any student have access to the scripts for the tapes, nor were the tapes "loaded" for the tests. Below is an analysis of the resulting data:

TEST #	MEANS		STANDARD DEVIATIONS		STATISTICS	
	EXPERIMENTAL (tapes)	CONTROL (no tapes)	EXPERIMENTAL	CONTROL	t TEST	SIGNIFICANCE LEVEL
1	79.44	73.07	14.45	14.73	1.5564	Not sig
2	76.71	65.92	12.37	15.11	2.9207	p<.01
3	80.38	70.84	12.26	12.53	2.7732	p<.02
4	83.84	73.92	9.96	11.99	3.1809□ □	p<.01
5	72.00	58.91	14.62	14.68	3.0925	p<.01
6	66.64	54.88	17.92	14.28	2.5655	p<.02
Combine d	76.56	66.37	14.68	15.46	5.9160	p<.001

Reports from teachers using the cognitive tapes for their classes are consistent with the controlled study result. I have yet to devise a method for testing efficacy in the areas of mental imagery enhancement, creativity, and anxiety reduction.

In this age of strict quantitative accountability we are tempted to elevate that which can be reduced to numbers to a position of pre-eminence and ignore the qualitative. From the point of view of many students who have utilized Hemi-Sync, the affective aspect of it is far more important than the cognitive. Of course the only evidence I can offer is anecdotal. Many of my students volunteer (usually in private) information about how much better they feel after listening to a tape: "My whole day seems brighter."; "I feel good about myself and my studies."; "I get along better with people after listening to your tapes."; "For the first time in my life I really enjoy school."; "My mind seems to be clearer. I understand things better."; "When I came to school this morning I was so tired and nervous, but after listening to tape number three I felt like a new person, and the whole day has been just great." Hearing such reports is so commonplace that I stopped recording them long ago. Perhaps the affective component is best summarized by a statement from the Dean of Instruction, who, after some hesitation finally listened to a tape: "I haven't felt so relaxed and good all over for many years. Even if those tapes didn't speed up learning at all, they are well worth all of your efforts for the way they make a person feel."

Following the lead of Robert Monroe (and much other research that applies in a peripheral way) I concentrated all efforts on binaurally phased sound patterns until early 1983. Binaural phasing results from providing a signal to one ear and a different signal to the other ear. For example, if the left ear is subjected to 300 Hz. and the right ear to 305 Hz., the brain (in a person with normal hearing) will experience a 5 Hz. beat (the difference between the two administered frequencies). Binaural phasing is an extremely effective entrainment technique, but obviously requires that the subject listen with stereo headphones. Enabling large numbers of students to use the method requires rather elaborate and expensive equipment. Tacoma Community College has such equipment in a listening laboratory accommodating sixteen students at a time. Most schools lack such a facility, which has been the major obstacle preventing widespread use of the Hemi-Sync method.

In 1982 a Tacoma Public Schools teacher, JoDee Owens, became interested in my work. She wanted to use the method in her class, but even if there had been no problem about acquiring the equipment, the prospect of having thirty squirming six-year-olds tethered by headphone cords while trying to write and . . . was terrifying. JoDee wanted to try loudspeakers, but I assured her that the efficacy of the method was a function of binaural phasing, so speakers wouldn't work. Her persistence weakened my conviction, and by the spring of 1983 I capitulated, agreeing to try it. Initial results were promising, so we spent much time during the summer of 1983 preparing tapes for the new group of first-graders she would have in September. The effect on her pupils has been dramatic. Her principal (Emma Sneed), the pupils' parents, and other teachers are amazed. Bruce Arneklev, of the Tacoma Public Schools Research and Evaluation Division, summed up his impression as follows:

[The process used by JoDee] results in a great deal of independence and cooperation on the part of her first grade class. Each of the 22 students I observed made their own choices from exercises she had neatly printed on chalkboards on two sides of the room. They completed words (spelling), sentences (grammar), and wrote stories on their own while she worked with small reading groups. Then they read their stories, gave one minute "talks" and answered questions which were raised by other members of the class. (FIRST GRADERS!)

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I am still convinced that delivering the sound patterns with loudspeakers is less effective than with headphones, but headphones are totally impractical in a classroom setting. Furthermore, speakers have some advantages beyond low cost and ease of use: (1) the teacher benefits from hearing the music-masked sound patterns; (2) use of Hemi-Sync does not encroach upon time needed for regular classroom activities -- it is simply a background for those activities; (3) the HemiSync/music ambiance for normal classroom activities encourages cooperation, mutual trust, and social harmony.

V. Types of Attention

'Attention' is much in need of precise definition. Its use has spanned a range from the chronic conceptual cramp characterizing bigotry to the indiscriminate receptivity of the amorphous sycophant. Etymologically, 'attention' derives from Latin 'attendere,' to stretch toward, which allows

considerable latitude of specificity. But post-Renaissance developments in the Western world contrived to make detailed analysis the desired attentional mode, so that for most people today 'attention' is nearly synonymous with 'concentration.' The hemispheric specialization model of brain functioning, so popular in recent years, assigns this concentrative type of attention to the left hemisphere and casts the right hemisphere into the role of global awareness. Although there is little doubt that the hemispheric paradigm has been grossly oversimplified by popularizers, it can serve a useful function if we resist the temptation to treat it as gospel.

There are notable differences between the analytic, particulate, causal, linear, quantitative style of attending (left hemisphere) and the synoptic, Gestalt, holistic, simultaneous, qualitative style (right hemisphere). Both ancient wisdom and modern research hold that the wrinkled brow, clenched teeth, tense muscles, high anxiety type of attention (identified with "type A" personalities) which dominates our society is an eliminative, conservative, no-change mode, thus inimical to education and conducive to psychopathologies. This "left hemisphere" type of attention seems essential to training, and potential members of a society certainly need to be trained to perform useful social functions. But members of a free society need to know more than the intricacies of their own narrow slots. A free society requires members who are aware of the larger picture, people with expansive consciousness enabling them to appreciate other points of view, to tolerate paradoxes, to entertain ideals, to dream.

Lester Fehmi and George Fritz propose 'narrow focus' and 'Open Focus' as terms for the two sorts of attention described above. They portray narrow focused attention as an exclusive, constrictive, obsessive-compulsive, hysteric, stressful style of attending. Open focused attention includes narrow focused attention within its (in principle) unlimited range, thereby relieving the individual of the strain of screening out all that fails to fit into the preestablished restrictive schema of narrow focus. Mindful of the need for both types if we are to actualize our potential, they claim that people can learn to reap the benefits of narrow focus while engaging in Open Focus. The two styles of attention are not mutually exclusive.

It needs to be emphasized that simultaneous access to Open Focus, while at the same time rendering order out of the chaos of sensation, facilitates healthful and productive attentional behavior. Release of a rigidly apprehended focus of attention is associated with higher amplitude of EEG activity, as exemplified by alpha waves, and by a greater phase agreement of synchrony between the activity occurring at all lobes. Open focused attention is also associated with effortlessness and softening of goal-oriented behavior. Concomitant with Open Focus are moments of greater unself-consciousness, feelings of release of energy ("aha" experiences), more creative thoughts and associations, a greater sense of unity or well-being, a lack of criticalness or judgmentalness, and a more general or integrated awareness of all of one's experience simultaneously.²¹

Fehmi and Fritz are therapists. They provide no direct evidence that Open Focus is as effective as narrow focus in learning algebra, for example. But it could well be that their terminology is an attempt to label a phenomenon well-known to all experienced and aware teachers: There is a kind of attention (whatever we may call it) which results in rote learning with little or no awareness of the significance of what has been learned ("going through the motions" learning); there is another kind of attention that enables the learner to connect what is being learned with an indefinite number of

aspects of his/her reality. If this be their intention (as it probably is), then Open Focus should receive the enthusiastic endorsement of educators.

In any event, the hypothesis which I began testing in 1978 is this: Many people attempt to learn while in a state of consciousness characterized by extremely fragmented attention. Their attention flits from one thing to another in an uncontrolled manner, only occasionally impinging upon that which they wish to learn. Self-awareness of their plight only adds another distraction, and (in extreme, cases) may result in such frustration that they give up entirely. It is possible to learn to control one's attention (Buddhist meditation techniques, for example), but the classical methods are so demanding that few people have the motivation to pursue them. Therefore, an externally imposed non-demanding a method which will relieve the learner of the state of fragmented attention and induce a state of focused attention should give him/her the first-hand experience of an optimal learning state, thereby providing the motivation to pursue attention control by whatever means s/he deems appropriate.

Admonishing the learner to "pay attention" works no better today than it did centuries ago, probably because the appeal attempts to bring about an attitude change (affective domain) by cognitive means, and there is much experimental evidence supporting the contention that affect and cognition belong to two partially independent psychophysiological systems.

The dismal failure in achieving substantial attitude change through various forms of communication or persuasion is another indication that affect is fairly independent and often impervious to cognition. ²²

Attending is not a cognitive function. It may be construed as a precondition for cognition, but is closely allied with affect, for it is a matter of attitude. Although "No change, no learning" is the most universally accepted pedagogical axiom, most people in the present era take it to mean change in cognitive content, which, consistent with the "container theory" of learning, involves no change in state of consciousness. While people in our culture are extremely reluctant to give up their normal state of consciousness for the sake of more effective learning, they actively pursue ways for altering their consciousness for the sake of self-indulgence. Among their "accepted" and "benign" methods are intoxication (by alcohol, sugar, caffeine, prescribed drugs, etc.), viewing dramatic productions, exposure to television, sexual arousal, reading, listening to politicians, engaging in sports, and MUSIC. Of all the consciousness altering techniques, listening to music is the least threatening, therefore it is the best means for approaching an understandably wary public.

Music comprises all of the elements needed for psychophysical entrainment, and much music is extremely effective at entraining the nervous system. However, to my knowledge no composer has developed music for the expressed purpose of facilitating cognitive learning. Music is always directed to influencing feelings, emotions, attitudes (the affective domain). Certain Hemi-Sync patterns induce the optimum state of consciousness for cognitive learning, but they impress many persons as clinical and boring. The obvious solution: mix music with Hemi-Sync sounds.

VI. Music Plus Hemi-Sync

But what kind of music should be used?

The Byzantines distinguished between pneumata (spiritual sounds: the octave, fifth, and fourth) and somata (bodily sounds: thirds and seconds). The ancient Greeks believed that different musical modes induce specific affective states in listeners. The classical music of India has occasioned extremely subtle categorizations in terms of the moods and feeling-states it elicits.

There is near-universal agreement that music has profound effects upon human emotions, but until recently little systematic study of the relationships between musical styles and specific emotions had been attempted. In the last two decades the field of psychoacoustics was born and has passed through early infancy. Although leaders in this new discipline disagree sharply on numerous issues, a measure of consensus concerning the basic sound patterns and the emotions they elicit is beginning to appear. Manfred Clynes, perhaps the most notable pioneer in the field, has amassed sufficient experimental evidence to prompt the assertion that there are "dynamic forms which have innate meaning, forms that can act upon the nervous system not in arbitrary ways but like keys in a lock, activating thereby specific brain processes" which either are the physical manifestations of emotions or cause us to react with emotion. He has isolated dynamic forms which correlate highly with anger, hate, grief, love, sex, joy, and reverence.²³

Without benefit of research findings, most of us are sufficiently sensitive to the dynamics of sound to judge the "Missa Solemnis" inappropriate for a teenagers' party. Few of us would play a John Phillip Sousa march to set the mood for a romantic evening. But when pressed to cite the qualities of music most likely to engender a specific emotion, we flounder. Musical taste varies greatly. But in spite of the perilous nature of such a venture, it seems necessary to offer some guidelines for selection of music to use with Hemi-Sync:

1. Avoid familiar music.
2. Avoid music with a distinct beat (it can interfere the Hemi-Sync pattern).
3. Avoid music with lyrics.
4. Avoid music that compels people to move.
5. Avoid music with large, sudden changes in amplitude.
6. Avoid music that demands the listener's attention.
7. Avoid music that shocks or irritates the listener.
8. Use music with sustained tones and subtle variations.
9. Use music that is mellifluous, i.e., avoid cacophony.
10. Use music that is systematically ambiguous, i.e., that allows the greatest possible range of interpretation.

Popular music, of whatever genre, violates the first guideline. Beethoven's Ninth Symphony violates one, three, and six. Punk Rock violates all ten. It is fairly easy to eliminate entire classes of music in this manner, but not so easy to select particular compositions that satisfy the criteria.

Below is a list of musical works which have been found to work well for the purposes indicated. The absence of "classical" compositions is due to the fact that such works are familiar to many

people, and most others (especially the young) view them as dangerous to their self-image ("What if I should actually begin to like that kind of music?").

The classification follows what is rapidly becoming a standard in distinguishing among the many functions of consciousness: cognitive, affective, and transpersonal (see Calyeon's Mind Sight ²⁷). Some of the compositions fit into two categories, either because of stylistic variation from one part to another or because the music serves the two functions equally well.

Purpose Code: A = affect (eliciting emotions, feelings). C = cognitive (rational thought processes, data, causal relations). T = transpersonal (intuitive, mystical, spiritual).

LAURA ALLEN Reflections I & II - A, T	IASOS Angelic Music - T Crystal Love - T Interditgenional Music - A, T Throne Realms - T
WILLIAM AURA Aurasound I - C Aurasound II - C Heartspace - T Lovely Day - C Timeless - C	JEAN-MICHEL JARRE Equinoxe - C Magnetic Fields -C Oxygene -C
WALTER CARLOS Sonic Seasonings - A, T	GEORGIA KELLY Seapeace - C Tarashanti - C The Sound of Spirit C, A Birds of Paradise - C
MALCOLM CECIL Radianance - C□	KITARO Ki - C Oasis - C Silk Road - C Silver Cloud - C Ken Tai/Astral Trip - A, C Tao - C
GEOFFREY CHANDLER Starscapes A, T	GAIL LAUGHTON Harps of the Ancient Temples - C
CONSTANCE DEMBY Skies Above Skies - A, T Sunborne - A, T	THIJS van LEER Introspection II - C
BRIAN ENO Ambient I - C Ambient 11 - A, C Ambient III - A, T Ambient IV - A, T	ROBERT SCHRÖDER Floating Music - C

EDGAR FROESE Aqua - A	JORDAN de la SIERRA Gymnosphere - A, T
SYLVAN GREY Ice Flowers Melting - C	DON SLEPIAN The Sea of Bliss - A, T
STEVE HALPERN All of his compositions - A, C	MICHAEL STEARNS Morning Jewel - A, T Ancient Leaves - A, T Planetary Unfolding - T Light Play - A, T Lyra Sound Constellation - T
HENRY WOLFF and NANCY HENNINGS Tibetan Bells I & II - A, T	VANGELIS China - C Spiral - C Ognacio - C L'Apocalypse des Animeaux - C
PAUL HORN Inside I and II - A, T	CYRILLE VERDEAUX Offrandes - C
	CYRILLE VERDEAUX and BERNARD XOLOTL Prophecy - C

VII. Imagery

Coming from one of the few intellectuals to achieve the rank of folk-hero, Albert Einstein's statement "Imagination is more important than knowledge" may strike some as strange. Its strangeness is easily traced to the popular conviction that the universe and knowledge are rational, whereas imagination is irrational. This conviction was born in ancient Greece, passed through puberty during the Renaissance, and matured (as psychology's obstreperous post-adolescent, Behaviorism) during the first half of the present century.

Now that the scourge of Behaviorism is behind us, we can once again turn to the infinite resources of imagination for succor. The use of imagery in nearly all types of therapy is increasing exponentially. ²⁴ Learning, whether in a therapeutic or academic setting, depends in large part upon the re-creation of experience, that is, we learn something new (have a new experience) only by using prior experiences as building-blocks, thus the ability to re-create experiences that we have had is vital to learning. There seem to be only three ways to recreate experience: (1) by contriving every detail of the original experience; (2) by reducing the original experience to a language (conventional signs); (3) by imagining the original experience. The first method would be impractical even if it were not logically impossible; the second provides only a pale shadow of the original, for languages function by abstracting from experience (a child will never experience the taste of a tomato by means of a description); the third, however, recreates the original experience to the extent that one's imaging ability is not attenuated by conditioning. An imagined experience is available as a totality to all of the senses. All facets of the experience are present at the same time,

enabling the subject to be aware of the multitude of complex relationships which comprise the totality without the laborious sequential processing of language-mediated awareness.²⁵

Not only does imagery allow for the guided or spontaneous creation of experience, it also facilitates vivid storage and recall of significant events. When the patient has a mental image available for repeated reference, he/she speculates less, concentrates better, and is more likely to maintain an intense affective response. The visual experience is simultaneous, like the real experience, and mental images elicit a depth of emotion with greater ease than does a verbally censored recital of affect.²⁶

Pedagogy's fifty-year love affair with Behaviorism has left it diseased and nearly impotent. Many offspring from this union can still be heard intoning the litany: If you can't express it, then you don't know it. The silliness of this "great truth" can be appreciated by considering an extreme case: A knowledgeable person becomes totally paralyzed, thus she is unable to express anything. Does it follow that she knows nothing?

The study of pedagogical uses of imagery is currently enjoying a revival. Of the numerous researchers who have made notable contributions, probably none surpasses that of Beverly-Colleene Galyean. Her various journal articles and book, Mind Sight: Learning through Imaging²⁷, contain a wealth of insight and practical advice for - the use of imagery in the classroom. Anyone wishing to use imagery for learning should study her work with care.

VIII. Classroom Use of Hemi-Sync

The fundamental use of Hemi-Sync in the classroom is attention-focusing. This can be accomplished with or without masking music, but experience has shown that carefully-chosen music enhances the effect. Whether used with music or alone, the Hemi-Sync sounds should be barely audible -- definitely not loud enough to interfere with communication.

There is little point in focusing attention unless it is to be put to work. It can be put to work on traditional classroom tasks, and the teacher will see a subtle but definite shift in students' attitudes (hence performance). For those adventuresome teachers who wish to create a more dramatic transformation, imagery combined with Hemi-Sync will make learning exciting and rewarding for everyone involved.

The optimum use of Hemi-Sync requires that its pattern be tailored to the intended use. Studying arithmetic requires a Hemi-Sync pattern which differs from the ideal pattern for studying literature. Selection of the best pattern for different classroom activities requires not only knowledge of the effects of Hemi-Sync, but also an analysis of the individual teacher's style; thus is best done on an individual basis. Attempting to set forth all of the considerations in this essay would result in some unfortunate interpretations.

The electronic equipment needed consists of a Hemi-Sync synthesizer²⁸, a pair of good speakers, and a music source. The synthesizer generates and mixes the necessary sounds, allows mixing of music with those sounds, and amplifies the resulting signal for delivery to speakers. A tape deck or phonograph (with preamplifier) is used to feed music to the synthesizer.

REFERENCES AND NOTES:

1. James, William, The Principles of Psychology, New York: Holt, 1890.
2. For some examples, see the 800+ articles and books cited in the bibliography of Norman Dixon's Preconscious Processing, New York: John Wiley and Sons, 1981.
3. Should the reader believe that there is a bit of paranoia behind this statement, read Felix Morrow, "William James and John Dewey on Consciousness: Suppressed Writings", Journal of Humanistic Psychology, vol. 24, no. 1, 1984, pp. 69-79. Morrow carefully documents his allegation that writings of both James and Dewey espousing unfashionable views of consciousness were deliberately kept from publication by people who felt threatened.
4. O'Regan, Brendan, Institute of Noetic Sciences Newsletter, Spring 1982.
5. Maslow, Abraham, The Farther Reaches of Human Nature, New York: Penguin, 1976.
6. Deikman, Arthur, The Observing Self, Boston: Free Press, 1982, p. 129.
7. It is illuminating to note that 'trauma' is a Greek word meaning wound, and that in German 'Traum' means dream. "Stopping the world" is don Juan's expression for the trauma that wakens us from the Traum of consensus reality. See Carlos Castañeda, A Separate Reality.
8. For a lucid account of the problems humans encounter in attempting to conceive of other realities, see Alex Comfort, Reality and Empathy, Albany: State University of New York Press, 1984.
9. Walsh, Roger, "The Consciousness Disciplines", Journal of Humanistic Psychology, vol. 23, no. 2, Spring 1983, p. 28.
10. See Marilyn Ferguson, The Aquarian Conspiracy, Los Angeles: J. P. Tarcher, 1980, and Stanley Krippner, "Some Implications of Consciousness Research for Education", unpublished paper, 1983.
11. I should like to deem it unnecessary to enter a caveat here, relying instead upon the good sense of the reader, but prudence dictates that since one never knows what sort of people might read one's output, a disclaimer is in order. The public falls prey to sensationalistic uses of expressions such as 'altered states of consciousness' to the extent that mere mention of the expression calls up ghoulish associations. Instead of giving thought to what they encounter, many people seem to prefer the "knee-jerk" reaction. Of the thousands of examples which could be adduced, a particularly silly one from the Watergate era will serve to illustrate my point. The news media, in reporting events surrounding the President's audio tapes, chose (quite appropriately) the term 'expletive' to refer to emphatic (though unnecessary) expressions used on the tapes. Since the words so used on these tapes happened to be swear-words, and since the public was unfamiliar with 'expletive,' the vast majority of people came

to believe that 'expletive' means swear-word. That we allow such active ignorance to determine the vocabulary we use contributes mightily to the poverty of our language, consequently to imprecision and obfuscation of thought processes.

Failure to see that being in love, being intoxicated, being depressed, being angry, being ecstatic, etc., involve altered states of consciousness obscures similarities which can be profoundly important. Schooling which does not alter students' consciousness is a total failure -- and that includes parochial schooling.

12. There are many versions of the tale, all of which convey the same message: Nasrudin came upon a drunken man crawling around beneath a street light. Asked what he sought, the drunken man replied "My house-key!" "Where did you lose it?" asked Nasrudin. "In my house." came the reply. "Then why search for it here?" "Because the light is better here." See Idris Shah, The Exploits of the Incomparable Mulla Nasrudin, New York: E. P. Dutton, 1972.
13. Lozanov, Georgi, Suggestology and Outlines of Suggestopedy, New York: Gordon and Breach, 1978.
14. 'Instruction' derives from Latin 'instruere,' to pile upon. 'Teach' derives from the Anglo-Saxon root 'tacn,' which meant sign or symbol, hence to show, to demonstrate. Thus instruction is appropriate to training, where facts and truths are "piled upon" the learner to ensure desired performance. Teaching shows the learner a way out of his/her state of ignorance, hence is an educative ('education' comes from Latin 'educate', to lead out) process. In her The Life of the Mind, Hannah Arendt elucidates this issue by distinguishing between ratiocination, which is goal-oriented, and pure thinking, which is the quest for meaning (see especially vol. 1, p. 15). That goal-directed reasoning is a mechanical activity devoid of meaning, thus inherently demeaning to an organism aspiring to transcend its material limitations, is a theme found in the writings of philosophers and theologians down through the ages.
15. Whitehead, Alfred North, The Aims of Education, New York: Macmillan, 1929.
16. Of the great number of philosophers, physicists, transpersonal psychologists, and neurophysiologists who support this view, the two who are most influential are David Bohm (see particularly his Wholeness and the Implicate Order, London: Routledge and Kegan Paul, 1980) and Karl Pribram (Languages of the Brain, Monterey, California: Brookes/Cole, 1971). For a sensitive account written in lay language, see Robert Lawlor, "The Resounding Cosmos and the Myth of Desire", Parabola, vol. 5, no. 2, 1980, pp. 78-85.
17. Lyall Watson, author of the Preface to Lawrence Blair's Rhythms of Vision, New York: Schocken Books, 1976.
18. Sheldrake, Rupert, A New Science of Life: The Hypothesis of Formative Causation, Los Angeles; J. P. Tarcher, 1981.

19. It is alarming that this point escapes so many people. A particularly blatant example is the categorical rejection of hypnosis by a number of religious groups on the grounds that hypnosis can be used to promote attitudes of which they disapprove, while any disinterested observer acquainted with hypnotic techniques can see that the objecting groups make extensive use of hypnosis! And many of them watch television, without a doubt the most effective hypnotic device yet invented.
20. Inter-office memorandum from Dr. Bruce Arneklev, Research and Evaluation, to Dr. Richard Manion, Assistant Superintendent for Curriculum and Instruction, dated 14 February 1984.
21. Fehmi, Lester G. and Fritz, George, "Open Focus: The Attentional Foundation of Health and Well-Being", Somatics, Spring 1980, p. 25.
22. Zajonc, R. B., "Feeling and Thinking: Preferences Need No Inferences", American Psychologist, vol. 35, 1980, p. 176.
23. Clynes, Manfred, and Nettheim, N., "The Living Quality of Music: Neurobiologic Patterns of Communicating Feeling", in Clynes, M., Music, Mind, and Brain, New York: Plenum, 1980, pp. 47-82.
24. Sheikh, Anees (ed.), Imagination and Healing, Farmingdale, New York: Baywood Publishing, 1984.
25. Nikola Tesla, the great engineer/inventor, could design a complex machine in his imagination, set it into operation, allow it to run for weeks or months, then disassemble it to check for wear. Only after he had corrected any flaws in this manner did he describe it to his draftsmen, who then drew plans so that the machine could be built.
26. Habeck, Beverly K., and Sheikh, Anees A., "Imagery and the Treatment of Phobic Disorders", in Sheikh, A. (ed.), Imagination and Healing, Farmingdale, New York, Baywood Publishing, 1984, p. 176.
27. Calyeen, Beverly-Colleene, Mind Sight: Learning Through Imaging, Center for Integrative Learning, 767 Gladys Avenue, Long Beach, California 90804, 1983. Calyeen's book is primarily a how-to-do manual. For more scholarly treatments see Anees Sheikh (note 24, above), which has bibliographies listing hundreds of books and journal articles on various facets of imagery.
28. The Hemi-Sync synthesizer [was] manufactured by AWI Electronics [disbanded], 7620 29th West, Tacoma, Washington 98466.

BINAURALLY PHASED SOUND IN THE CLASSROOM

The recent spate of reports decrying the quality of education in the United States came as no surprise to many of us in education. But now that public attention has been drawn to the tragic situation in our schools, the question becomes: What shall we do about it?

Even a quick survey of history will reveal that when fault is found with what is taking place on stage, there are always some experts waiting in the wings, ready to rush in and set things aright. Those who are charged with the conduct of our educational institutions -- persons of experience and prudence, we trust -- are properly reluctant to replace the old script and cast with an entirely new production. On the other hand, something needs to be changed.

Common to nearly all proposals for rectification of the situation is avowal of the need for an overall attitude change. Learning needs to be accorded higher status in the culture's hierarchy of values. But changing parents' attitudes toward learning is difficult. It is also difficult to change students' attitudes, and teachers are not pushovers. A change in attitude is a subtle thing, rarely accomplished by edict. The most successful educational leaders are those who have developed the art of insinuating attitudinal determinants with minimum commotion.

Binaurally phased sound patterns masked by music help to bring about this subtle attitude change. Combining recent findings from neuropsychology with advances in electronics, the sound provides an environmental factor that enhances both cognitive and affective learning. Unlike many techniques for facilitating learning, this method is non-intrusive. The only noticeable environmental difference is the presence of pleasant, non-frantic music at a low level.

The Principle

Extensive research conducted by psychologists and neurophysiologists during the past few decades confirms what the sages of antiquity knew: The human brain resonates with sound patterns in a frequency range of approximately 0.5 to 40 Hz. Research also provides strong evidence to the effect that the brain wave frequency range of normal waking consciousness (the beta range, from 13 to 25 Hz) is not the range for optimal learning. Optimal learning occurs between 3.5 and 7 Hz. (the theta range). However, human beings are capable of different kinds of learning. Research and experimentation conducted at Tacoma Community College since 1978 have established particular sound patterns that enhance specific types of learning.

The Effects

Since 1978 several thousand students, from elementary grades through graduate school, have utilized this method for cognitive and affective learning enhancement. There is no known instance of negative or undesirable effects. Desirable effects noted by teachers and evaluators include the following:

1. Students exhibit markedly improved attention to the task before them.
2. There is much less unproductive and disruptive behavior.
3. A feeling of calmness, trust, cooperation, and self-confidence pervades the classroom.
4. The teacher has very effective control of the classroom mood.
5. Imaging ability is greatly enhanced.
6. Students and teacher are much more in touch with their emotions.
7. Self-confidence and being in touch with emotions enables development of self regulation.

8. Students quickly learn to regulate their behavior, relieving the teacher of "warden" duties so that more time can be devoted to teaching.
9. As shown by test scores and other student accomplishments, cognitive and affective learning are enhanced.
10. Students and teachers like it.

The "Acid" Test

While there is little doubt about the value of research for providing initial indications of promising routes, traveling the route remains the only reliable assessment. Binaurally phased sound has been used at Tacoma Community College since 1978 in art, philosophy, psychology, speech, creative writing, and foreign languages with great success. Since 1983 it has been used in numerous schools in the United States and Canada with equal success. The U. S. Army is currently using it in a foreign language program and is conducting a year-long evaluation before adopting it on a widespread basis.

Cost of Equipping a Classroom [circa 1985]

The sound patterns are produced by a specially-designed "Binaural Phaser" (patent applied for). Its cost is \$450. The proper kind of music is vital, and although such music is available through some retail outlets, the tapes are usually twenty to thirty minutes per side, requiring frequent changing by the teacher. Tapes with forty-five minutes per side of specially composed music are available from Western Educational Systems for \$10.00 per cassette. If the school already has a good stereo tape deck and speakers, nothing more is needed; if not, tape deck and speakers may be purchased locally or from Western Educational Systems [disbanded] (\$200 for a good quality tape deck and speakers designed expressly for classroom use). Thus the cost of the Binaural Phaser, tape deck, speakers, and five tapes (the minimum needed to avoid undue repetition) is \$700. All of the electronic/electrical components carry a standard one year warranty.

Teacher Training

To ensure proper use of this learning enhancement method, Western Educational Systems [disbanded] will not sell Binaural Phasers to any school until the teachers who will use them have received training in their proper use. This is accomplished in a one-day workshop consisting of through explanations of the theory, operation of the Binaural Phaser, and how to apply the method effectively to a variety of commonly encountered classroom situations. Workshops are led by two representatives of Western Educational Systems [disbanded], both of whom are expert at using the method and at presenting it to others. The cost of a workshop is \$500 plus transportation and lodging, regardless of the number of teachers and administrators attending (maximum sixty).

Western Educational Systems [disbanded] 3734 71st West. Tacoma, Washington 98466 (206) 564-3937 (206) 564-7479

Initial Précis of 1984-85 EEG Experiments with Binaurally Phased Audio Stimuli*

Selected papers on using hemi-sync and binaural phasing to facilitate learning, individually & in classrooms - 21

1. Every subject exhibited a statistically significant increase in hemispheric synchronization when binaurally phased patterns were used.
2. Music alone did not produce a significant increase in hemispheric synchronization.
3. For one group of subjects, all eighty EEG recordings showed at least a 300% greater increase in amplitude of theta brain waves than delta, alpha, or beta brain waves. (The only binaurally phased stimulus used was a 4.0 Hz. beat frequency.)
4. Masking the binaurally phased sound increased both theta amplitude and hemispheric synchronization an average of 40%.
5. The 4.0 Hz. stimulus resulted in maximum mean amplitude in the delta-theta range. Beta was consistently 200-300% lower than delta-theta in amplitude. (Note that 4.0 Hz. is the border between theta and delta #, thus one would expect a 4.0 Hz. entraining stimulus to affect both ranges.)
6. Of the carrier frequencies tested (150, 300, and 500 Hz.), 300 Hz. produced the greatest increase in theta output (28.65%). However, masking a 150 Hz. carrier with pink sound resulted in a 32.37% increase in theta output, so it appears that the use of masking is more important than choice of carrier frequency.

Experiments to determine the relative efficacy of stimulus delivery media (earphones and speakers) are currently under way.

* With completion of a co-variant analysis in early 1986, more conclusions will be justified.

Since these experiments were designed to facilitate work in the field of education, rather than in electroencephalography, neurophysiology, and the like, the old four-range classification of brain wave frequencies was used (0.5 - 4.0 Hz., delta; 4.0 - 8.0 Hz., theta, etc.).

COMMENTS ABOUT USING HEMI-SYNC IN CLASS

INSTRUCTOR COMMENTS

August 24, 1985

Dear Devon,

After my experience with the Synchronizer in the classroom this summer, I wanted to share a few observations with you.

In a University of Puget Sound course for public school teachers, attended by 26 teachers, one counselor and one principal, I used a synchronizer and was pleased with the results, to say the least. This is the second summer I have taught this course, and results were consistent, as you will have seen from the comments written by the students from the second course. The students the first summer said similar things in our discussion the last day of class. Typically, these students said things like, "I've been here all day and it feels like it's been an hour." In other summer courses I have attended or taught I have heard students say the opposite: "It is only 10 A.M. and I feel like I have been here all day."

I can summarize my evaluation of the synchronizer with a simple statement: As a university instructor, I would always choose to use the synchronizer, and would never work without it if I could avoid doing so."

What I observed was:

1. a high level of attention and participation. Students did not drift. They stay involved. I admit I am a great instructor, but I have not seen the steady, consistent degree of involvement when I was not using the machine.
2. Class discussions were active, fun and on track. People stayed involved. Everyone seemed attentive, listening and responding. That is not always the case.
3. Students' energy stayed high, all day. At times in the afternoon on hot days, some seemed sleepy, but they stayed awake and receptive. I was impressed with how well teachers, who were in the middle of summer vacation, handled being in class all day for five days.
4. There was a high level of enjoyment, vitality and pleasure all day. Attitudes and good humor were evident.

I have seen good participation, attention, enjoyment, etc. when teaching before, but there is a subtle difference when the synchronizer is running. I would use it only for my own enjoyment, frankly. I much prefer working with it.

As for my credibility as an observer: I recently learned that during my four years as an instructor at National University, the third largest, accredited university in CA, I was ranked in the top four

instructors by student evaluations -- among hundreds of faculty members. I believe teaching is better with the machine. Many thanks for your contribution.

Hans Heinzerling

STUDENT COMMENTS

July 1985

The following comments were elicited by a University of Puget Sound graduate-level course in classroom management, taught by Hans Heinzerling. The students were teachers and administrators from Kindergarten through high school. Some speak of "the music" but make no mention of Hemi-Sync. This is due to the fact that the Hemi-Sync patterns are completely masked by the music, so it is the music which is noticed...

- ∞ "The music kept me more alert and attentive. This became evident when the music stopped and I felt as though something was wrong."
- ∞ "I loved it! It was soothing and interesting -- not distracting as so much music is. Creates culture."
- ∞ "At first the warm 'first day' and slow music induced not only a calming effect but 'sleep' need. However, later it gave quiet feeling and the time during lecture moved quite rapidly. I plan to see if I can buy the tapes and 'give it a try' in the Fall. To be open to all new approaches is important."
- ∞ "I loved all of it!"
- ∞ "The Hemi-Sync Synthesizer was soothing through the class. Its relaxing effects highly enhanced learning."
- ∞ "Hemi-Sync seemed to work for me. I seemed to concentrate better and here's how I know. Normally, classes seem to drag a little, even if the teacher is organized funny etc. In Hans' class, time seemed to fly by. I am assuming that the music helped me concentrate better, getting me more involved with what was said and as a result time passed quickly."
- ∞ "I felt Hemi-Sync had a positive effect on my learning. I felt much more relaxed than I normally do -- less distracted and mentally alert."
- ∞ "I found the background music to be extremely relaxing. At first, I wondered how the instructor was able to talk over the music without being distracted. As the course went on, I realized that he had been conditioned to do any type of work with the music being played. In turn, I became accustomed to hearing the music and instantly noted the difference when it stopped. Volume fluctuation was adjusted when necessary. In my own teaching, I would probably use this when students were working together in groups or individually on assignments/tasks."
- ∞ "At first it was distracting -- then became very relaxing."

- ∞ "I thought it was irritating."
- ∞ "I enjoyed the music. I was aware of it but found it soothing most of the time." "The music bothered me at times. It helped when the volume was lower."
- ∞ "The first day I could hear it more and was (possibly) annoyed by it. The next day I became used to it and seemed to integrate it into the atmosphere. It seemed that it was repetitious."
- ∞ "Found music soothing but at times longed for a fluctuation which eventually irritated me (I expected fluctuation and never got it)."
- ∞ "The music was very peaceful and relaxing. At the beginning I paid very close attention to it and was aware of it. But as time went on it was soothing and relaxing and was subconsciously relaxing. I would like to introduce this into my classroom next year."
- ∞ "Background music was relaxing and soothing. At times I didn't realize the music was on until the tape ran out and then I missed it. If it helped or hindered my learning this week I don't know."
- ∞ "If the sound effects are strictly sound effects (with no harmony or regular beat) they are effective for aiding concentration. I am a musician, and I found that I wanted to listen to the music more than the lecture."
- ∞ "The music was very enjoyable and useful for myself -- it blocked out the 'many' little noises that often take my attention."

THE FACILITATION OF LEARNING

Suzanne Evans Morris, Ph.D.
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 March 1985

The ability to learn rapidly and efficiently is influenced by the learning environment. Information and the learner do not exist in a vacuum. All aspects of the physical environment create a setting which supports or deters maximal learning. This paper will explore the influence of specific sensory information and the effect of environmental suggestions upon learning. The role of sound and music will be explored in depth. The concept of facilitation will be presented as a model for learning programs. When sensory information and environmental suggestions are coordinated to allow the learner to discover new abilities and knowledge, acceleration of learning occurs. Implications for the education of the child with a developmental disability will be discussed.

Neurological Organization and Learning

Numerous theories of brain function and consciousness have been utilized to explain how we learn (Russell 1979, Kimura 1973, Krippner 1983, Pribram 1971, MacLean 1978). Although a limited and changing understanding of the central nervous system makes a clear picture impossible, current knowledge suggests that both the cortex and subcortex are crucial to learning. The sub-cortex (which processes important aspects of memory, emotion, motivation, and automatic movement patterns) provides an important foundation for the information processing of the cortex. The two hemispheres of the cortex work together with each side contributing a preferential strategy for viewing reality. Our current educational system contributes to an asymmetry of function in information processing by emphasizing predominantly the skills of the linear, analytical, rational left hemisphere. The holistic, simultaneous, visual, metaphoric skills of the right hemisphere are not stressed.

Sensations from hearing, vision, taste, smell, touch, pressure and movement provide the input to the brain which is organized for movement, cognition and learning. The richness of the sensory environment and the interactive experience of the individual with the environment contribute to the growth of intelligence.

As multiple sensory information impinges upon the brain, a finely-tuned filter system comes into play. Sensory input which is pertinent to the learner's inner needs and goals reaches a level of consciousness. Input which is less important or distracting is dampened down centrally. This allows the individual to focus attention and reduces the level of distraction. Children who have been labeled hyperactive are unsuccessful in filtering out irrelevant information. They are pulled from one experience to the next and are unable to maintain the focus of attention needed for successful learning. Attention may be centered in a narrow focus on a carefully defined area or topic. It may also be a broader or more open focus which centers upon a wide area of related ideas or objects. This reflects the two major types of thinking or observing styles seen in the two hemispheres of the brain. A narrow attentional focus is more in keeping with the linear, analytical style of the left hemisphere while an open focus reflects the global, simultaneous style of the right hemisphere.

Suggestion and Learning

The external environment provides a wide range of suggestions (Lozanov 1978, Krippner 1983). The physical setting, input through visual, auditory and tactile systems, the style of the instructor and learning materials, and the specific cultural and linguistic systems involved suggest important aspects of the learning task. For example, a room with soft comfortable chairs and tables, paintings on the walls and soft background music intimates that learning will take place in a relaxed manner. A similar room with hard straight-back chairs facing a large desk and black chalk-board may imply that learning will be more "old-fashioned." This may bring forth associations for the learner which suggest an authoritarian style and strict discipline in the learning process.

The internal environment also creates its own reality. We respond to events in our life as if certain beliefs constituted a universal reality. Each individual operates from a set of beliefs about the nature of learning. These beliefs have developed from early experiences in which we encountered ease or difficulty in learning, from family sayings or proverbs (i.e. "You can't teach an old dog new tricks",

"No pain, no gain", I'm a chip off the old block"), and from expectations (i.e. "I know this will be difficult for you....").

We are constantly surrounded and influenced by the suggestions present in our environment. It is not a question of whether we should be exposed to a multiplicity of suggestions within the learning setting. The exposure is there. Often the term "suggestion" or "suggestibility" is used to imply that the learner is at the mercy of the teacher and the environment ... that a type of hypnotism or brainwashing is occurring. This is not the case. When we consider the tremendous variety of advertising and role-model suggestions provided on television and in popular songs and magazines, we must acknowledge that all persons are not influenced in the same way by the suggestions provided. If they are in line with our basic beliefs, the suggestions may positively influence us. We may be influenced to try out a product or idea as long as it is not in opposition to our beliefs. For example, a commercial for a sugar-coated cereal may influence our buying decisions if we believe that no type of food in moderation is harmful to the body. If we believe that pre-sugared foods are not healthy, the commercial will have little effect on our behavior.

When we are involved in the education of others, we have the choice of how to organize the environment for learning. We may choose to facilitate learning which is easy and efficient or we may choose to convince the learner that the task will be difficult and full of failure. If we do nothing, the physical space and our habitual teaching style still contribute to the learning process, but in a haphazard fashion.

Facilitation of Motor Learning Through Touch and Movement

The word "facilitate" means "to make easy or less difficult" (Webster 1956). In learning it implies the selection of those components which will make learning easier. The major task of the teacher or therapist is to facilitate the process of learning and development. This implies that the educator assumes that learning should be easy and that tools for creating easier learning are available. Since learning is based upon sensory input, it implies that one might organize or choreograph the sensory input to enhance development. This can be done in a manner which suggests ease of learning, increases positive expectations and integrates cortical-subcortical and right-left hemisphere means of processing and retrieving information.

The concept of facilitation is frequently encountered in rehabilitation (Bobath 1964, Feldenkrais 1972, Rywernant 1983). Within this context it refers to a variety of approaches and techniques which elicit an automatic movement or a sensation of unfamiliar movement in response to sensory input (primarily tactile, kinesthetic and vestibular). These automatic motor responses occur at a subcortical level of the central nervous system. As the individual experiences the sensory-motor connection repeatedly and compares the new sensations of the pattern with sensations of habitual movement, new patterns of neurological organization may become established. This enables the response to emerge at a cortical or volitional level of performance. The learning of the new pattern depends upon the inhibition or cessation of abnormal tension and stereotypic movements which limit the individual's potential. As new movement is explored and emerges, the sensory system completes the sensory-motor-sensory cycle by feeding back the pattern and allowing its comparison with alternative movements stored in the brain. The individual may choose which of the optional patterns will be selected for use.

The child who has learned to move against the tension of spasticity or the instability of hypotonia may develop a self-image which includes the information that movement is hard work and full of moments of frustration and failure. If non-facilitatory approaches to movement rehabilitation are used, the child may struggle to achieve developmental milestones. A sense of struggle and efforting will be reinforced. A belief in life as a struggle or helplessness as a means of coping may become reinforced. When the therapist facilitates movement in an easy, effortless manner, the child experiences an ease and pleasure in movement. With repetition and greater interaction with the environment, self-limiting beliefs related to difficulty and helplessness begin to change. This is true primarily if the therapist allows the child to discover the advantages of moving in the new way and contrasts the new way with the more familiar or habitual manner of experiencing the world of movement.

When a child is diagnosed as having a neurological movement disorder, a therapy program for motor learning or re-learning based on principles of brain function and organization may be implemented. This is less likely to occur in programs for cognitive or academic learning. Yet the neurological organization for cognitive learning and motor learning follow many of the same principles. In a treatment program for a child with cerebral palsy a major emphasis is placed upon the development of symmetry in body position and movement. Both sides of the brain become involved in activities which reduce the lopsidedness which the brain damage has created. Both subcortical and cortical activities are included in the program. Movement is taught automatically through facilitation. Conscious awareness of the new pattern follows. This is followed by the ability to initiate the movement at a volitional level. When the new pattern is well-established, it returns to the level of a sub-cortical, automatic pattern which can be initiated at will and integrated with other movement patterns. Therapy for the neurologically impaired child changes the way in which the brain becomes organized for movement. It also changes the way in which the brain is potentially organized for cognitive learning.

In the design of programs for the developmentally disabled child, facilitation through touch and movement has played a primary role in physical rehabilitation. Facilitation through the visual and auditory systems is a newer concept.

Facilitation of Learning Through the Auditory System

The auditory system plays a primary role in early language and cognitive learning. The infant rapidly develops the ability to attend, to localize and to discriminate sounds in the environment. This leads to the discovery of the meaning of sounds and words and development of language as a tool for further learning. When the ability to use hearing efficiently is impaired, the child experiences difficulty in language and verbal cognitive learning. Early amplification of sound and emphasis upon other sensory channels in developing a total communication system have assisted hearing impaired children to develop a language system for learning.

When it malfunctions the auditory system receives attention. However, the possibility of utilizing this sensory channel for non-linguistic facilitation of learning has only recently been explored. The use of background music to enhance learning has been implemented in the study of memory, language learning, creativity, and reading. (Alexander 1982, Gambel et al 1982, Prichard and Taylor

1980, Schuster and Mouzon 1982). Research studies show an increase or enhancement of learning when music is incorporated (Schuster and Mouzon 1982, Isern 1960, Stein et al 1982). The type of background music has varied among studies and may account for conflicting findings. The use of slow Baroque music with a 60-beat-per-minute tempo has been used in numerous studies exploring the effectiveness of Lozanov's Suggestopaedia approach to learning. Schuster and Mouzon (1982) found that students learning vocabulary lists with a background of Baroque music (Handel's Water Music) achieved a 24% higher acquisition score and a 26% higher retention score than students learning the list without music. The corresponding data for a group of students with classical music (Rimsky-Korsakoff's Scheherazade Suite) as a learning background were acquisition 12% and retention 15%.

These slower musical tempos have been of interest to physicians and therapists searching for ways to influence the physiological rhythms of the body. Music influences the rhythms of heartbeat, respiratory rate, and rhythmical movement coordination (Cook 1981, Halpern 1985, Safranek et al 1982). In a sense, one might say that specific rhythms and tempos in music facilitate different body rhythms and coordinations. One may also speculate that music through the auditory system may facilitate learning.

Brain wave patterns change under different stimulus and learning conditions. The brain responds to sound by changing its electrical waveform. Electrical energy of the brain can be measured by the electroencephalograph (EEG). This response to sound becomes an objective measure of subcortical hearing acuity in very young or impaired individuals. At a cortical level, the brain follows or tracks the frequency of sounds presented to the ear (Oster 1973). Changes and differences in the electrical frequencies of the cortex can be monitored as sounds are presented auditorily. When two sound frequencies differing by a small amount are produced, a third sound is created. This is perceived as a pulsing or warbling of the tone. The pulsed tone (called a difference tone or beat-frequency) occurs as portions of the original waveforms amplify or cancel each other out. Patterns and distribution of electrical energy are associated with different types of learning and different states of consciousness.

If carefully selected and programmed sounds are capable of changing the brain's electrical energy patterns, a powerful tool exists for facilitating new experiences. An approach utilizing this concept was developed by Robert Monroe. Research (Monroe 1982, Schul 1982, Edrington 1984b) supports the theory that different frequencies presented to each ear through stereo headphones create a difference tone as the brain puts together the two tones it actually hears. Through EEG monitoring the difference tone is identified by a change in the electrical pattern produced by the brain. For example, frequencies of 200 Hz and 210 Hz produce a difference tone or beat frequency of 10 Hz.

Monitoring of the brain's electricity (EEG) shows that the brain produces the 10 Hz pattern with equal frequency and amplitude of the waveform in both hemispheres. Because of the apparent synchronization of the two halves of the brain occurring with this type of facilitation, Monroe has called this procedure HemiSync (short for Hemispheric Synchronization). It is not known whether the synchronization is achieved through integration of the two sounds subcortically or cortically. Clinical and educational implications of the HemiSync technology are being explored by members of the Professional Division of the Monroe Institute of Applied Sciences (1984). Research to

identify specific physiological measures associated with different states of consciousness induced by Hemi-Sync signals is in progress.

Receptivity for learning is related to specific states of consciousness. Predominant brainwave patterns are associated with different states of consciousness or awareness (Bruya 1984, Budzynski 1981, Funderburk 1977, Furman 1978, Goldberg 1983, Rama et al 1976). For example beta frequencies ranging from 13-26 Hz are associated with concentration, and alert problem solving; alpha frequencies (8-13 Hz) occur when the eyes are closed and a state of alert relaxation is present; theta (4-7 Hz) is associated with deep relaxation with a high receptivity for new experiences and learning; delta (1-3 Hz) occurs during sleep. Budzynski (1981) has described the theta state as a transition zone between wakefulness and sleep in which one can absorb new information in an uncritical, non-analytical fashion. He speculated that this allows new information to be considered by the right hemisphere through bypassing the critical filters of the left hemisphere. Thus, information leading to a change in self-concept would become more available; modification of habitual behaviors or consideration of one's belief system could occur more easily if alternatives were presented during a period of theta activity. The duration of the theta transition period is relatively short, a period of 1-10 seconds as the individual drifts into sleep. It may also occur with disciplined meditative states (Funderburk 1977) as a state of reverie with strongly enhanced Imagery.

Edrington (1984b) reported the results of preliminary studies in which Hemi-Sync tones carrying a narrow-band theta signal were mixed with music and presented under earphones to adult subjects. Monitoring of the EEG waveforms showed an increase in the frequency of occurrence of theta signals from both hemispheres. An increase in the amplitude of the theta signal was also evident. These patterns were not present when the subject was presented only with music. A pilot study exploring the utilization of Hemi-Sync as a background for classroom learning was completed in 1984 (Edrington 1984b). A mixture of music and Hemi-Sync signals (delta, theta and beta waveforms) was presented through stereo speakers in 24 selected classrooms in western Washington state. Teachers reported that students were more focused in attention, more enthusiastic about learning and able to learn more material in a given period of time. It was also reported that when the music + Hemi-Sync background was faded out, students were able to achieve the same focused attention for learning. It appeared that as the student was allowed to experience a quieter, more focused approach to learning that this alternative was selected more frequently when the learning signals were not present. The experience of utilizing the HemiSync signals as "training wheels" to explore a new way of being or of experiencing reality is basic to the concepts of the Monroe Institute's Gateway Program (a week-long experiential program designed to allow the Individual to explore inner states of awareness through concentrated experience with Hemi-Sync tapes). Participants find within a 3-day period that they are able to recreate the same inner sensations and experiences independently of the taped signals. The experience of inner control of brain waves and other physiological responses is also characteristic of biofeedback (Brown 1980).

The introduction of theta signals (via Hemi-Sync) into the learning environment theoretically allows for a broader and deeper processing of the information provided by the teacher. The learner is less likely to insert selective filters which mask portions of the information. A key factor in the maximizing of learning potential is the strong inner belief that one is capable of unlimited learning (Lozanov 1978, Barzakov 1984). It is conceivable that the Hemi-Sync environment increases the

probability that the filters of personal limitation will be less active, and the learner will discover a new Joy and success In learning that had not been previously recognized.

A state of hemispheric synchronization or coherence has been documented in a state of deep meditation (Banquet 1973, Funderburk 1977, Goldberg 1983). It is associated with profound physical relaxation combined with clear mental alertness. The deep physical relaxation occurring in a state of intense mental clarity combines a coherent activation of subcortical and cortical portions of the brain. This coherent state may also be characteristic of the "aha phenomenon" and of peak experiences occurring in expanded states of awareness. Increases in imagery and intuitive knowledge are also associated with this condition. This physiological and psychological state can be mimicked or replicated using the Hemi-Sync technology, allowing the individual to experience states of consciousness which are available for new insights and understandings.

The experiences in classroom learning and control of states of consciousness are similar to the facilitation model described for motor learning. The individual is exposed to sensory input which alters the typical way of experiencing the self and reality. A way of learning without efforting and experiencing frequent failure is introduced. As the new response becomes more familiar, it is easier to return to the neurological organization which evokes it. The pattern can be volitional repeated. The new experience may then be selected as part of the repertoire for learning, perceiving, or moving. Facilitation techniques become a means of presenting new alternatives to the central nervous system and the mind. The final selection is up to the individual.

Facilitation of Learning in the Child with a Developmental Disability

The actualization of the learning potential-of a child with a developmental disability (i.e. cerebral palsy, developmental delay, mental retardation, seizure disorder) is limited by the expectations and beliefs of parents and professionals. Diagnosis of a disability is traumatic for the family of an infant or young child. Professionals often focus upon the difficulties which the child will experience in learning and movement. The fear of creating unrealistic positive expectations motivates many therapists and physicians to push for parental acceptance of the child's limitations. This is frequently presented as a form of realism to prevent parental denial of the problem. There is a sense that it is better for parents to expect little of the child and be pleasantly surprised if performance is better than predicted. This reflects a caution on the part of professionals and a fear of erring on the side of disappointing the family later if the child shows greater limitations than originally foreseen.

Each landmark of normalcy is searched for and amplified as the family passes through the process of mourning for the lost dream of a normal child. Professional statements of future limitation may be temporarily ignored while confronting the differences shown by their infant. As delays or differences become more apparent, the infant may be pushed to produce hoped-for milestones for which he is not ready. The infant may exert effort to please important adults or develop a sense of personal failure when effort falls to achieve the desired result. Some families find it easier to give up hope and accept the professional edict of limitation; this provides protection from further disappointment as the infant develops. In both cases the child is unable to develop the knowledge of being loved and accepted unconditionally by the family. Negative fears and beliefs can create barriers to the development of the child's full learning capacity.

Studies of elementary school children show that students progress in classroom learning in harmony with the expectations of their teachers. When a teacher was informed that a child of normal intelligence was mentally slow, the child made limited progress in learning and responded as a limited child. When the same child was exposed to a teacher who was told she was gifted, a greater than normal amount of learning took place (Rosenthal and Jacobson 1968). In a legendary study (Rosenthal 1974) a litter of rats was bred for a high level of homogeneity. The litter was divided into two groups for a maze learning study. Group A was described as a group bred for maze-running intelligence; Group B was described as coming from a long line of slow-learning rats. Under identical learning situations, Group A learned rapidly; Group B completed the task in a delayed manner. The uncontrolled variable was the mental set or expectation of the psychologist taking the rats through the maze.

The suggestions provided by the environment to the developmentally disabled infant and child encourage the adoption of a belief system of limitations. Personal experience with movement and early cognitive learning may reinforce an attitude that life is difficult. The ability to tap the child's true potential and accelerate learning is reduced when experience is filtered through a belief in limits.

The design of an optimum learning environment for the child must include a sense of expectancy a sense of excitement and anticipation that something wonderful will occur or be discovered. This differs from the usual atmosphere of expectation which occurs in most learning situations. Expectations are goal-oriented and the focus is placed upon the end product. Expectancy is goal free. One takes a path moving in the desired direction. The final goal is not clearly defined. The general direction may lead to a wide variety of skills and knowledge. The process becomes the focus of treatment. The anticipation that the journey will be pleasant and adventurous allows for unexpected discoveries and learnings along the way. The teacher or therapist becomes free to enjoy the child and the mutual discoveries about the world.

When facilitation techniques are incorporated into the session, the child discovers options. Facilitation of new reactions and sensory-motor behaviors expands the realm of possibilities. It allows the child to discover new ways of being. When this process is combined with an environment which constantly suggests that the child can learn, can communicate clearly, and can move with greater coordination and skill, the child begins to believe that these new patterns are possible.

Positive suggestions are carried by many features of the sensory environment. (Lozanov 1978, Barzakov 1984, Prichard and Taylor 1980). The physical environment of a hospital or clinic suggests illness or impairment to the child and family. A therapy room or classroom which is home-like rather than institution-like allows for the concept of learning and wholeness. Therapy space which includes rooms similar to those found in the child's home suggests that what is being discovered or learned can be used at home. Isolated space within a school or clinic suggests that what is learned has little to do with everyday life. The positive effects of a physical environment can also be enhanced through the use of art, color, music, flowers, and natural light.

The therapist or teacher provides numerous indirect suggestions to the child through the rhythm and intonation of the voice and through a sense of authenticity. Children are attuned to the nonverbal

communication of adults. Facial expression, body movement, and vocal tones carry clear messages of the adult's feelings and intent. As language skills develop, the child becomes aware of discrepancies between what is said and what is believed and felt. Lozanov (1978) speaks of the importance of the dual plane of interaction. Suggestions become more effective when the teacher's statements are in harmony with what she actually believes. A sense of authenticity, love and concern carries a very strong message to the learner about the teacher's belief that changes will occur.

A childlike state of openness, receptivity, acceptance, playfulness and exploration enhances the learning experience for both the child and teacher. As in early childhood, the learning of a new skill becomes a theme with multiple variations. The infant and young child explores and creates hundreds of modifications of a single concept or movement. This weaving and reweaving of the same ideas and patterns is characteristic of a positive learning environment. Learning becomes rich through interconnections with past experience and knowledge and new connections with future skills.

For many children and families the provision of an environment rich in positive suggestions creates an adequate foundation for learning. For others the needs are more complex. The deep inner beliefs of the individual (mental set) can create selective filters which do not allow the positive suggestions for learning to be believed and integrated. One does not work directly for a change in the mental set, for logical arguments presenting another view will be rejected and the current view may become stronger. Non-judgmental -questions may be incorporated by a skilled therapist to stimulate awareness of belief systems and the possibility of discarding those that are no longer useful (Kaufman 1981). However, Barzakov (1984) has observed that shifts in the mental set will occur when physiological and psychological stimuli are orchestrated in a relaxed and unpressured fashion. Many of the techniques incorporated into the Optimal Learning Program of the Barzak Institute stimulate the information processing styles of the right hemisphere and the limbic system. The use of music, guided Imagery, art and drama bypass the more critical mode of the left hemisphere and engage the individual in a relaxed, receptive state of mind. As the individual is guided into experiencing an acceleration in learning, the mind set of personal limitations often changes.

A non-verbal approach to the development of a positive mind set is used with the young child. A set of new or unfamiliar experiences is created in an atmosphere of warm anticipation. Techniques which facilitate new movement or cognitive patterns allow the child to repeat something which has been experienced. There is no longer a search for an unfamiliar pattern in a sea of effort and uncertainty. Patterns can be matched and compared within the same sensory system, rather than across modalities. The child who experiences the inner sensations of mouth closure as righting reactions are facilitated for head control will find it much easier to repeat the closing movement. It will be more difficult if the learning must take place by following verbal instructions or imitating the visual pattern in a mirror. Facilitation techniques utilizing tactile and vestibular input to guide movement are familiar to most therapists and will not be discussed in this paper. The parallel features of auditory facilitation need to be explored in greater depth.

Music can be a highly effective facilitator of improved physical movement, communication and language skills for the child with a developmental disability. Staum (1983) showed that a steady rhythm and appropriate musical tempo increased the control of a rhythmic gait in walking in a

group of patients with cerebral palsy, hemiplegia, arthritis and scoliosis. Background music decreased the amount of muscle tension In an electromyographic biofeedback assisted relaxation task for a group of spastic cerebral palsied adults (Scartellf, 1982). The research of Safranek et al (1982) on the effect of an auditory rhythm on EMG measures of muscle activity supports the idea that specific auditory input has a direct influence on the neurological control of movement. They found that the muscle firing became more regular with a regular auditory beat and more irregular with an irregular beat. A greater degree of co-contraction of the agonist and antagonist muscles occurred when an auditory rhythm was provided. The anapestic beat (da da DA) found in much rock music reduced the strength of the deltoid muscle in adult subjects from 40 lbs to 15 lbs (Diamond 1979). Music has also been explored as a therapeutic means of reducing hyperactivity (Scott 1970), increasing body awareness, communication and overall development (Knill 1983), and increasing the use of speech and communication skills (Seybold 1971, Saperston 1973, Hollander and Juhrs 1974, Michel and May 1974, Band 1980)

Within the therapy setting music can be appropriately selected to facilitate movement and communication (Morris 1985). Rhythmical folk music with a clear beat can become the interactive focus for the child and therapist during facilitation of movement. The rhythm of the music can provide additional facilitation of sustained muscle contraction and rhythmical movement. Vocalization can be increased as the child sings-along. Music with a one-beat-per-second tempo is quieting and calming to both the child and the therapist. Children who experience difficulty filtering out extraneous sensory input appear to deal with sensory information more appropriately as slower Baroque music is played in the background (Morris 1983, Morris 1985). When quiet music is played at a mealtime, the child with a feeding disorder is often able to eat with better coordination. The sucking rhythm is approximately one suck-swallow per second. Music with a similar tempo and a regular rhythm can be combined with rhythmical rocking and stroking of the tongue. With the addition of auditory and vestibular facilitation, the Infant with a poor sucking reflex frequently begins to suck rhythmically (Morris 1982).

The addition of Hemi-Sync signals to the background music increases the child's focus of attention and creates a mental set of open receptivity. Positive feedback and suggestions about ease and success of learning are provided while the child is in a focused state and is more accepting of new possibilities. The use of Hemi-Sync in the therapy-learning environment of the young physically handicapped child is being explored. Clinical observations Indicate that the use of Hemi-Sync music contributes to a positive learning environment for both the child and therapist. The following examples illustrate the types of changes which were observed during a period where Hemi-Sync tapes were used for 1-2 hours per week. Baseline observation periods of responses without background auditory Input, and with a music background were used for comparison. Other treatment techniques were unchanged as Hemi-Sync was added to the program.

A four-year-old boy with ataxic cerebral palsy and severe mental retardation initially showed severe distractibility, irregular breathing patterns and breath-holding when moving or eating. He had learned to move into a crawling position on his hands and knees but was unable to crawl more than 2-3 feet. Touch to his body or sounds in the room were so distracting that his attention was immediately diverted, and he fell over. His initial response to Hemi-Sync music was highly variable. During some sessions he was physically calm and attention and coordination improved. In other sessions there appeared to be no effect. Change was initially noted in a regularization of the

breathing patterns. Breathe-holding episodes occurred less frequently and a deeper, more regular pattern emerged. During periods of quieter breathing, his attention was focused and he was able to listen and accept touch to his body without wiggling and grabbing the therapist's hand. During this period he began to crawl throughout his home. He was able to remember the location of favorite rooms and began to explore cupboards and drawers. This was primarily related to a more focused attention span and a reduction in tactile hypersensitivity.

An 11-month-old boy with cerebral palsy showed severe disorganization of his response to sensory input. Because of difficulty filtering out unwanted sensory information, he began to withdraw from a confusing, overwhelming world. He flapped his hands, rocked back and forth and used poor eye contact with adults caring for him. These autistic-like behaviors occurred primarily when he was over stimulated. Baroque music with a 60 beat-per minute tempo was initially introduced into the program. He was greatly calmed by the music and the rocking and flapping behaviors were absent or reduced with this type of music background. Music with a faster tempo or a poorly defined rhythm increased his disorganization and exaggerated his hyperactivity, rocking, squealing and hysterical laughing. Although the slow, rhythmical music improved his ability to learn during therapy sessions, there was little carryover into situations without the music. After 5 months of treatment with the music background, Hemi-Sync music was introduced. His ability to tolerate touch to the head, face and mouth improved, and he was calmer and more focused during treatment sessions. Major gains were made in eye contact, socialization and language skills. At 22 months his responses continue to be qualitatively better during Hemi-Sync treatment sessions. He is consistently able to maintain an appropriate control of attention and learning without the assistance of special auditory input. The periods of self-stimulation and withdrawal occur with less frequency and are reduced in intensity and duration. They are seen primarily when he is in a highly over stimulating environment, is fatigued or frustrated.

A 20-month-old boy with cerebral palsy and multiple congenital anomalies was seen for treatment of a feeding disorder. Because of severe sucking and swallowing problems he had been fed by tube-feedings since early infancy. Attempts to give him some food by mouth were unsuccessful. He cried, spit out food, gagged and choked. When therapy was initiated, he was willing to put a few toys and his fingers into his mouth. He was a discouraged, fearful child whose experience with food had been negative and threatening. He was determined that no food or liquid would approach the mouth. He did not like to be physically handled, and often cried when picked up and held by the therapist. Slow baroque music was calming and contributed to a learning environment of playful exploration. He began to accept a pacifier in his mouth and joined in spitting and sound-making games. Although improvement in sucking coordination was observed, he continued to refuse any substance that tasted like food. Hemi-Sync music was introduced into the therapy program after four months of treatment. Positive statements about his ability to taste some juice or pureed fruit were made as small amounts of food and liquid were introduced into the play. Although his initial resistance was high, he became more open and accepting toward the end of the treatment period. The greater willingness to accept taste was not present during sessions which did not include Hemi-Sync. After 5 months of weekly therapy with the Hemi-Sync background, he is accepting small amounts of a wide variety of foods. He is enjoying tastes and accepts some food at home. The sucking response is stronger and his ability to swallow his own saliva and small amounts of food and liquid has improved. The inclusion of Hemi-Sync in an encouraging, playful learning

environment has removed many of the fearful barriers and allowed him to discover his growing abilities to eat by mouth.

The introduction of Hemi-Sync signals into the therapy environment must be done with care and with close observation of the child's nonverbal signals. Several children have been seen who responded negatively to Hemi-Sync. One Infant cried each time a tape with the Hemi-Sync signals was used. An older boy became more hyperactive with the Hemi-Sync tapes. Both were calmed and became better organized when slow Baroque music was used as a background to the therapy session. Each child is unique. Clinical generalizations are difficult to make with the limited data available at this time. For example, although two children with sensory organizing difficulties responded poorly to the tapes, a third child whose clinical behaviors were similar, responded positively and made major gains in reducing seizures, improving her focus of attention, and developing some basic communication skills when Hemi-Sync tapes were included in her program (Morris 1983).

The tapes become more effective with repetition. The brain appears to recognize the signals and actively assists in creating a calm focused attention. Eventually the new response becomes habitual and can be used by the child when Hemi-Sync is not present. Responses to the tapes have varied somewhat from day to day, indicating that a state of physiological and psychological readiness may be major factors in their effectiveness as facilitators of learning.

The prospect of deliberately creating a learning environment which can enhance the potential of the developmentally disabled child is exciting. A milieu of expectancy and positive suggestions for easy, enjoyable learning can reduce the barriers of effort and failure which limit progress. The auditory facilitation of new patterns of relaxation, focused attention and improved sensory organization through music and Hemi-Sync adds a new dimension to education.

Summary

The following observations and concepts have been presented. Their review will facilitate the incorporation of these ideas into treatment programs for the child with a developmental disability.

1. The ability to learn rapidly and efficiently is enhanced by a positive mental set for learning and by organizing sensory input in a manner which facilitates neurological organization.
2. The brain is capable of processing information in a wide variety of ways. Learning approaches which are compatible with brain organization present material in a fashion which engages the full capacity of the brain. A teaching session would offer opportunities to deal with information verbally, linearly and sequentially. The same information would also be presented in a visual or simultaneous fashion, enabling a more holistic process to occur. The linkage between rational and emotional capacities is engaged through role-playing, guided imagery and music. Both logical and intuitive approaches are respected in the whole-brain learning environment.
3. The environment provides a constant barrage of suggestions which guide the learner in developing a mind set for learning. These influence the way in which information is processed and unconsciously set limits (or limitlessness) for what the individual may achieve. The

majority of suggestions in our western culture are negative, proposing that learning involves effort and a painful struggle to succeed.

4. The concept of facilitation can be applied to all learning situations. It implies that approaches will be used which make learning easier or less difficult. Facilitation is familiar to therapists working with the motor learning of Individuals with neurological disorders. The repeated elicitation of a new motor pattern allows new learning to occur without stress and efforting against abnormal movement patterns. This concept should become the basis of all educational programs.
5. Facilitation of learning can occur as a result of organizing the sensory input in a way which automatically elicits a new response from the learner. As the learner experiences the new motor or cognitive pattern, a contrast with the more familiar or habitual pattern is developed. The learner is then free to select the new pattern and incorporate it into daily living.
6. Touch and movement have been the primary sensory modalities used in the facilitation of motor learning. Through the repetition of organized sensory input the brain creates a new movement pattern which can later be repeated at will.
7. Facilitation of motor and cognitive learning also occurs through the auditory system. Music has provided the primary source of organized non-linguistic information used to facilitate learning. Specific rhythms and tempos have facilitated changes in respiration, heartbeat, sucking and walking rhythms, muscle contraction, vocabulary learning and creativity. The structure of the sensory input guides the nervous system into a new pattern of organization. With repetition and awareness of the contrast between new and old responses, the individual may choose to recreate the learned pattern without a musical stimulus.
8. A similar auditory facilitation of learning is provided by the Hemi-Sync signals developed by Robert Monroe. Changes in the electrical pattern of the brain can be facilitated through the creation of beat frequencies which represent the difference between two tones presented separately to each ear. When the difference between the original frequencies is small (i.e. between 1 and 25 Hz), the brain can be guided into producing electrical patterns which are characteristic of known states of consciousness. The physiological and psychological correlates of these states of awareness accompany the electrical changes in the brain cortex.
9. The presence of theta patterns (4-7 Hz) in the brain has been associated with states of increased receptivity for learning and reduced filtering of information by the left hemisphere. This state of awareness is available for relatively brief periods as the individual enters a state of reverie prior to falling asleep. Hemi-Sync signals, however, can facilitate a prolonged state of theta to produce a relaxed receptivity for learning. When beta signals (14-26 Hz) are added to the theta, a state of alert concentration is produced.
10. Hemi-Sync signals create a state of coherence in the brain. Right and left hemispheres as well as subcortical areas become activated in harmony, reflected by equal frequency and amplitude of EEG patterns from both hemispheres. This creates an internal physiological environment for learning which involves the whole brain. The linear, sequential style of logical problem solving

preferred by the left hemisphere is brought into balance with the global, intuitive style of the right hemisphere and limbic system (subcortex). This allows the learner to have greater access to internal and external knowledge and provides a milieu for expanded intuition in problem solving.

11. One of the by-products of hemispheric synchronization appears to be a highly focused state of attending. The ability to reduce "mind chatter" and focus the attention is critical for efficient learning.
12. Hemi-Sync and other approaches to facilitation create a experience of success and a reduction of the self-imposed barriers to efficient learning. When the learner repeatedly experiences new responses and discovers learning occurring rapidly and with minimal effort, limiting views of personal abilities and potential are questioned or discarded. As the individual affirms personal power and potential in learning, learning increases.
13. Because the child with a developmental disability often receives negative suggestions about learning, he is often at a disadvantage. In addition, the youngster makes early discoveries which may provide added data that learning is effortful and difficult. The beliefs or mind set of the child, family and therapist/educator may limit the ability to tap the child's full potential..
14. The learning environment of the handicapped child should include a sense of expectancy and discovery. Facilitation techniques can enable the child to explore and discover hidden abilities and develop a belief in possibilities and success. The addition of auditory facilitation through music and Hemi-Sync can allow the child to experience more efficient sensory integration, movement and attention. The creation of an environment rich in positive suggestions enables the child to discard limiting beliefs. A focus upon the process of learning, rather than the end product, creates a setting in which the child's abilities may blossom.

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Binaural Phaser in a Foreign Language Program

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In current theories of second language acquisition certain hypotheses are advanced concerning the difference between acquisition and learning: there is apparently a natural order in which a second language is acquired that corresponds to acquisition of the first language; conscious "learning" of grammar or structure is basically to serve as a monitor or editor of utterances; we acquire (not learn) a language by constant comprehensible input that pushes a little beyond our current competencies; and finally, there is a major influence of the affective filter in second language acquisition. It is primarily this last hypothesis that is addressed here.

As language teachers we have a common concern, namely: How can we assist our students in focusing attention and lowering the affective filter so that more of the comprehensible input that we so carefully provide will be absorbed?

Stephen Krashen, in his books Principles and Practices in Second Language Acquisition and The Natural Approach: Language Acquisition in the Classroom, has outlined the affective variables that relate to success in second language acquisition. Our students vary with respect to the intensity of their filters but at some level these variables include motivation, attitudes about learning, notions about the difficulty of a language, self-esteem, personal or classroom anxiety, and stress. Although comprehensible input is a primary causative variable in second language acquisition, the affective variables act to impede or facilitate the acquisition process (Krashen, 1982). "The Affective Filter hypothesis implies that our pedagogical goals should not only include providing comprehensible input but creating a situation that encourages a low filter ... the effective teacher is someone who can provide input and help make it comprehensible in a low anxiety situation" (Krashen, 1982, p. 32).

As we strive to be effective teachers, I would like to describe how my colleagues and I are using an electronic aid -- the Binaural Phaser -- to create a relaxed, low anxiety environment for our students. We are using this equipment in a rather unusual setting for second language acquisition, but the concerns and stresses of language students are universal. This setting is the Foreign Language Program at Fort Lewis, Washington, a large Army post in Washington State. Our students are either professional Army linguists (interpreters, interrogators or voice interceptors) who have been trained at the Defense Language Institute and are now trying to maintain their proficiency, or personnel who are just beginning to acquire a second language. For all of our students, trying to find the time for language training causes a great deal of stress. They come to us with fragmented attention because language training is only a part of the myriad military activities in which they are involved. Since we cannot control the quantity of time, our primary concern is to make certain that the time spent in our program is quality time. To that end we have upgraded our texts, installed modern language laboratories, hired excellent native speakers as teachers and implemented an accelerated teaching methodology. The learning environment is very carefully orchestrated with the use of color, music, props, posters, suggestion and relaxation techniques. This

accelerated methodology is eclectic and draws from methods such as the Natural Approach, Suggestopedia, Total Physical Response and the use of the Binaural Phaser.

The Binaural Phaser is a signal generator that produces a sound pattern masked with music. The tones produced by the Binaural Phaser would be quite boring on their own so we use masking music. In some cases the music selections are New Age music and in others Classical. Suggestions for appropriate music will be given when the actual operation of the Binaural Phaser is discussed.

Current EEG studies now going on at Tacoma Community College in Tacoma, Washington, demonstrate that these sound patterns lower or bypass the affective filter inducing a state of consciousness that is highly receptive to learning and new experiences, or in EEG terms, synchronization of the hemispheres in high amplitude Theta. Although it may seem paradoxical, the state of consciousness achieved by this method is characterized by bodily relaxation and mental alertness.

It would be useful at this time to talk briefly about the functions of the right and left hemispheres of the brain. Although when we "divide" brain functions we are speaking rather metaphorically, it is generally accepted that each hemisphere has a particular way of viewing reality or processing information. We characterize the left hemisphere as linear, sequential, analytical and logical. For example, mathematical calculations and language production are considered left brain functions. The right hemisphere is characterized as holistic, intuitive and metaphoric. It is involved with the Gestalt; with pattern recognition. We typically consider aesthetic perceptions, music, and non-verbal communication as right brain functions (Springer/Deutsch).

In all learning situations it would be valuable to utilize both hemispheres fully by providing rich input to both. Unfortunately, our current educational system could be said to cause an asymmetry of function in information processing by emphasizing and rewarding the skills of the linear, sequential left and not stressing the intuitive, creative functions of the right (Morris,). The Binaural Phaser and accelerated methodology we are using provides stimuli which engage the right and left hemispheres simultaneously.

In addition to the issue of synchronization, there is a definite relationship between brain frequencies and states of consciousness. Some background would be apropos here.

In the early 1970's, neurologists studied experienced meditators and yogis who, in a very relaxed bodily state but with great mental alertness, seemed to be able to acquire copious amounts of cognitive information and retain it remarkably well. (Lozanov, the Bulgarian scientist who developed the theory of Suggestopedia, also studied yogis and had similar findings). When these individuals were hooked up to EEG machines it was found that not only were the electrical patterns in each hemisphere of the brain synchronized but they were also found to be in a state of consciousness characterized predominantly by the brain wave known as Theta. A quick review of brain waves will show why this was important.

The advent of the EEG required a categorization of brain wave frequencies. The brain's output seems to have a frequency spectrum from about .5 Hz (Delta) to 40 Hz (Gamma) and there appears to be a correlation between certain states of consciousness and certain frequency ranges. Since most

of us are familiar with the simpler classification ranging from .5 Hz to 26 Hz, I will discuss it here. (Actually Delta and Beta are broken down into two further categories).

For descriptive purposes we can say that:

BETA is the 13-26 Hz band and is associated with a state of consciousness characterized by concentration and problem solving (e.g. doing mathematics; acquiring cognitive information).

ALPHA is the 8-13 Hz band and is associated with a state of relaxation but it is unfocused.

THETA is the 4-8 Hz band and is associated with a state of deep relaxation but it is focused. In this state there is a high receptivity to learning and new experiences.

DELTA is the .5-4 Hz band and is associated with deep sleep. A typical EEG read-out shows all waves present but depending upon the activity being performed, one will predominate.

For many years Alpha was in vogue as the desired state for relaxed learning, but about fifteen years ago Elmer and Alyce Green of the Menninger Foundation discovered that Theta was the optimal learning state (Greens). The predominant brain wave is obviously dependent upon the activity required as well. The Binaural Phaser permits one to select and mix the frequencies depending upon the learning task. This will be discussed more fully at the end of the paper.

How do certain frequencies induce specific states of consciousness? The cause is psychophysical entrainment, which is the central nervous system's resonance with a pattern. From the beginning of time humans have used rhythms or repeated motions, sights, sounds and touches as stimuli to focus attention. Music and dance are indigenous to all cultures. The experienced meditator uses rhythmic breathing or a mantra, for example. Entrainment via any of the senses is possible but audition is clearly the most versatile and easiest to use.

Auditory entrainment by stimuli such as chanting and drumming has been used for thousands of years, but in 1839, H. W. Dove, a German researcher, discovered binaural beats (Oster). Binaural beats are created by sending an auditory signal of a certain frequency to one ear and a signal of a different frequency to the other ear. For example, if the left ear is supplied with a 400 Hz tone and the right with a 404 Hz tone, the brain "hears" or experiences a 4 Hz binaural beat in addition to the carrier tones.

Binaural beats entrain the central nervous system much more effectively than externally produced beats. So in the example just mentioned, the binaural beat stimulus to the central nervous system is 4 Hz, which happens to be in the Theta range. The central nervous system will resonate to the stimulus and Theta will predominate. The use of binaural phasing to induce Theta is significant because it is the "slipperiest" state. Although experienced meditators can maintain Theta for extended periods, ordinarily people are in Theta only while going into sleep (the hypnagogic state) and coming out of sleep (the hypnopompic state). An interesting aside is that these are the periods

recommended by theories such as Suggestopedia for listening to tapes of cognitive information. This is not to be confused with sleep learning.

Thomas Budzynski in his article "Brain Lateralization and Rescripting" described the Theta state as a transitional zone between wakefulness and sleep in which one can absorb new information to be processed by the right hemisphere through bypassing the critical filters of the left (Budzynski).

Research with binaural phasing has been going on at Tacoma Community College since 1978 under the direction of Devon Edrington. Up until 1982, the Binaural Phaser was used with earphones in a very sophisticated listening laboratory to concentrate on four major areas that depend upon focusing attention: enhancement of cognitive learning, enhancement of mental imagery, promotion of creativity and allaying anxiety (e.g. test anxiety).

Teachers in Psychology, Philosophy, Religion, Speech, Art, English and Foreign Languages were and are involved, in using the Binaural Phaser in their classrooms as well as the listening laboratory. As mentioned earlier, EEG studies have been done and are still in progress that graphically show on a computer print-out that hemispheric synchronization is taking place. Readings show that amplitude (the size of the sine wave) and frequency (the number of waves per second) of the brain waves are the same in the left and right hemispheres of the brain when the subject is using the Binaural Phaser with earphones.

In 1982, Jo Dee Owens, a first grade teacher in Tacoma, convinced Mr. Edrington to try the Binaural Phaser with speakers. Connecting thirty first graders to earphones would have been highly impractical and normal classroom activity would have been impossible. The goal of the experiment was to determine whether the same beneficial results could be achieved with speakers. There is no question that the earphones have a much more profound effect but teachers now experimenting with delivery-of the binaurally phased sound patterns via speakers have some extremely positive reports concerning observable behavior as well as the general atmosphere in the classroom.

The Binaural Phaser used with speakers causes the tones to be mixed ambiently and what is heard is a monophonic beat rather than a binaural beat. It is an auditory stimulus heard by both ears (a basic stereo mix) but the entrainment still seems to take place as demonstrated by the behaviors exhibited, i.e. relaxation, focusing, alertness, and concentration depending on the frequency of the beat.

The experience of teachers using speakers with the Binaural Phaser is observation of behaviors and is anecdotal in nature. EEG experiments currently under way at Tacoma Community College will give us hard data as to the efficacy of the Binaural Phaser with speakers. All of us that are using the Binaural Phaser--the Fort Lewis Foreign Language Program, the Tacoma School District, clinicians, criminologists--are keeping close records and learning a great deal. We are refining our ability to identify certain frequencies that cause certain states of consciousness to be manifested.

In our language program at Fort Lewis we see the Binaural Phaser as a tremendous tool for lowering the affective filters of our students. Because it is possible to use the machine both in the classroom and in the language laboratory, we are able to use it in a variety of ways. The Binaural Phaser is used environmentally to create, an atmosphere conducive to study, as a relaxation technique to reduce stress associated with language acquisition, as a method for relieving or

reducing test anxiety, to supplement guided imagery, and as a medium to augment taped cognitive information. The different settings and the features of the Binaural Phaser allow us the flexibility to utilize it in all these applications.

The most important factor in obtaining optimal results is the selection of the appropriate pattern of frequencies. The Binaural Phaser allows the selection of six different beat frequencies, three pure and three combination settings. The choice will depend on the state of consciousness best suited to the intended classroom activity. A description of these settings will demonstrate this point. The six settings are: Delta, Theta, Alpha, Theta/Delta, Theta/Beta, and Theta/Delta/Beta.

Delta produces deep relaxation. It is a well known fact that sustained concentration upon an intellectual task is difficult when a person is in an excited state. Students who have come from any activity involving considerable sensory stimulation have difficulty "settling down" to an intellectual task such as a foreign language lesson. Use of Delta for a few minutes (not more than five) greatly accelerates the calming process which enables the student to begin to focus concentration. The teacher should be alert for signs of drowsiness while this setting is in use, for prolonged exposure will induce sleep.

Besides the Delta setting the combination settings are the ones most often used. The Theta setting and the Theta/Delta setting are used for relaxation, imaging and affective learning. The use of guided imagery is rapidly gaining acceptance in education. Whether the teacher makes a conscious use of imaging techniques or not, there is no doubt about the importance of imaging, particularly visual and auditory, for learning. These settings are appropriate for any period during which students are listening to a story, watching a film, drawing, composing, dealing with spatial relationships, or engaging in any predominantly "right brain" activity. Guided imagery to enhance cultural awareness has proven to be very effective in our language classes. Students can be asked to image a general cultural ambiance of the target country such as sights, sounds, smells, colors or a specific experience such as greeting someone, buying a ticket or ordering in a restaurant. The Theta/Delta setting is particularly useful for facilitating this type of imagery. Mind Sight: Learning Through Imaging (Galyean) has some very useful model scripts for guided imagery as well as excellent breathing patterns.

Optimal cognitive learning is achieved with a relaxed body and an alert mind. The setting Theta/Alpha/Beta-greatly assists attention focusing and cognitive learning by helping learners reach and maintain this state. This is the most frequently used setting since most classroom learning, particularly in secondary and postsecondary education, is cognitive.

Theta/Beta may prove to be the most efficacious setting for those areas of cognitive learning in which visual and auditory imagery is central, as in geometries, music theory, and foreign languages. We find this setting particularly useful for creating an atmosphere conducive to concentration when students are studying independently or when the teacher is conducting a lesson.

Besides the settings for beat frequencies, other features of the Binaural Phaser include an adjustable carrier frequency, level control, balance control and synthetic surf sounds. Finally, the music knob controls the volume of the music that masks the tones of the Binaural Phaser. The music is played on a standard audio cassette deck and fed into the Binaural Phaser which serves as an amplifier. As

mentioned earlier, the type of music that is most appropriate for masking the tones of the Binaural Phaser is either New Age (composers such as Michael Stearns, Brian Eno, Steve Halpern, Kitaro, etc.) and Classical. The Classical selections are specifically the Largo and Adagio movements of the Baroque composers.

Because the music should be in the background and never loud enough to interfere with classroom activities, music to be avoided includes familiar music, music with lyrics, music that compels movement or has sudden changes in amplitude. Generally, any music that demands the attention of the listener should be avoided.

Every learning situation is unique, as is every learner. Thus, the teacher must be sensitive to the situation and select beat frequency settings accordingly. With experience, the teacher will develop patterns of use appropriate to his/her teaching style, the type of student, and the learning situation. The Binaural Phaser is not a panacea but simply a very useful teaching tool that can be extremely valuable in the repertoire of a creative teacher.

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[While no longer available] the Binaural Phaser [used] was from Western Educational Systems, 3734 71st West, Tacoma, Washington, 98466, (206) 564-3937.

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