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How Can Educational Psychology Be Meaningful?

A Review of Jensen, E. (1995) Brain-based learning and teaching

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Arizona State University West

Brain-based Learning and Teaching translates the complex research bases from educational psychology and neurological science into practical classroom applications. We asked three questions as we reviewed this book. First, does the information in this book reflect the known research in a clear and credible manner? Second, how does this book compare with standard textbooks used in typical educational psychology classes and/or special educational methods classes? And third, if we were to choose to use this book, how and where would we integrate it into our curriculum?

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[1]Alphabetical order of authorship indicates that both authors assumed equal responsibility for conceptualizing and writing this review. Requests for reprints should be addressed to Dr. Louette McGraw.

Eric Jensen, M. A., is a teacher who has applied accelerated learning and brain-based learning approaches to classrooms. Brain-based Learning and Teaching contains 23 chapters (with titles such as "Triune Brain Theory Implications," "Getting Attention & Keeping It," and "From Lesson Planning to Learning Planning"). Jensen includes a 28-page bibliography, reference materials, an appendix that cites organizations that focus on brain-based learning, and follow-up resources (such as workshops and seminars).

Jensen's latest book offers research summaries and practical advice for instructional implementation based on reviews of studies that span four decades, with an emphasis on work that has been published since 1980. We noticed that more than 500 references were cited in the bibliography: 88% published since 1980 and 11% published between 1959 and 1979. Readers familiar with brain-based literature will recognize many of the names of the researchers he cites (i.e., Reuven Feuerstein, Howard Gardener, and Georgi Lazanov). We noted, however, that there were not many experimental research articles cited, thus making it difficult to evaluate whether the books cited relied heavily on interpretation as distinguished from experimentation.

In this book, Jensen practices many of the techniques he recommends. For example, he uses mindmaps as "advance organizers" to visually and succinctly preview the content of each chapter. A "check for understanding" is placed at the end of each chapter. On

the other hand, Jensen tends to use lists, a technique for which he finds negative correlations for achievement! Finally, by citing specific resources and readings that can be researched, Jensen makes it possible for curious and more skeptical readers to come to their own conclusions about his knowledge claims.

Perhaps the most intriguing aspects of this book are the sections entitled "What This Means To You." After summarizing what a researcher has discovered, Jensen often enriches the text with a diagram, a table, or a chart to evoke the reader's visual memory. He then ends the section with specific examples that show teachers what they might "do" with this information.

Jensen has provided a valuable service to teachers by translating the often arcane language of educational researchers into a more accessible, conversational language. In doing so, however, it seems to us that some important information is missing. For example, Jensen does not include a critique of the research he summarizes, nor does he summarize how the studies are conducted. With this disclaimer in mind, it is often not possible to fully understand the value of the study being interpreted by Jensen. We are sometimes left with the feeling that the knowledge claims may be a little exaggerated. However, it should be noted that this lack of detailed analysis is found in other educational psychology textbooks, as well.

When comparing Jensen's text with other educational psychology textbooks, we found that Jensen's

chapter headings corresponded well. Most educational psychology textbooks have sections on motivation and learning, cognitive thinking, memory, and so on. The major difference between Jensen's book and standard educational psychology texts is the almost relentless focus on implications for practice. Many of the suggestions to teachers from motivational research, constructivist perspectives, even critical theory are emphasized. Jensen stresses the importance of novelty, emotion, context, choice, personal meaning construction, and the need for an environment free of threat and anxiety.

Some of his conclusions seem to go beyond the research available from educational psychology. For instance his conclusion that extrinsic reward strongly deters intrinsic motivation is not supported by a recent meta-analysis of this literature (Cameron & Pierce, 1994). Another instance of this tendency is the strong recommendation for graphic organizers. The research literature in this area again does not lend itself to such clear cut support for the benefits of maps, webs, and other models. The critical reader must ask the question whether these strong generalizations are warranted from the research evidence and whether these strong generalizations are correct interpretations of the research evidence.

Jensen's strategies for improving learning for students who are under-performing are well supported from many areas of educational research: choice, appropriate challenge, and complexity in assignments; giving

content personal meaning; using stories and metaphors to make content relevant; evoking positive emotions in the learning process; learning content with multiple modes; using diversity and variety in learning to reach students' differing learning styles; and using apprenticeships. We detect a redundancy in many of the chapters where the same implications for practice are made again and again. There is also some ambiguity: calling for group discussion to create meaning, but at the same time saying in chapter one that group learning needs to be minimized. In chapters four and eight different explanations of what attracts the brain can be confusing.

Some ideas that one of the reviewers (Dr. McGraw, an educational psychology professor who is a newcomer to accelerated learning information) found very innovative and supported by personal experience in trying to achieve conceptual change in undergraduate students include the following: suspense, surprise, disequilibrium, uncertainty, and disorder to achieve a richer, more powerful understanding of content. Jensen's suggestion that chaos and confusion may be one of the few ways to naturally trigger new learning seems to be corroborated. Another similarity is the idea that conceptual change cannot occur without the confrontation with our own perceptions, biases, and cultural blinders. It is interesting that this principle of conceptual change comes from two such diverse fields-brain-based pedagogical theory and a critical theory of pedagogy.

In contrast, the other reviewer (Dr. Nevin who

has been using various accelerated learning techniques in her special education methods classes since 1984) uses the technique of inviting students to experiment with the ideas presented in many of the chapters. This viewpoint has been helpful in encouraging special education teacher education candidates to break out of their current (often narrowly defined) paradigms of viewing learners as deficient. The chapter on "lesson learning versus lesson planning" is relevant: most special education lesson planning formats typically focus on what the teacher does.

In conclusion, we both firmly believe this book is valuable reading for teachers at any academic level who want to improve the level of learning for all their students. We agree that Jensen's book would complement the ideas presented in traditional educational psychology textbooks. Indeed, this book could help the novice as well as the veteran make more meaningful sense of educational psychology knowledge. We also look forward to a sequel to this book which might be devoted to stories about lessons in which these principles of learning are used.

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Accelerative Learning and The Emerging Science of Wholeness

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Abstract

As practitioners of the art and science of accelerative learning we are faced with some profound challenges: To be sure that our work is firmly grounded in research, to answer critics in an intelligent and convincing manner, and to continue to explore the edges of potentialities of the human mind and spirit.

In responding to these challenges, we find insights by noting parallels to the "new sciences." Both have roots in the study of the physical universe. Both reveal surprises about that universe and invite us to rethink previous belief systems. Both offer breakthrough suggestions on how we can dramatically expand, not only our learning and creativity, but also our consciousness of the human condition and our place in the universe.

Turning and turning in the widening gyre
The falcon cannot hear the falconer;
Things fall apart; the centre cannot hold.
Mere anachy is loosed upon the world.
The blood-dimmed tide is loosed, and everywhere
The ceremony of innocence is drowned;
The best lack all conviction, while the worst
Are full of passionate intensity.
Surely some revelation is at hand;
Surely the Second Coming is at hand!

"The Second Coming" W.B. Yeats

Accelerative learning experienced birth pangs approximately 30 years ago with the research of Dr. Georgi Lozanov and others. Its evolution through infancy and teenage years, to early adulthood was fraught with difficulties ranging from critics' honest skepticism to political repression to outright rejection among scientists and fanatics alike.

There seems to be greater acceptance now. But in the late 70's and early 80's teachers were taken to court and lost their jobs for practicing *suggestopedia*. They are in good company. Copernicus, Galileo, Darwin, and more recently, Ilya Prigogene, Karl Pribram, David Bohm, and many others share a similar story. But there are many anecdotes of mental turn-arounds; one favorite is that of the early French Academy which officially pronounced that it was patently impossible for such a thing as meteorites to exist--until one fell shortly afterwards and broke most of their windows.

Most people don't readily embrace change; it takes a long time for daring new ideas to gain acceptance with the general public. As we approach the 21st century, however, new paradigms are emerging in virtually every field: education, physics, mathematics, chemistry, biology, and neurophysiology. For the sake of brevity, these areas of study will be referred to as the "new sciences." Their proponents are eminent professionals exhaustively trained in their fields and respected by colleagues for precision and past contributions. However, their current descriptions of the universe are, frankly, revolutionary.

The work of Dr. Lozanov and Dr. Gateva, although carried out in virtual isolation due to the political situation in Bulgaria, parallels that of other "new scientists." Some of the basic shared premises are:

a) All matter is interconnected.

b) Rational, logical approaches to understanding the world are not always sufficient to comprehend its complexities; a global approach is generally more effective.

c) The substrata of information below the level of consciousness plays an infinitely greater role than previously realized.

d) Since the universe is flowing rather than static, some very surprising events can occur which go against our previous notion of logic.

In order to put the above into perspective, let us offer a very brief overview of scientific thought over the

past 300 years. In the West, our inheritance, based on the thinking of Newton and Descartes, is rational, mechanistic, essentially left-brained, and it worked well for us for centuries. In this classical way of viewing the world, all matter, including the brain/mind system, was thought to be comprehensible once it could be broken into composite pieces and analyzed. This system is very clean; it is still responsible for most of our thinking. Unfortunately, it neglects to account for consciousness, for accelerative learning, for many other phenomena reported by scientists and lay people worldwide.

At about the time Dr. Lozanov began his studies into the potential powers of the mind and came up with astounding results, others in a variety of fields were doing the same. And the pejorative descriptions commonly applied to quantum physicians were similar to those applied to suggestopedia: *absurd, impossible, bizarre, beyond belief*. Even Einstein once said that quantum theory reminded him of the "system of an exceedingly intelligent paranoic, concocted of incoherent elements of thought." Are these theoreticians crackpots? Or are they geniuses? If the latter is the case, then "surely a revelation is at hand."

Before we probe into the somewhat mind-boggling theories of people like Prigogene, Pribram, and Sheldrake, let us provide an example of the old and the new paradigms in a more familiar field: education. The world and its ensuing pedagogy, according to Newton, was linear, static, predictable. The world and its ensuing pedagogy, according to our renegade theoreticians, presents a strikingly different picture:

Assumptions of 19th and early 20th century paradigm of education	**Assumptons of the new paradigm of education**
a) Information given in small pieces, presented logically	a) Large amounts of information presented globally
b) Limited expections of students	b) Realization that students can learn 3-5 times faster tha previously believed
c) Emphasis on analytical, left-brain thinking	c) Whole-brain thinking
d) Concern with norms	d) Concern with the individual's performance, stressing limitless potential
e) Classroom designed for efficiency, convenience	e) Emphasis on aesthetics; inclusion of the arts, comfort, breath

Those of us in education can, doubtless, think of many other examples. We know the patterns well. The old assumptions were based on linearity, limited potential, and obeisance to established norms. The new assumptions are based on a belief in the virtually limitless potentials of our minds and our creativity.

Let us observe how similar but even more dramatic changes in consciousness are encouraged by a new paradigm in chemistry. In 1977 Ilya Prigogene won the Nobel Prize for his theory of dissipative structures. Essentially it accounts for leaps to higher levels of complexity that occur throughout the universe. It answers question that has confounded scientists for centuries:

Given the existence of entropy as a fact of living structures, how is it that the universe is not "running down" but in fact continues to create higher patterns and more complex levels of organization? This restructuring, this escaping to a higher order, occurs in fields as diverse as biology, chemistry, pyschology, sociology, and education.

To understand this theory we need to recall that in the patterns of nature nothing is fixed. Everything is composed of particles that are in constant flow. Open systems (like seeds, certain chemical reactions, or the brain) are all dissipative structures; they maintain their form through a constant exchange of energy with the environment. They are highly organized but always in process. The more complex a system, the more it is interconnected in many ways and at many points, and the more vulnerable it is to internal fluctuations. When fluctuations in the energy levels are minimal, the system absorbs them and the basic structure is not affected. But when the fluctuations reach a critical size, they "perturb" the sytem. By increasing the number of new interactions, the pattern breaks up and reorganizes into a new, higher order.

The more complex a system, the more "unstable" it is; that is, the more likely it is that a large perturbation will upset the delicate balance of the system and it will restructure itself into a new order. The brain, of course, is a perfect example of a dissipative structure. It is the ultimate in complexity; it is in a constant state of flow and interaction with the environment; it is characterized

by abrupt shifts and sensitivity to perturbation. Brainwaves reflect fluctuations of energy, and in normal consciousness, beta waves dominate most people's EEG patterns. Psycho-relaxation tends to increase the slower, larger alpha and theta waves. Inward attention, in other words, generates a larger fluctuation in the brain. In a relaxed state, then, fluctuations can reach a critical level, large enough to provoke the shift into a higher level of organization. This is apparently when our students have the "Aha! I got it!" experiences. It is also the state where original, creative, intuitive *knowing* occurs.

What interests us *via a vis* suggestopedia is that learning shifts are often preceded by stress involving excitement, creative tension, even some confusion and anxiety. We know that crisis is essentially another facet of opportunity and that the creative process requires chaos before form emerges, thus a perturbation is essential for a dramatic shift or awakening to occur. This apparent contradiction (relaxation vs. stress) has been somewhat confusing to students of accelerative learning. However, we must keep in mind that only under the right circumstances does a perturbation lead to a new structuring. If the system is too "stable" (read fixed), the new information will not affect it. If there is too much stress, it could lead to a breakdown of the system. The solutions: 1) create a supportive environment as a fabric on which high content material, presented in a highly emotional manner can be safely introduced and 2) keep up a varied rhythm in the classroom, balancing relaxing with high energy activities.

At a Florence, Italy training in 1989 Dr. Lozanov said: "If there is not a huge amount of material being presented, this is not suggestopedia." Does this not sound like Prigogene's dissipative structure (perturbation of the system is required to move to a new level)? The crucial point here is that Prigogene's theory not only helps to explain why suggestopedia is so effective, but it also explains scientifically why suggestopedia is qualitatively different from traditional learning. It cannot be said that accelerative learning is simply doing more of what works, or adding new elements, or increasing the amount of information taken in. *Suggestology is of a different order!* It is the theory of the author that when we have equipment of sufficient power and subtlety to measure it, the brain will actually *look different* when suggestopedia is occurring. There will be more synaptic connections. Blocks, which are now believed to be more than merely ideas, but actually physical, observable dense protein matter, will be circumvented and many other measurable changes will be apparent.

Several new ideas emerged from Ilya Prigogene's transformative work. One is chaos theory which scientists say is more than just another theory. It is fundamentally a new approach to seeing, studying and interpreting the universe with far-reaching implications. It is a mathematical system to help explain non-linear structures, those which appear to be unpredictable and erratic, ie., the weather, clouds, rivers, the stock market, fibrillating hearts, in fact most systems in the universe (Goerner, 1994). Although predictable processes are involved, the outcomes are often unpredictable. But the

remarkable results are beginning to point to a universe that is precisely structured with a deep underlying unity even in areas that have previously appeared chaotic and random. This is the amazing world of fractals and strange attractors, patterns within patterns, and the possibility that it is dynamic relationship with the external world which gives rise to all form. On a purely subjective, mataphoric level, it is interesting to note the similarities between chaos theory and suggestopedia. In both cases there is a carefully ordered underlying plan. On the surface the form may appear to be interesting yet somewhat chaotic. However, when the observers have arrived at the point where they can see how all the pieces fit together, they can apppreciate the beauty of the patterns involved, both in the art of the presentation and in the internal pattern of the materials being presented. In education chaos is often equated with fear. But we need to understand that chaos is natural and necessary. Without it, scientists say, there would be no order, no creativity.

The other element of chaos theory that is relevant to us is the concept that when dealing with nonlinear systems, if you add A and B you get A plus B plus something extra, something unpredictable. The whole is greater than the sum of the parts. Trying to understand the universe by breaking it into bits is rather like trying to comprehend *King Lear* by putting a copy through a shredder and reading each minute fragment in isolation... or trying to teach people to communicate in a new language by analyzing class 3 stem-changes in irregular verbs. Unfortunately, however, in both the

educational and scientific communities it is this reductionist approach that usually still holds the power and the purse.

Let us now move from dissipative structures and chaos theory to another, equally mind-boggling discovery known as Bell's Theorum. It was proposed in 1964 by physicist J.S. Bell and experimentally confirmed in 1972 by Einstein. When the particles of a two-particle system (which are identical twins in polarity) are separated and the polarity of one is changed by an experimenter, the other changes *at the same precise nanosecond.* They remain mysteriously connected. Later experiments found that identical twins separated at birth and unaware of each other's existence displayed uncanny similarities in tastes, personal decisions, life styles and wives! Apparently elements in the universe are connected, bonded, on both micro and macro-cosmic levels. This, too, corroborates Dr. Lozanov's belief in the importance of the suggestive link. Is it posible, perhaps, that when there is an emotional connection between members of a class, that entrainment (breathing, speaking, gesturing in union) might occur? This subtle but deep connection of teacher with students and the students with each other in a suggestopedic class may, indeed, be proven by science to play a much greater role in the efficacy of learning than previously believed.

A fourth area and a crux of quantum physics is the conundrum of wave vs. particle. It seems that not only does the basic *stuff* of existence turn out to be both wave and a particle (seemingly mutually contradictory

states), but that two facts can determine which aspect will reveal itself in a given moment. The first is simply that someone is watching, called the *observer effect*. The second is expectations or intentionality. As teachers we may not be too concerned about wave vs. particle. But look what intentionality can do:

William Tiller, a Stanford University science professor, reported in 1986 the results of an experiment in intention. He created a device that releases electrons when subjected to healing intent. Normally the device would emit a maximum of one burst of electrons every five minutes. When individuals intentionally focused healing energy through their hands more than 50,000 bursts were recorded. When they placed their hands around the device with no healing intention (focusing instead on mathematical calculations) no bursts were recorded. Later, Tiller added visualization, and after thousands of experiments, he concluded that there is an energy beyond the electromagnetic spectrum, emitted by humans, that can activate the release of electrons. This subtle energy, he hypothesized, can transfer infor- mation directed by the mind and focused by intention, attention, imagery, and love.

The fifth and sixth areas from the new sciences will be discussed together, since, combined, they provide insights that are more profound than when studied separately. Physicist David Bohm of the University of London talks about the universe in terms of implicate and explicate levels of reality (Bohm, 1991). Neuroscientist Karl Pribram of Stanford sees the brain as a holo-

gram interpreting a holographic universe (Talbot, 1991). While both of these scientists are highly respected in their fields, the theories they propose are rather abstract, esoteric, difficult to prove. Both men hasten to point out that theirs are working models and, as always in science, they will probably be altered or replaced as new information becomes available. In themeantime, they are thought-provoking and may provide additional insights into how suggestopedia works.

Briefly, the theories are that our brains mathematically construct "concrete" reality by interpreting frequencies from other realms of patterned primary reality that transcend time and space. In a state that Dr. Lozanov calls "vigilance," that relaxed altertness so necessary for accelerated learning to occur, students may actually be accessing the invisible matrix that generates "concrete" reality. This theory could account for all the phenomena that seem to contravene existing scientific "law" by demonstrating that such restrictions are themselves products of our prerceptual constructs. Theoretical physics has already demonstrated that events cannot be described in mechanical terms at subatomic levels. Furthermore, creative thinkers and problem-solvers in fields as diverse as business, psychology, science, art, music, theology, mysticism, poetry, and everyday living have attested to receiving insights from "some other realm." And this has been reported for a long as human history has been recorded.

Holography is a method of lensless photography in which the wave field of light scattered by an object is

recorded on a plate as an interference pattern. Because there is not focusing lens, the plate appears as a meaningless pattern of swirls. However, when the photographic record--the hologram--is placed in a coherent light beam, often a laser, the original wave pattern is regenerated. A three dimensional image appears. *The fascinating fact is that any piece of the hologram will reconstruct the entire image.*

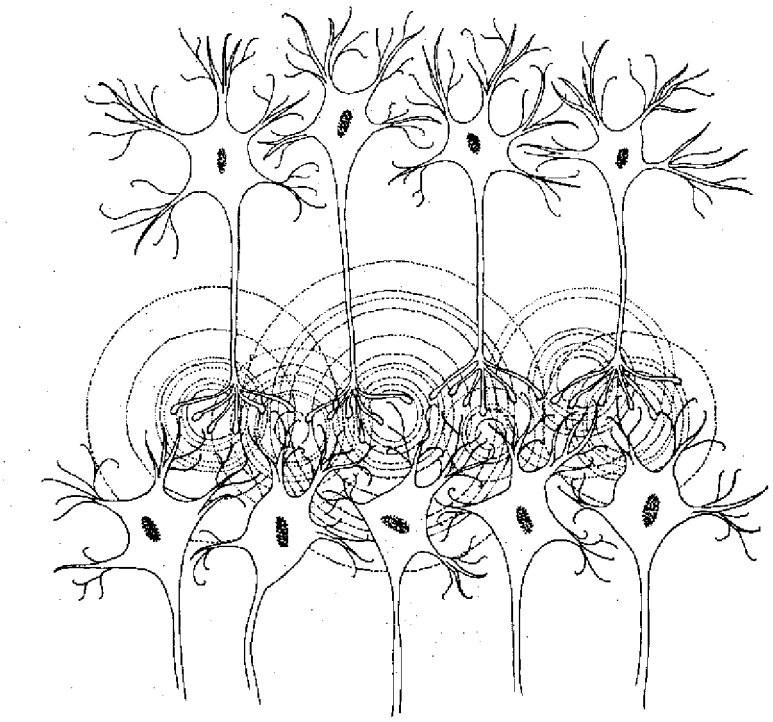
David Bohm says that the hologram is a starting point for a new description of reality: the *enfolded* order. Classical study of reality has focused primarily on secondary manifestations--the *unfolded* aspect of things, not their source. But these appearances are abstracted from an intangible, invisible flux that is not comprised of parts; it is an inseparable interconnectedness.

Bohm, like everyone else we have been discussing here, says that primary physical laws cannot be discovered by a science that attempts to break the world into parts. And Karl Pribram believes that the brain's "deep structure" is essentially holographic, analogous to the concept of holography for which Dennis Gabor won a Nobel Prize (Talbot, 1991.)

If, as it is believed, the brain structures see, hear, taste, smell, and touch by sophisticated mathematical analysis of temporal and spatial frequencies, then these mathematical devices may depend on interactions at the junctions between cells (synapses) via a network of fine fibers on the branching axons. Nerve impulses in this fine-fiber network manifest in slow waves with the

potential to carry out the mathematics. (Other researchers have speculated that the alpha brainwave rhythm may be a timing device necessary for the computation. However, Dr. Lozanov stated at his training in Florence, Italy, 1989, that his research indicates that an alpha state is not a prerequisite for accelerative learning. It may or may not be present and doesn't necessarily affect results.) Pribram has suggested that interference patterns are stored across the membrane of nerve synapses as permanent changes in their electrical sensitivity. In optical holography, literally thousands of holographic images can be recalled separately by illuminating a scene or some aspect of a scene like the one originally stored. In an analogous way, Pribram proposed, the brain-cell snyapses could contain thousands of holographic images. This model could account for the phenomenon of association--how one image or experience or idea recalls another somewhat like it, how perception leads to thought to perception to thought in a stream of consciousness, an unfolding and constant refolding of holographically stored memory.

Please refer to the diagram on the next page from Looking glass univerise, John Briggs & David Peat, 1984.



A fanciful picture of interfering wave fronts of electrical activity in the area of nerve synapses. Pribram believes that very subtle changes in electrical sensitivity in the area of the synapses store the holograms. A virtually iinfinite number of holograms could be stored together in these synapse areas all over the brain. The storage process may involve the constant flowing of electrical activity that takes place between synapses.

Most interestingly, Dr. Lozanov presents a model similar to the one above. The brain constructs are com-

pared to branches of a tree, and we are reminded to present information globally. If we were to diagram a suggestopedic lesson plan on this model, we would fill in the major branches first to give the students an overall picture. Traditionally, however, a teacher would start with the first branch, with all its outshoots, and methodically cover every detail, then review, then make sure, with a test, that students understood, and then finally go on to the next point. With a system that is so incompatible with the way the brain and the world function, it is no wonder that our education systems are less than effective. On the other hand, a presentation that initially touches on the major points, Lozanov tells us, calms the personality because the student can see the whole picture but doesn't have pressure to know and remember everything. Most importantly, neuronic traces are being formed so that the student will eventually fill in the details (the smaller branches), and the new knowledge will more naturally go into long-term memory.

And so we find parallels between the work of Pribram and Lozanov. Both researchers suggest that the hologram and the brain seem to have information distributed thoughout the system., and both suggest that learning will be more efficient when access and recall are handled non-linearly.

One other rather eerie similarity between the findings of brain research and holography is that when one part is missing, another provides the information, although somewhat blurrily. Patients who have had a partial lobotomy surprised researchers with their ability

to produce information or skills that should have been lost, somehow "making up" for that storage area that was destroyed. Similarly, when a piece of a holographic photo is broken off, the whole picture can be seen in that piece, no matter how tiny it may be.

Apparently each fragment of the universe is encoded to produce information on the whole. The English poet William Blake definitely thought this to be true:

> *To See a World in a grain of Sand,*
> *And heaven in a Wild Flower,*
> *Hold Infinity in the palm of your hand.*
> *And Eternity in an Hour.*
>
> William Blake "Auguries of Innocence"
> *English Romantic Poetry and Prose*, 1956

After centuries of mutual mistrust, are we beginning to see the potential for romance among philosophers, poets, and scientists? Perhaps even a marriage, for most literary critics would read the above lines as a metaphor. Pribram, the penultimate scientist, suggests more boldly than the poets have dared that there may be no such thing as metaphor, or, more specifically, that all metaphor is true. *Everything is isomorphic*. (In Hermetic philosophy, "as above, so below".) We may now be experiencing the effects of a social hologram, a pattern of interconnectedness of individuals. And what are the implications for suggestology?

The following are anecdotal, and, therefore, not scientific. However, since we may soon have to rede-

fine what is scientific, and since they fit so well with implicate order and holographic theory, they may be of interest to the reader.

In 20 years of teaching Spanish suggestopedically, the author has observed/experienced the following:

1) Students will occasionally come out with a word or phrase that they swear they have never been exposed to before.

2) The sense of interconnectedness of teacher and class participants appears to be *the most* powerful element in achieving high results.

3) One of the precepts of accelerative learning to which most of our colleagues adhere is "the total result is greater than the sum of the elements that make up a suggestopedic class." But why is this? How, in a mechanical world, is this possible?

Finally, we must visit, albeit briefly, one more "cutting edge" theoretician who rejects reductionist approaches. Rupert Sheldrake's field is biology, and he is the author of the hypothesis of formative causation. Very succinctly, he proposes that the form, development, and behavior of living organisms are shaped and maintained by fields as yet unrecognized by any science (Sheldrake, 1981). These are labeled "morphogenetic fields" and are molded by the form and behavior of past organisms of the same species through direct connections across

both space and time through a process called "morphic resonance." In esence, he is saying that once something is learned by enough members of a species, the chances of other members learning it faster due to access to the morphogenetic field are vastly increased. According to Sheldrake, examples of learning through morphic resonance are the following: parallel inventions, the intuitive knowing of psychomotor skills such as tennis or drawing, the power of legends, myths, stories, and ritual, and the cumulative effect of an idea held by a number of individuals.

The jury is still in session on this one, but should this theory or some variant of it prove true, it would account for several beliefs of suggestology:

1) The concept of 'prestige' (learning something from someone of long-standing respect is likely to be more effective than learning it from just anyone). Is it possible that the prestige factor is also related to the fact that, since many people have learned from this person, or in this way, that a morphic resonance has been formed, and, as time goes on, it is more and more likely that the behaviors will be repeated? For example, the one-minute mile was once considered impossible, but once it was achieved, each succeeding achievement increased the possibility of its happening again. Similarly, it was once considered impossible to learn 3-5 times faster, but each time this is achieved, would it not make it more likely to be repeated in the future?

2) The use of classical music that has been appreciated by millions of people over time has been proven to be more effective than music that was composed yesterday. The same would be true of copies of classical pieces of art hanging in the classroom.

3) As teaching media, myths, stories, symbols, and rituals that have touched many peoples over centuries would affect students more powerfully than a translation of a current movie, for example. If ths is true, then we need to be very careful in writing or selecting our dialogues or other class materials.

As we conclude, we must remind ourselves that the 'new sciences' and suggestology have offered to many people's (but certainly not everyone's) satisfaction viable alternatives to traditional ways of viewing the universe. We find that our renegade thinkers hold many elements in common: a belief in a non-linear, wholistic approach to understanding life, a sense of the interconnected nature of the universe, a rejection of the Newtonian belief that all can be understood through left-brained analysis, and, perhaps, a promise of a new world order. The honest seekers also realize that we have a long way to go and the insights of the past years are simply a beginning, an offer of hope, an invitation for more. As we strive to understand, not only the nature of learning, but the overall plan of the universe, we need to take into account the wisdom of the past, blend it with the knowledge of the present, and figure out a way to weave it with whatever the challenges the future may offer.

THE PAST: *Now I a fourfold vision see,*
And a fourfold vision is given to me;
'Tis fourfold in my surpreme delight
And threefold in soft Beulah's night
And twofold Always. May God us keep
From Single vision and Newton's sleep.
William Blake c. 1802
"With Happiness Stretched Across the Hills"
English Romantic Poetry and Prose, 1956

To Blake, single vision was pure sensation such as scientists (Newton in particular) cultivate. Twofold vision added an intellectual appreciation of the object. Threefold infused the perception with an emotional value, and a fourfold vision crowned it with mystical insight as to its place in the universe.

Beulah, often represented as the moon, symbolizes a state of repose during which the mind is receptive to intellectual and spiritual suggestions.

THE PRESENT: *As a scientist I can say only that human potentials are greater than we know... personally I say they are unlimited*. Dr. Georgi Lozanov

THE FUTURE: As we approach the 21st century one thing is certain: The future is uncertain. Every field which attempts to understand life and the universe is discovering that "things fall apart, the centre cannot hold."

And this is why it is crucial for suggestology to become widespread everywhere that learning occurs.

For trying to understand the subtleties and complexities of the world with our old methods of learning would be like trying to perform high level computations with an abacus.

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Suggestopedia, Biofeedback and the Search for the Alpha State

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Introduction: The Search for Alpha

In the late 1960's and early 1970's, as is well known to JALT readers, a new and unique teaching method called Suggestopedia was developed at the Institute of Suggestology in Sofia, Bulgaria under the direction of Dr. Georgi Lozanov. The suggestopedic language class featured (and, indeed, still features) a relaxation session for unconscious assimilation of the lesson material. The original suggesto-pedic session was divided into two parts, active and passive, with each part comprising twenty minutes, the ideal meditation period in Yoga. During the active part, the teacher presented the appropriate foreign-language words or phrases with three different yogic intonations - declarative, whisper, loud command - while the students looked at the dialogue on the printed page and repeated

to themselves (using inner speech) the appropriate foreign words and phrases. (The Bulgarian translation of each word group was read first - quickly and in a monotone). During the passive or concert part, the teacher read the language dialogue a second time, but now in a soft, persuasive voice over a background of slow movements from baroque concerti grossi while the students, with eyes closed, visualized the text. (The slow movements used in the original concert, excerpted from the chamber music for violin and/or strings of Corelli, Handel, Bach, Vivaldi and Telemann, have, by definition, a rhythm of 60 beats to the minute, the ideal beat for meditation in Indian music). In the two parts of the session, the material was presented rhythmically on an eight-second cycle: two seconds - translation; four seconds - foreign-language phrase; two seconds - pause. The students were trained to breathe deeply and rhythmically in harmony with the teacher's voice and/or the baroque slow movements (Bancroft, 1994). According to its proponents, Suggestopedia contributed to a marked decrease in fatigue and tension, on the one hand, and a marked increase in memorization of language materials, on the other. The relaxation and improved memorization were said to be largely due to the "alpha state" - a state in which the body is relaxed but the mind is alert.

In Suggestology and Outlines of Suggestopedy, particularly in Chapter IV, "Towards a General Theory of Suggestion," Lozanov (1978) includes scattered references to electroencephalographic (or EEG) investigations, as well as pulse and blood pressure

measurements, of subjects under hypnosis, in a state of sleep, in the waking state and when executing yoga exercises. These investigations are linked to research into the subjects' "reserve [or learning] capacities" (p. 179). While details of brain wave research are not always provided, Lozanov gives the results of research conducted at the Institute of Suggestology: "it can be concluded that hypermnesia is not necessarily bound up with strenuous mental bioelectric activity and great strain. Hypermnesia can be achieved in states of concentrative pseudo- passiveness with an increased alpha rhythm" (p. 250).

At the Institute of Suggestology in the 1960's and 1970's, particular attention was paid to EEG (as well as pulse and blood pressure) investigations of suggestopedic students. In contrast to Western researchers, Lozanov investigated the use of "alpha biofeedback" with normal subjects and in an educational setting. In Chapter V of Suggestology and Outlines of Suggestopedy, there is a section entitled: "Suggesto-pedic Instruction and Cerebral Bioelectrical Activity" (pp. 232 ff). Attention at the Institute of Suggestology was focused on EEG analysis of students before the language class commenced, during class and before and after the special session for memorization of language materials. It was found that, following the special relaxation or concert session, alpha waves increased while there was a decrease in beta waves (p. 236). "The strongly marked increase in beta waves and reduction in alpha waves, typical of intensive mental work, were absent in the EEG of students during

suggestopedic instruction in a foreign language. The changes registered were typical of mental work of low intensity [. . .]" (p. 239). In addition, it was found that "the concert state was characterized by the alpha rhythm increasing over its level before classes [began], and the beta rhythm dropping under its initial level" (p. 239). In the Lozanov thesis, alpha is linked to the bringing into play of the students' reserve capacities and to improved memory and concentration. There is no discussion, however, of what causes the increase in alpha during the special session. It is the aim of this paper, through a discussion of biofeedback and brain waves (especially the alpha wave), to show that the original suggestopedic concert contained a number of the essential elements for producing the alpha state - a state considered necessary for improved memory and concentration by modern researchers such as Brian Morrissey (1996).

It seems likely that Georgi Lozanov was aware of research in brain wave biofeedback going on outside Bulgaria in the 1960's and 1970's; he was invited to California in 1971, for example, by Barbara Brown, the author of New Mind, New Body and Stress and the Art of Biofeedback. It is not possible to say with certainty that Lozanov was directly influenced by American research in his "brain wave" investigations; however, one can say that educators and researchers at the Institute of Suggestology in the 1960's and 1970's were in tune with this "modern" area of research: brain wave (and, in particular, alpha) biofeedback.

In the 1960's and 1970's, particularly in the United

States, a great deal of interest was expressed in research into biofeedback - said to be an ideal "drug-free" way of treating human illnesses because it made available information about biological activities to the individual concerned and evoked complex mental processes to change the body's physiological activities and to exert learned control over "involuntary" functions. The number of researchers burgeoned in a few years from less than 10 to more than 2,000 active investigators in the biofeedback field. (Early researchers included: Brown, Green, Mulholland, Kamiya, Budzynski, Murphy, Stoyva). In 1969 the Biofeedback Research Society was formed - renamed in 1976 the Biofeedback Society of America and in 1988 the Association of Applied Psycho-physiology and Biofeedback. Coinciding with movements in "pop" psychology, as well as Transpersonal Psychology, and "holistic" medicine, a social revolution and the "hippy" movement, an increasing interest in Transcendental Meditation and Eastern religions as well as in psychedelic drugs and dream consciousness and a renewed interest in hypnosis, brain wave biofeedback received great attention in the media in the late 1960's and early 1970's. Excitement was generated by the fact that brain-wave impulses, which elude our normal consciousness, are piped through EEG machine electrodes, amplified by delicate circuitry and finally translated into light, sound or some other medium that is accessible to the senses. Biofeedback and the EEG were said to be research strategies for exploring consciousness (or varying states of consciousness). The alpha brain wave, in particular, was linked to an altered state of consciousness - a new

state of mind, one that was stress-free, revelatory of mind/body harmony and in tune with ancient and mystic spirituality.

Articles in Tart's Altered States of Consciousness, which was first published in 1969, included studies of changes in brain functioning during the altered states of consciousness (ASC's) produced by the practice of Zen and Yoga. The adept practitioners of both Zen and Yoga showed almost continuous alpha waves (normally associated with a state of relaxed alertness in ordinary subjects) during meditation. In addition, Kamiya (1972) showed that ordinary subjects (but especially those with an interest in meditation, introspection, sensitivity training, good interpersonal relationships, dreaming, etc.) could be trained, by conventional operant techniques, to produce an EEG pattern similar to that found in meditating Zen monks and yogis, viz., almost continuous alpha rhythm. Coincident with the development of alpha biofeedback was the study of brain electrical activity as related to susceptibility to hypnosis. People with a fair amount of alpha in the EEG were found to be those who were most susceptible to hypnosis. Research studies conducted in the late 1960's reported that high susceptibles (i.e., those individuals who are very suggestible) produced more waking alpha density than nonsusceptibles (De Pascalis, 1989).

Subjects reported the high alpha state as being one of general pleasantness and relaxation. In the popular press, the mood state of a subject was said to

be changed by having the subject “turn on” his/her alpha. Once tuned into him (her) self, almost anyone, it appeared, could learn to identify specific brain wave states and, in short order, learn to control them. The possibility of not only controlling brain wave activity but also that of influencing subjective feelings associated with brain wave activity naturally elicited a wave of enthusiasm among behavioral scientists - not to mention members of the general public. The popularity of brain wave research nurtured a cult of the “alpha high”; the alpha experience was idealized as an intrinsic good. Experts in EEG reported interesting correlations between the state of emotional set and consciousness, on the one hand, and the amount of alpha waves generated by the subject, on the other (Basmajian, 1989, p. 3). Since alpha was said to be a principal brain wave correlate of meditation, there was an enthusiastic popular belief that alpha wave biofeedback was a “shortcut meditation technique” (Brown,1974, p. 326). The potential of biofeedback techniques for regulation and modification of mind and consciousness was said to be “enormous” (Brown, 1977, p. 146).

The original enthusiasm generated by the development of brain wave biofeedback stemmed, in part, from the belief that it might provide a royal road to higher (or even mystical) states of awareness or consciousness. After an initial period of euphoria, however, alpha enhancement training with biofeedback became increasingly controversial. The growing suspicion that something was not quite right with the earlier studies culminated in a flurry of critical analyses.

These were directed both at the methodological inadequacies of the reported studies and their philosophical underpinnings. With respect to the latter, it was charged that much of the work, instead of being directed to a scientific understanding of alpha control, was using alpha enhancement as a pathway toward higher (or mystical) states of consciousness (Yates, 1980, p. 277). The alpha experience was said to be not simply due to alpha enhancement but to such factors as suggestion, expectations, initial bias and experimental setting. As reported in Yates (1980, p. 306), Plotkin stressed particularly the importance of suggestion and expectation in alpha experiments and the similarity of the situation created in many alpha studies to the situation created in sensory-deprivation experiments. Attacks were delivered on the "cult of alpha" and the "alpha culture."

While the "new (exciting) age" of mind/body harmony did not really come into being, alpha biofeedback did not really lead to teaching everyone how to feel happy and serene and biofeedback therapy (described initially as "unprecedented" and "limitless") did not prove to be the universal panacea for which researchers had hoped, biofeedback can make individuals aware that they must take responsibility for the maintenance and control of their own health and it has proved useful in the treatment of organic illnesses and psychological problems. Brain wave biofeedback has been used to treat subjects with social and psychological problems, as well as psychosomatic illnesses (such as insomnia and muscle tension) and

chronic pain - such as that associated with migraine and tension headaches, for example (Hutchison, 1994). Biofeedback, including alpha conditioning, has played a significant role in developing a methodology for helping epileptics to achieve better management of their seizure conditions (Lubar, 1989, pp. 84ff). Rehabilitation of physical function has been one of the major successes of biofeedback (Yates, 1980, p. 487); results of biofeedback training with disabled people have been "impressive" (Yates,1980, p. 498).

Writing in the 1970's, Brown stated that one of the most constructive uses of biofeedback may be in education (Brown, 1974, p. 387). Biofeedback, she maintained, can be used in conjunction with teaching machines to alert the student to his/her optimal mind/body state for any given learning situation. Physical and mental attitudes more suitable for learning, as well as improvement of attention span by voluntary means, can be learned more readily via biofeedback.

Since the heyday of the 1960's and 1970's, biofeedback has been used for teaching in the classroom (Peper, 1979), to promote visual attention, to stimulate creativity, to induce a state of relaxed alertness. It has been used in education in conjunction with the reduction of stress levels and very often with those who have learning problems (Hutchison, 1994, chapter 30, "From Learning Disabilities to Learning Superabilities"). EEG biofeedback is used to work effectively with children who experience attention deficit disorder (ADD) and other disorders of behavior. This includes children who are

hyperkinetic and/or learning disabled (Lubar, 1989, p. 77; Hutchison, 1994). However, as can be seen from bibliographies in such books as Hutchison's Megabrain Power, most of the current research in biofeedback is in the health area: psychiatric illness, alcohol and drug addiction, epilepsy, stroke, phobias, memory impairment, stress reduction, etc. As Hutchison (1991, pp. 94 ff) points out, it is much easier to get funds to do research for medical and therapeutic purposes than it is to explore the possibilities of using mind devices on perfectly healthy people for the purpose of stimulating mental excellence.

In recent years, there has been a plethora of consumer- oriented EEG devices, many linked with computers and/or combined with sound and light stimulation. (For example, the CAP scan [Computerized Automated Psychophysiological scan] and the IBVA [Interactive Brainwave Visual Analyzer] combine recent breakthroughs in computers, computerized electroencephalography and biofeedback [Hutchison, 1991, p. 152; Morrissey, 1996]). In contrast to the 1970's, these "mind machines" are small, portable, more affordable and user-friendly (Hutchison, 1991). These devices can not only observe brain wave patterns but can also induce relaxation and alter brain wave patterns without lengthy training. While many new devices appear with exaggerated claims and personal testimonies, as opposed to solid research data (Hutchison, 1991, 1994; Ostrander and Schroeder, 1991, chapter 19), "mind machines" have proved to be (or have the potential to be) effective tools for

accelerated learning (Hutchison, 1991, 1994).

It is useful to reexamine the area of biofeedback (including brain wave biofeedback) as it relates not only to health in the sense of mind/body harmony but also to an ideal learning state (the state of relaxed alertness), one that was most definitely sought by suggestopedic researchers and educators at the Institute of Suggestology in the late 1960's and early 1970's and one which is crucial today if students are to be prepared for the challenges of the twenty-first century.

(Bio)Feedback

The term "feedback" is of relatively recent origin, coined by pioneers in the field around the beginning of this century. Mathematician Norbert Wiener, a founding father of research in feedback, concisely defined it as a "method of controlling a system by reinserting into it the results of its past performance" (Karlins and Andrews, 1972, p. 26). *Bio* feedback is simply a particular kind of feedback - feedback from different parts of our body such as the brain, the heart, the circulatory system, the different muscle groups, long believed to be outside the realm of conscious control. Biofeedback is essentially the return (the feeding back) of biological information to the person from whose body the information came.

Humans are regulated by two nervous systems: the voluntary and the involuntary. The voluntary, or somatic nervous system includes the nerve cells and fibers that serve the skeletal muscles. It is responsible

for all arm, leg and jaw movement, for changing posture - in short, for all movement that we normally regard as deliberate or "consciously controlled." The involuntary, or autonomic nervous system involves the eye pupils, heart, blood vessels, stomach, endocrine glands and all functions traditionally considered automatic or "beyond our control" (Karlins and Andrews, 1972, p. 34). Insofar as the brain is concerned, the very brain processes involved in patterned neural self-regulation are normally unobservable and not available to direct conscious experience (Schwartz, 1979, p. 57).

Biofeedback may be defined as the technique of using equipment (usually electronic) to reveal to human beings some of their internal physiological activities or functions, normal and abnormal, in the form of visual and auditory signals, in order to teach them to exert voluntary control over their own internal somatic activities or functions (such as heart rate, blood pressure, muscle tension, brain waves) by manipulating the displayed signals. Most instruments developed for biofeedback have been designed so that the individual undergoing biofeedback training can see or hear (or both) the monitor of his/her selected biological activity more or less continuously. This technique inserts a person's volition into the gap of an open feedback loop (hence the name biofeedback). Unlike conditioned responses, the animal involved, here necessarily a human being, must want voluntarily to change the signals in order to meet certain goals (Basmajian, 1989, p. 1). Biofeedback is "the process or technique for learning voluntary control over automatically, reflexly regulated body functions"

(Brown, 1977, p. 3).

To many researchers, the idea that individuals can learn to control a selected, unfelt internal body activity means that the individual can be "conditioned" to react in a specific way to a stimulus, i.e., to a signal containing the biofeedback information. In laboratory experiments and in some clinical applications, this approach to achieving "control" is brought about by giving the biofeedback signal every time the individual's physiological activity changes in a predetermined way. This process is called reinforcement and the signal is used to reinforce what the individual has learned. He (or she) is rewarded for having completed a performance, that of changing a selected physiological activity in a desired direction, and his/her brain mechanisms must now search for relationships between performing correctly and the biofeedback signal that led him/her to the correct performance. According to Brown (1977, p. 15), the only useful result of biofeedback training would be that kind of voluntary control over body activity that can be invoked *at will* and when necessary or appropriate or desirable. (This control is similar to that exerted by the Indian yogis who are able to regulate or dominate their inner beings by slowing the heart beat or controlling breathing in closed spaces, etc). With the exception of those suffering from severe behavioral disorders, the patient's (or subject's) training should reach a point where s/he can demonstrate control over the selected physiological function without the biofeedback signal.

According to Brown (1977, p. 146), “the ultimate biofeedback may well be brain wave biofeedback.” Although the discovery was made (in the late 19th century) that electrical activity could be recorded from the cortex of the brain, it was not until the 1920’s that Hans Berger discovered the existence of brain waves and showed a relationship between brain wave patterns and mental states. (It is somewhat difficult to point out exactly when the first operant conditioning studies of the EEG were carried out, although, since the 1940’s, changes in the EEG have been believed to be associated with different states of consciousness). The remarkable contribution of biofeedback to brain/mind research is its ability to produce relatively “steady states” (Brown, 1977, p. 146). Once individuals learn voluntary control to sustain the presence of specific patterns or of specific elements of brain activity, such as alpha activity, the identification and precise definition of accompanying feeling states and mind activities becomes much easier. Brain wave biofeedback may be used for “disordered functions” or for producing, sustaining and controlling brain/mind states conducive to tranquillity and creativity. According to Brown (1977, p. 153), “EEG biofeedback has probably contributed more toward understanding the relationship between brain electrical activity and the products of brain activity labelled mental and emotional than any other prior scientific approach.”

Brain electrical activity patterns are usually referred to as the EEG, the abbreviation of the recorded brain wave pattern called the electroencephalogram. (The electro-encephalograph is a device for recording

the electrical activity of the brain). EEG generally (or traditionally) implies the standard recording of brain electrical activity from eight or more electrodes or electrode pairs placed on the scalp according to a standard configuration. For each pair of electrodes the electroencephalogram has a channel of amplification and an ink- writing voltmeter that records on folding paper tape. Electrodes placed on the scalp pick up impulses that arise from the outermost area of the brain, the cerebral cortex. To record the electrical activity of deeper regions, needle electrodes can be surgically inserted into those specific areas.

What we know about brain electrical activity patterns is almost totally dependent upon the instruments used to record them. Since EEG patterns recorded from different scalp areas over the brain can vary remarkably, considerable care must be taken in interpreting both the research and clinical results of EEG biofeedback. Lester Fehmi's Brain Wave Biofeedback Synchronizer, for example, in contrast to devices which only monitor one or two of the brain's major lobes, is a multi- channel phase-sensitive biofeedback EEG, one that simultaneously monitors all the major lobes of the brain and signals when the user is in a state of whole-brain, in-phase synchrony (Hutchison, 1991, pp. 320-21). While traditional EEG's display only the frequency of the highest voltage they pick up on a specific location on the scalp, the Mind Mirror is said to take in, process and display the entire frequency spectrum in a logical and easily understood pattern (Hutchison, 1991, p. 175).

Throughout the history of EEG machines, attention has been focused on relatively slow brain waves and, for the most part, on those slow, very large components that are signs of brain pathology. (Most EEG machines dampen the amplitudes beginning at about 30 Hz. [cycles per second] and eliminate all brain electrical activity occurring above frequencies of 50 or 60 Hz.) The rationale for limiting EEG recording to slow brain wave frequencies has been mainly the inability of recording pens to reproduce high frequencies, the impossibility of electronic circuitry to discriminate very low voltage, fast EEG activity, and the apparently relatively greater importance of the slow, high voltage waves for human activity.

Brain Waves

Insofar as brain waves are concerned, it is mainly the rhythmic waves that have been labelled: beta, alpha, theta and delta. (Hans Berger, the pioneer of brain wave study, discovered alpha in 1929. The main thrust of clinical and experimental studies with the electroencephalogram [EEG] has been in the area of operant control of brain wave activity, with particular emphasis on the production and control of alpha rhythm). When people are aroused and/or focus attention on the outside world or external events, they usually produce only beta frequencies. If they close their eyes and think of nothing in particular, they generally produce a mixture of alpha and beta. If they become drowsy and slip toward sleep, theta frequencies often appear and there is less evidence of alpha and beta. Delta waves are not

normally present except in deep sleep. In approximate terms, delta waves are 1 to 4 Hz; theta are 4 to 8 Hz; alpha are 8 to 13 Hz. (or cycles per second). " Beta" is generally used to indicate all EEG activity of (assumed) frequencies higher than that of alpha. As the term is used by different investigators, it can refer to rhythmic or nonrhythmic EEG activity and to different frequency ranges (e.g., 13 to 28 or 28 to 40 Hz). In general, beta activity is quite low voltage and because of this and its close relationship to the characteristics of electrical noise in frequency and voltage, it is difficult to quantify precisely. Technically speaking, beta is not a smooth rhythm, but "a flurry of electrical static" (Karlins and Andrews, 1972, p. 73).

Brain wave activity is said to be related to behavior. It is generally accepted that beta activity accompanies alert behavior, information processing and concentrated mental activity such as that involved in solving problems in mathematics. High beta activity is associated with complex cognitive tasks and is correlated with attentional or memory processes; lower beta activity is associated with anxious emotions. Beta descriptors, which have both positive and negative aspects, include: active, alert, anxious, energetic, excited, exhilarated, lively, restless, stimulated and tense (Lubar, 1989, p. 76).

Theta activity, which is slower than alpha, can be recorded from many portions of the cortex or from the cerebrum in both awake and sleeping individuals. On the average, theta waves are about one-half the

frequency of alpha waves. They are sparse in the normal waking EEG pattern and are found most frequently during drowsiness and dreaming. Theta production is generally possible only with the eyes closed. However, theta activity can occur during alert behavior, generally sporadically, and can appear at moments of sudden insight or recognition of events in memory. Theta is often associated with day-dreaming or reverie and vivid visualizations and hypnogogic imagery. Delta waves, which have a lower frequency range, occur almost exclusively during the deeper stages of sleep and usually appear as single waves. Theta and delta thus represent slower rates of cortical synchronization than alpha. "Physically, the trip from beta to delta is a rhythmic unwinding; psychologically it is experienced as a quieting of the mind" (Karlins and Andrews, 1972, p. 74).

The Alpha Wave

According to the terminology committee of the International Federation for Electroencephalography and Clinical Neurophysiology, the official definition of alpha rhythm is: " rhythm, usually with a frequency 8-13 c/sec in adults, most prominent in the posterior areas, present most markedly when eyes are closed, and attenuated during attention, especially visual" (Lynch and Paskewitz, 1979, pp. 326-27). The alpha wave is not the most dominant, largest or most prevalent brain wave but it does have the distinction of being discovered first (by Hans Berger in the 1920's, as mentioned above) and of being the most studied. Alpha appears to be a slowing down of electrical discord into a pulsating hum

which sweeps regularly over the brain cortex, usually from front to back. The alpha rhythm is a rhythmic spindle (between 8 and 13 Hz., as mentioned) which can be recorded best from the posterior portion of the human or cerebral cortex. (It is important for practitioners using biofeedback for altering EEG activity to realize that the EEG recorded with scalp electrodes in humans are the tip of an iceberg [Lubar, 1989, p. 68]). According to Brown (1974, p. 313), one of the reasons why the most easily observed aspect of brain activity appears to be the alpha rhythm is that EEG recordings are generally done under conditions of relaxation. (A reclining chair is said to be a useful item of equipment. Many patients prefer to have the chair tilted to a semi-reclining position [about 45 degrees from the vertical] so that they have a good head rest [Stoyva, 1989, p. 174]).

Although alpha is defined as rhythmic EEG activity having a frequency of somewhere between 8 and 13 Hz., alpha frequency varies from person to person and it varies in the same individual depending on a number of factors, such as level of attention, state of consciousness, mood, etc. Researchers have divided subjects as follows: 1) those with no alpha, even with eyes closed and their mind at rest; 2) those with alpha only with their eyes closed and their mind at rest; 3) those with alpha present even with their eyes open and their mind active (Lynch and Paskewitz, 1979,pp. 328-29). The exact characteristics of alpha activity can also differ depending on the location of the scalp recording electrodes. Frequently alpha in the frontal and pre-

central areas can differ remarkably from that found in the mid-scalp or occipital regions. Not only are there a host of different kinds of alpha, but there are many influences that affect what is seen on the EEG record. Just to name a few: the type of electrodes and their placement, the type of recording device, skull thickness, electrical environmental noise, genetic factors, personality, intelligence, conditions of stress and the individual's mode of reacting to stress, endocrine factors, physiological drives such as hunger and fatigue, attention, motivation, the amount of information the individual has about his (or her) brain waves, body and his/her task (Brown, 1974, p. 318).

The behavioral state most closely identified with alpha activity is relaxed wakefulness (i.e., an alert but relaxed state). This implies that the brain state is a receptive one, and that it is not actively engaged in any specific mental or emotional activity. Alpha also appears when attention is focused inwardly. Alpha activity can be present, however, during certain kinds of alertness and attention, if the stimulus is not truly novel (Brown, 1974, p. 323) or when a particular mental activity is habitual. It is reported by Brown (1977, p. 150) that Einstein maintained an EEG pattern with considerable alpha while solving moderately complex mathematical problems, but that, when he was confronted with a new kind of problem, his alpha disappeared. According to Rosenboom (1976, pp. 12-13), during periods of repetition or reproduction of highly rehearsed patterns, one observes associated increases in alpha in musicians. It is possible that the "production of alpha

by a performing musician is related to his [her] ability to concentrate on the internal state, and, through disciplined practice, disengage him [her] self from the need to perform physical orientation in order to produce the 'right' notes or music."

Alpha tends to disappear during mental work, alerting, orienting, dreaming, hunger, visual activity, emotional arousal and frustration. One of the first reported characteristics of the alpha rhythm was the fact that it would block when the subject was presented with any of a variety of sensory or attentional stimuli (Lynch and Paskewitz, 1979, p. 326). On the other hand, "alpha activity occurs in the feedback situation when an individual ceases to pay attention to any of a number of stimuli which normally block this activity" (Lynch and Paskewitz, 1979, p. 335). These stimuli may be cognitive, somatic, emotional, etc. In addition to the feedback process, any other process by which these influences may be removed (as in the original passive or concert session in Suggestopedia) will result in increased alpha activity.

Reports of biofeedback studies continue to support neurophysiologically derived notions that the subjective feeling state during the presence of alpha activity in the EEG is a generally tranquil, comfortable, relaxed, pleasant feeling, although there may be occasional exceptions. (Alpha descriptors include: at ease, calm, composed, passive-like, peaceful, placid, relaxed, tranquil, uncritical and unfocused [Lubar, 1989, p. 76]). Some people report the flow of considerable

imagery, almost a day-dreaming reverie. (Kamiya [1979], on the other hand, found that the presence of alpha was reported as being associated with less visual imagery). Subjects in the " alpha feedback" situation often report dissociative phenomena such as feelings of floating, being unaware of the immediate environment and distorted time perception (Lynch and Paskewitz, 1979, p. 333). The fact that, in general, the presence of alpha activity in the EEG and the absence of beta activity indicates a mental-emotional state of relaxed wakefulness is almost reason enough to suggest its use in individuals who complain of anxiety and tension and whose EEG shows an abnormally low content of alpha (Brown, 1977, p. 153). Certain investigators feel that alpha biofeedback is appropriate as a stress-reduction measure, particularly for emotional stress (Brown, 1977, p. 187). One chief objective of alpha training is that, by learning to turn the attention inwardly, the subject naturally decreases the visual input of anxiety-related information (Brown, 1977, p. 240). Alpha's association with relaxed wakefulness is useful not only in therapy or self- exploration but also in stress-free learning. Alpha is ideal for learning new information, data, facts, material that one wants to be fully aware of and have readily available in waking consciousness (Hutchison, 1994, p. 211).

Concepts such as turning the attention inward, passive concentration, relaxing physically, not trying, emptying the mind (as in certain forms of meditation), encouraging the subject to invent mental strategies, are all useful for promoting alpha (Brown, 1977, p. 241).

Alpha will sometimes increase to a marked extent in subjects who are just sitting quietly in a comfortable chair. Closed eyes or, if eyes are open, an environment with subdued lighting (or a dark room), as well as a state of (induced) relaxation are conditions in which alpha production is normally maximal and the individual bursts of alpha are frequent (Brown, 1977, p. 171). The average human being exhibits alpha activity (which is only a relatively small part of the brain's electrical components manifest in the EEG pattern) only between one and perhaps 20 percent of the time when the eyes are open, and anywhere from 35 to 75 percent of the time when the eyes are closed; alpha rarely occupies more than 50 percent of the total EEG activity (Brown, 1977, p. 234). According to Brown (1977, pp. 238-39), "it is a simple fact that alpha becomes maximal in amount when the eyes are closed."

Alpha may also appear when the eyes are open. Move the eyes (i.e., the eye muscles) up and alpha appears; move them down and it disappears. Biofeedback researchers have tended to limit their recordings and feedback signals to the occipital scalp areas that overlie the interpretive visual cortex area, presumably because of the eye-alpha relationship (Brown, 1974, p. 328). Alpha waves can be made to appear when the eyes are open if attention is turned inward, away from the outside world, if one learns to "observe without looking" (Green et al.,1979, p. 128). In contrast, studies have shown that the greater the complexity of the visual input, the stronger is the alpha blocking response. According to Rosenboom (1976, p.

12), listening to or performing “stable, non-moving musical drones” (i.e., repetitious, monotonous-sounding music) is almost always accompanied by the presence of “more than normal alpha.” (Participation in a “drone sound” usually involves a kind of meditation which seems “logically connected” to the alpha state). It appears, however, that some type of “optimal level of arousal” exists for the occurrence of alpha activity. While, if the subject is too aroused, alpha activity will be diminished, if the subject becomes too drowsy, alpha will also be diminished (Lynch and Paskewitz, 1979, p. 330).

The Suggestopedic Concert Session and Alpha

It can be seen, from an examination of the North American research on alpha bio-feedback and the original version of Suggestopedia, that a number of the essential elements for producing the alpha state were an intrinsic part of the original suggesto-pedic language class - especially of the original passive (or concert) session. During this session, as mentioned above, the teacher read the language dialogue in a soft, soothing and persuasive voice over a background of slow movements from baroque chamber music while the students relaxed in their chairs and breathed rhythmically and deeply in time to the rhythm of the music and the teacher’s voice. The original suggestopedic concert session incorporated physical and mental (or psychological) relaxation: a relaxed posture and inner concentration or visualization (i.e., inward focusing).

Students' eyes were closed during the original passive session and they sat quietly in special chairs with a 45 degree angle and a head rest. The language materials for memorization were read over a background of slow-moving, repetitious and monotonous-sounding music. Students were told not to pay direct attention to the language materials being read but just to relax and listen to the music. Lighting was subdued in the classroom and the classroom atmosphere was calm and pleasant. Indeed, it was probably because of the "alpha state" that students were able to memorize large amounts of language material effortlessly - often, it was claimed, to levels of hypermnesia.

Since the new "mind machines" (Hutchison, 1991) can be used to get students quickly and easily into the alpha state, what is needed, according to Morrissey (1996), is a fully computer- automated accelerated learning classroom where participants develop control over their brain wave activity through biofeedback training and where brain wave states can be changed at desired moments in the teaching/learning cycle and the appropriate state prolonged, once it has been induced. Morrissey believes that tomorrow's classroom will be brain wave driven; teaching methods, styles, materials and the like will be determined by the brain wave activity of the learners. Brain wave technology equips educators with the means for detecting and/or confirming suggestive effects in the classroom through the collection and utilization of scientific data (Morrissey, 1996, p. 59).

In contrast to most other researchers in accelerated learning who subjectively evaluate their students' learning state, Morrissey (1996) is of the opinion that it is very important to reproduce the brain wave patterns which were operational during the original suggestopedic class and to verify these objectively with the appropriate equipment. With his system, called brainwave biotek, he shows that we can scientifically demonstrate and provide feedback of the effects which various suggestive means (dimmed lights, concert readings, use of special music, etc.) as well as various teaching strategies (games, songs, readings, etc.) have on students' EEG's and determine what effect those EEG's are having on intellectual performance and achievement (Morrissey, 1996). His research using the computer-based (and wireless) Interactive Brainwave Visual Analyzer (IBVA) shows that concentration, memory recall and classroom learning will be optimized if the instructor alternates cyclically between inputting information (especially during the concert session) with students maximizing alpha and their activating and elaborating upon the information while maximizing beta. However, as Morrissey (1996, pp. 52-53) admits, more research is needed in such areas as memory expansion and long term retention of materials. In his foreword to Morrissey's Ultimate Learning States, Donald Schuster says: " Exciting possibilities exist. Can we at last duplicate Lozanov's stimulating report of hypermnesia (extraordinary memory)? Can we repeat it on demand and specify its conditions? Can we train classroom teachers to use it in public education? Potentially these questions can be answered affirmatively, but it's up to us as researchers and educators to get busy doing the research."

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Sources of reference information on accelerated learning

The easiest access to published information on accelerative (-ed) learning, SALT, suggestopedia, and Super Learning is through the ERIC system available in many university and college libraries. Secondary sources are *Dissertation Abstracts* and *Psychological Abstracts* along with the periodic author and topic indices of the *Journal of Accelerative Learning and Teaching*. Chapter 3 of *Suggestive Accelerative Learning Techniques* (1986) by Schuster and Gritton [University of Toronto Press] has an extensive review of the literature then available.

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