Brainwave Connections

Dedicated to communication and education in the emerging fields of neurofeedback, mental fitness, neuromeditation, and brain modification

Volume 1, Issue 4 Fall 2005

WATCH YOUR THOUGHTS

Watch your thoughts; they become words.

Watch your words; they become actions.

Watch your actions; they become habits.

Watch your habits; they become character.

Watch your character; it becomes your destiny

Frank Outlaw

On Seeing the Light

There was a time when sunlight was the most important factor in daily life, and all things were based upon it. In pioneer times, the working day was defined as extending from "Cain to Cain't." That is, as soon as one could see the early light of day, one rose and got to work. And as soon as darkness ensued, there was nothing to do but to retire and wait for morning. Today, we exercise control over our light, and our daily activities are subsequently under our own volition, or so we think. We now live in a world of variously self-styled "early risers" or "morning people", as well as "night owls," those who are most comfortable while the world around them sleeps quietly. Today, we are free to select our own sources of light, and to decide how we choose to heed them. We shape our lives through such decisions, and these decisions determine who and what we become. The article on entropy and freedom of choice relates this concept to neurofeedback. We hope that it sheds a useful light on this important topic.

In this issue:

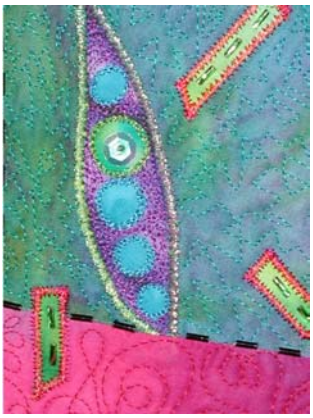
In coming issues:

- *"But what do I do?": Instructions to Neurofeedback Trainees*
- *Book Reviews, Site Reviews, and personal commentaries*

Information, Entropy, and Freedom of Choice

The reduction of entropy involves directed change, leading to order.

(Artist: Steve Ince)



The result of directed change is order. There may be no restrictions or preconceived limits as to what that order may be...

(Artist: Deana Hartman)

Article by:

Thomas F. Collura, Ph.D., P.E., BCN

Dr. Collura is a biomedical engineer, neurophysiologist, and neurofeedback systems developer.

When we work with the brain and neurofeedback, we enter a unique realm of intervention, compared with conventional modalities. Our culture has been built upon an emphasis on the physical and chemical reality within which we live. Our healers tend to be surgeons who work with bones, tissue, and organs. Mental interventions are dominated by chemical diagnoses and medical treatments to "put things right."

Neurofeedback appeals to the "soft" concept of information, rather than the "hard" concepts of chemistry and physics. Neurofeedback can produce lasting change at the synaptic level, but the mechanism of change is one of information management, not direct physical effect.

It is appropriate to ask, ***"what does it take to make a decision?"*** In the most abstract sense, the following things are needed: ***The ability to discern, the energy to make a change, and the intention to choose.*** These three factors, discernment, energy, and intention are sufficient to cause any individual or system to change, and to use that change to lead in a particular direction. If any of these factors are missing, directed change is no longer possible.

Neurofeedback operates by making the unseen seen, and by making the unfelt felt. By providing information to the trainee, neurofeedback provides the key element of discernment (of brain state, via the EEG). Because we are not normally aware of our brainwaves, this information is missing in everyday experience.

Given that brain state can be discerned, what are the factors that allow positive change to occur? Quite simply, they are the presence of the intention to change, and the energy to make that change.

The amount of energy needed to change a system can be exceeding small. James Clerk Maxwell is responsible for the concept of "Maxwell's Demon." This is an imaginary agent that has the ability to determine the temperature of a particle, and to open or close a door that allows that particle to pass from one chamber to another. It can be shown that such an agent could cause a contained gas to become hot in one chamber and cold in the other. In principle, such an agent could create an unlimited amount of energy, simply by letting tiny particles selectively move.

In reality, no such demon exists. However, this concept shows us in principle, the immense power of the simple ability to make a decision. And fortunately for us, our brains are endowed with the ability to make discernments and decisions that facilitate our progress in life, given that we choose to make decisions. This capacity leads to the possibility of learning, or operant conditioning, which is the guiding principle that leads intelligent beings to understand and adapt to their environment.

In neurofeedback, each point earned, each moment of progress, constitutes a tiny decision. Each decision produces a change in direction, and with proper care, that direction is well determined and purposeful.

The presence of information, permitting change, produces no less than the freedom of choice that separates us from all other beings on earth. We are capable of making discernments, and of making decisions based upon them.

When a system is deprived of the ability to discern, or the information necessary to make a decision, free will is compromised. Freedom requires good information, and the clarity to make decisions.

In summary, the power of neurofeedback lies in the simple ability of the brain to discern small events, and to make small decisions. Through the progress made during thousands of tiny decisions, great change can become possible, and significant order can be achieved.

And what are the elements that make this possible? Belief in change, a willingness to change, and the intention to use the information provided. Given these precursors, only a tiny amount of energy and effort are sufficient to reap all the benefits and progress that are there for the taking.

A Relaxation/Activation model of Alpha

It is common to regard the alpha rhythm as an idling rhythm, one that occurs when no active work is done. This is taken in contrast to the faster rhythms such as beta and gamma, which are considered to represent a "processing" phase. Thus, the concentration/relaxation cycle is taken to be that characterized by phases of relaxation (alpha) and phases of concentration (beta). The use of alpha enhance protocols, and the use of "squash" protocols, both appeal to the notion of this cycle, and seek to produce either a preponderance of one phase, or the facility to alternate flexibly between phases.

Based on laboratory research, it is now evident that the alpha mechanism is not simply a pacing or timekeeping mechanism (Shaw, 2003). Rather, it participates in memory scanning and related mental processing in a profound manner. Contrary to the concept that thinking occurs when alpha is absent, it is more correct to say that alpha activity persists during essentially all mental processing, but that it takes on a character of desynchronization during certain tasks

The mechanism that produces synchronous alpha also operates at the single cell level, as the relaxation of inhibitory fibers whose primary function is to throttle the activity of the active (pyramidal) cells. These are primarily thalamocortical (collateral afferent) and cortico-cortical projections, that hold back the pyramidal cells from firing, despite the considerable excitatory input they may see. These receive information including sensory, body awareness, muscle feedback, and related signals, impinging on a range of primary sensory, secondary sensory, and somatosensory areas.

Timing is what is controlled. At any given time, pyramidal cells are likely to be firing or not firing, as a function of their local population dynamics. But when the firing begins to synchronize, that alone is significant enough that ***a mere 1% of the cortical cells can determine over 96% of the EEG*** (Shaw 2003, page 19).

Alpha is always there at a cellular level. However, the memory scanning that it represents is modulated at a unit-cell level, so that the relative timing of neighboring cells is variable. Desynchronization and synchronization is what is modulated. Thus, the pyramidal cell populations can slide in and out of phase with each other, providing a wide range of surface amplitudes, which we see as EEG.

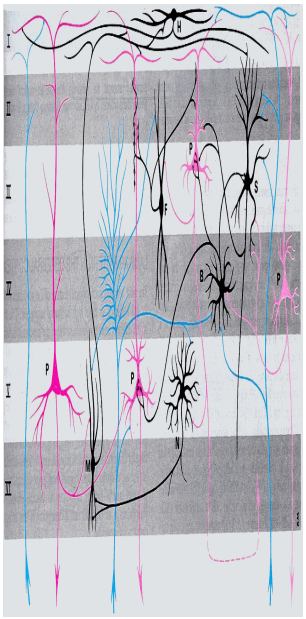
The highly synchronized (high alpha) state is a low entropy state. The more synchronization can be achieved, the lower the momentary entropy of the system. Entropy can be sequestered in time as well as in space. The time-space analog of a highly organized, crystalline material is the synchronous alpha activity in the brain. Rather than simply organizing matter in a structured fashion, the brain organizes events in both time and space, in a structured fashion

This provides a rationale for connectivity-based training. By considering the various connectivity pathways in the brain and training them explicitly for flexibility, it is possible to use a wide range of protocols toward a primary goal, without resorting to a simple model of "remediating what is too large or too small".

This also provides a rationale or downtraining, in the context of connectivity. The effect of downtraining a rhythm is to exercise the inhibitory influences, in such a way as to induce them to produce maximal desynchrony, hence independence. When viewed as an essential component in the momentary switching of mental tasks, this flexibility can be expected to lead to enhanced mental fluidity and effectiveness.

Alpha training thus provides functional relaxation, not systemic relaxation. That is, ***the mechanism, which performs at a cellular level, specifically modulates localized internal inhibitory influences***, resulting in an increase in synchronized, aggregate activity of active mental processing elements. Although these elements are not necessarily engaged in tasks at the time of the EEG training, the resulting learning provides flexibility of activation, which is a useful learned skill.

Alpha activity persists during essentially all mental processing, but it takes on a character of desynchroniza tion during certain tasks



Article by:

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Reference:

Shaw, J.C., (2003) The Brain's Alpha Rhythms and the Mind, Amsterdam: Elsevier Press

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Book Review:

Child and Adolescent Psychiatric Clinics of North America v. 14 (January 2005)

Guest Editors Laurence M. Hirshberg, PhD, Sufen Chiu, MD PhD, and Jean A. Frazier, MD

Each issue of Child and Adolescent Psychiatric Clinics of North America focuses on a single topic in child and adolescent psychiatry and is presented under the direction of an experienced guest editor. The January 2005 volume, entitled Emerging Interventions, presents brain-based interventions using the bioelectric domain, including EEG biofeedback or neurofeedback, repetitive transcranial magnetic stimulation, and vagal nerve stimulation. Each chapter presents a thorough review of the published research and clinical literature in the area, integrated with case discussions when indicated. This issue was edited by Dr. Laurence Hirshberg, NeuroDevelopment Center Director, along with two child psychiatry colleagues. The issue includes an article on QEEG in neuropsychiatry, articles on EEG biofeedback, and other topics. A free downloadable preface, plus the editors' overview chapter, are available online at www.neurodevelopmentcenter.com. The NDC has also negotiated a special discounted price of $50 for the entire book, when purchased through their website.

Site Review: Neurotherapy Center of Dallas, Inc.

Dr. Jonathan Walker is a neurologist and clinical neurophysiologist who as incorporated neurofeedback as an essential part of his work with children and adults. In addition to treating a wide range of clients, he also reads EEG for other clinicians, and is also an internationally known teacher and speaker.

Dr. Walker graduated from Baylor College of Medicine in 1960 and finished a residency in Neurology in 1965. He is board certified in neurology and electroencephalography and is President of the American Board of QEEG Technology, and President-Elect of the Neurofeedback Division of the Association for Applied Psychophysiology and Biofeedback.

He has been designated a "Health Care Hero" by the city of Dallas, in recognition of his contributions to clinical science and his continued work with the community.

Dr. Walker has found that many abnormalities that appear in the raw EEG can be addressed and normalized with neurofeedback. Based on his many years of experience and knowledge of the literature, Dr Walker can make training suggestions based on abnormalities seen in the EEG.

Dr Walker is also an authority on the use of "coherence" training for clients with seizures, dyslexia, brain injury, learning disabilities, and other concerns. He has published and teaches widely on this topic, and is a leading clinical researcher in this area.

It is unusual to find a practitioner with a strong foundation in conventional EEG and neuroscience, and who is also skilled with emerging therapies and techniques. Dr. Walker and his colleagues have extensive experience with a wide range of clients, and can provide specialized services on an as-needed basis.

www.neurotherapydallas.org