Brainwave Connections

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

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ON PERSONAL CONNECTIONS

It is appropriate to ask ourselves what constitutes a field, a discipline, or a body of knowledge. At one level, these can be understood as a snapshot of ideas, concepts, rules, standards, and other objective criteria. However, any science or practice is in fact the result of the aggregate activity of individuals, and evolves. These individuals work both independently and in collaboration to develop, articulate, and promulgate their work. As a result the emerging body of knowledge and practice is more of an extension of the human effort, and less of a static body of information.

Students of history and science gain insight by understanding the people who develop and promulgate the science, the climate in which they work, and the immediate goals at hand. Rather than being an objective and sterile body of knowledge, science is a living, breathing activity that reflects both the strengths and the foibles of those involved

In the case of neurofeedback, one example of an issue that takes on a human quality is that of setting of training targets, which gets into the topic of autothresholding and session control. There currently exist many varied opinions and practices in this area, and they are representative of the practitioners who developed them. The relevant issues include learning theory, motivation, operant conditioning, equipment capabilities, the needs of the client, and the practicalities of conducting the sessions.

Neurofeedback is more like music than paperhanging. It tolerates, in fact needs, considerable individual difference and flexibility in its concepts

and applications. In order to understand these issues, it is important to know and understand the practitioners behind them, and know how and why they reached their conclusions.

The article on thresholding in this issue has more to do with people than with numbers. Read it with an eye toward connecting with the individuals behind the thinking, and connecting with your trainees as you work.

ONE THING AT A TIME

In his article on "Things noticed along the way," Hal Schaus takes an uncommon view on the role of neurofeedback software and displays. It is that biofeedback training should be as boring as possible, in order to reap the maximum benefit. The challenge of attention training, according to this perspective, is to allow the trainee to learn to pay attention and focus, in the absence of stimulation. It is when we are faced with simple, possibly boring things that our attention may be most challenged. Learning this will equip the trainee to be comfortable with stillness, whether it is in history class, reading a book, listening to a family member, or watching a quiet sunset.

If we continually try to appeal to the need for stimulation, then we will only perpetuate the idea that everything needs to be exciting and ever-changing.

If, on the other hand, we learn to appreciate and respond to simplicity and stillness, then we will reap the benefits of depth of thought, clarity of feeling, and simplicity of life.

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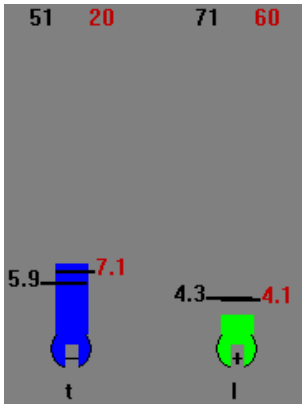
Thresholding—When and How



Autothresholding

In the example above, autothresholding is being used to set threshold levels for theta and lobeta training. The current theta threshold (shown in black) is 5.9 microvolts, and the current percent time over threshold is 51%. The target percentage is 20% (shown in red). Therefore, the autothresholding algorithm has chosen a new (higher) threshold of 7.1 microvolts. The question is, when should this new threshold be applied ("Updated")? When the value of 7.1 is used for the current threshold, the trainee will experience a change (increase) in the reward rate, as the training becomes"easier".

Autothresholding thus impacts the trainee's experience, expectations, and motivation.

Article by:

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

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

During technical and practical neurofeedback training, we are often asked about thresholding. People want to know how to choose thresholds, where to set the target percentages, when to update thresholds, and so on. Sometimes there is an expectation that there is a "best" or "only" way to work. In reality, use of thresholding is an art as well as a science, due to the range and variety of issues encountered, as well as individual differences in trainees and trainers.

According to Webster, a threshold is a "starting point". In neurofeedback, the thresholds marks the points in time when rewards may be forthcoming, thus when learning may begin. When using autothresholding, the computer is programmed to find and apply the best thresholds, so that the trainee experiences the desired rate of reward. When the computed thresholds are used, this is called "updating" them. One key questions is, exactly how often should thresholds be updated?

There is a wide range of opinion and practice in this area. We present here the dominant philosophies, along with mention of significant practitioners who have researched and used them. These are recommendations, not rules.

Set the thresholds once and try to avoid changing them (Lubar, Brownback). This point of view is based on the concept that the trainee is best served by seeing improvements (or reductions) in the feedback as the EEG changes, and that the changes should provide an accurate reflection. It may further propose that changing thresholds can frustrate or thwart learning by masking EEG improvements, as thresholds are adjusted to adapt to them.

Generally, thresholds are determined by an assessment process, that may be extensive. The trainee may be given one or more trial sessions, and the results of early training may be monitored, to ensure that the values chosen are robust. Multiple thresholds may be used. Once chosen, thresholds are held constant as much as possible, to provide a constant "bar" for the trainee to work with.

Set the thresholds at the beginning of each session and try to leave them alone (Ayers). This point of view recognizes that day-to-day changes may occur, and that the exact EEG readings for a particular session need not match those from previous (or subsequent) sessions. Part of the feedback to the client includes reporting the levels that are attained, and the thresholds that are used. Thus, the daily threshold levels become part of the feedback, and address the issues of motivation reward.

The basic approach is to inform the trainee of their levels for that day, and then see if they can "make your usual 1000 points" with the new targets. Thus, the feedback includes a sense of accomplishment.

Update the thresholds periodically, to adapt to short-term changes in the EEG (Othmer, Soutar). This approach is based largely on learning theory and operant conditioning research, which indicates that there is an optimal level of reward contingency for learning to occur. Typical time intervals for readjusting thresholds vary from 1 minute to 10 minutes, with 2 to 5 minutes being most common. It is also common to introduce a pause of 10 or 20 seconds, to allow the trainee to rest, and review the training results so far.

Update the thresholds continually, to emphasize training of variability (Brown & Brown). This approach is based on the concepts of dynamical systems, in which the primary goal is to provide the brain with information regarding short-term changes in brain state, to allow adaptive learning to occur. The principles of operant conditioning are not brought into play, as this is not viewed in a traditional learning model. The point of view here is that the brain will learn its own limits and parameters, and thus develop improved self-regulation.

In summary, we see that a full range of possibilities exists for the use of automatically adjusted training targets. The methods chosen will depend on the needs of the trainee, as well as the preferences and opinions of the trainer.

Personal Commentary—Things Noticed Along the Way

It all began in May of 1978 when I took my initial biofeedback training with Tom Budzynski, at the Biofeedback Institute of Denver. From that time until 1990, I combined biofeedback with my clinical practice. I did have a Twilight Learner that Tom worked out with Biofeedback Systems of Boulder, but that was the only EEG work until 1990.

I then went to Knoxville and studied with Joel Lubar for a few days and was off and running in the wild and wooly world of neurotherapy. I might add that any new health movement, whether it be behavioral or drugs, goes through a panacea stage filled with excitement and "magical cures." Of course there are also solid findings if you take time to dig them out.

I jumped in with much gusto and purchased a Lexicor NRS-24 from Tom Allen. There were also many phone calls to Tom as I ran into questions. To this day Tom is the sole voice that spoke often about the importance of breathing while doing neurotherapy.

I vividly recall my first case. It was an ADHD patient and I was doing a theta down, beta up protocol. The first few minutes seemed to be going along well and I was thinking this was a piece of cake. Then, Bam! The youngster couldn't do anything.

I called Tom in a panic and he told me to watch how the boy was breathing. Sure enough, at the next session, the first two or three minutes went O.K., then the boy started breathing very shallow, and his brain training started to fall apart again. When I taught him to breathe properly, his brain was able to train again.

As I proceeded to become a workshop "junkie" I started to become aware of the conflicting claims of some of the authorities. Claims were being made about the superiority of different makers of equipment. Other claims were made about protocols and there were diverse opinions about what data led to the best choice of treatment protocols. There was science and there was mysticism, but no good foundational material that everyone could agree upon.

I noticed then, and do now, that an awful lot of time is spent on trying to get equipment and/or software to work. It is not uncommon to buy equipment or software and then have to take a (not inexpensive) workshop to learn how to get things working.

I finally decided to not be blown about by the various claims and/or testimonials and started testing things in my own clinic. Following are some things I have observed, but I wish to be quick to add they are not aimed at any persons.

Up training fast frequencies is best accomplished by down-training slow activity. For example I get much better results downtraining delta of low theta as a means of increasing beta.

One exception to this is alpha/theta training. I have found however, that after just a few sessions, most patients don't increase alpha and theta very well. What works well to get alpha/ theta increase is use of audiovisual entrainment. I use the ROSHI and the David, Paradise XL+ to accomplish this.

While there are some practitioners who speak of getting better results by changing a particular band one or two hertz, I have been unable to replicate this. Neither have I been able to replicate some of the 40-hertz, or (recently close to) 60-hertz claims that are floating about. Training some of the lower frequency harmonics of the higher frequencies seems to do as WELL or better.

I sometimes get a chuckle when I read about all kinds of new and exciting displays for training ADD/ADHD patients. In my experience the last thing you want to do is create displays with a high degree of novelty. What the ADD/ADHD people have trouble with is dull, boring material.

It could be argued that, because of their needing novel stimuli, that something as boring as making a bar or a circle change would turn the client off.

(continued on page 4)

When I taught him to breathe properly, his brain was able to train again..

Article by:

Hal Schaus Jr., M.S., DAPA

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Brainwave Connections

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Book Review:

The Edison Gene: ADHD and the Gift of the Hunter Child

By Thom Hartmann

(2003) Rochester, Vermont: Park Street Press.

The Edison Gene is one of Tom Hartmann's excellent books, this one dealing with the topic of attention in the context of human history and society. From the introduction, "I was in India in 1993 to help manage a community for orphans and blind children on behalf of a German charity…with me were several Indian businessmen and a physician, and we had plenty of time to talk…Curious about how they viewed our children diagnosed as having Attention Deficit Hyperactivity Disorder (ADHD), I asked, "Are you familiar with those types of people who seem to crave stimulation, yet have a hard time staying with any one focus for a period of time? They may hop from career to career and sometimes even from relationship to relationship — but the whole time they remain incredibly creative and inventive."

"Ah, we know this type well," one of the men said, the other nodding in agreement. "What do you call this personality type?" I asked.

"Very holy," he said. "These are old souls, near the end of their karmic cycle."…"This is a man very close to becoming enlightened," a businessman added. "We have great respect for such individuals, although their lives may be difficult.

This book will also help to enlighten you, and to gain respect for such individuals, as well as for yourself.

Review by: Tom Collura

Things Noticed Along the Way (continued from page 3)

What I have found is that you can reward them for attaining a certain number of points on dull tasks. Sometimes it is getting to play a Nintendo game. Sometimes it is a free ticket to go bowling, play miniature golf, etc.

On the assessment side, you can't be too thorough in looking at family, social, medical, cognitive, and nutritional aspects of a patient. I recall a young man a colleague sent to me, due to difficulties in school. When I tested him I learned he had an I.Q. of 80 and a normal QEEG.

There are various assessment systems people use, some based on acquiring EEG data by using five or six sensors. I did simultaneous recordings with such systems and also recorded with my Lexicor. When I checked the data from the Lexicor, on an EEG viewer, over sixty per cent of the epoch's collected had to be rejected because of artifact.

On the other side of the coin, and to be fair, I have had patients where the post treatment QEEG showed great benefit, yet the improvement was marginal at best. Also, I had had patients with very good results from neurotherapy, who had a post treatment QEEG that showed no change, or was worse than the pre-treatment QEEG.

We have a lot to learn yet.

My biggest frustration has been in trying to get leaders in the field to move to consensus on foundational aspects. The purpose isn't to stifle exploration and new ideas, but to be able to present a validated and agreed on set of principles on which the field stands.

While not exhaustive, this would include an adequate knowledge of basic neuroscience, knowledge of relevant physics and electronics and knowing what EEG normal and abnormal states are and how they present themselves.

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"Within you there is a stillness and a sanctuary to which you can retreat at any time and be yourself"

-Hermann Hesse, Siddhartha