\[ z'_Y = r_{XY} z_X \]

and

\[ z'_X = r_{XY} z_Y \]
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Loss and Gain: From Neurotherapy to Applied Neuroscience

It was only a short while ago that I learned of the death of Eugene Peniston. I was one of the first to train with Gene and carry into clinical practice his landmark research in partnership with Paul Kulkosky. Adding the recent passing of Joseph Horvat, Margaret Ayers and also Bernard Brucker from the biofeedback field, I am moved to reflection, as events such as these typically encourage. First off, I am deeply saddened by the departure of these great human beings who have contributed so immeasurably to our field. I worked with them all and spent hours in conversation with each of them, as many of you have. They epitomized, in my view, the ideal of professionalism and dedication to their calling; their passing is our loss. I am certain that you all join me in offering sincere condolences to their loved ones.

Then, in my reflections, I am forcibly reminded of the sea change that is occurring in our field. The so-called original pioneers in the field of neurotherapy are in the process of turning over their legacy to a growing body of well-educated and energetic younger people. These “new pioneers,” are also dedicated to the field, but many of them are seeing it differently, as if through new eyes. They will take what we have learned and have strived to build, combine it with emerging research to broaden the scope of the field and, hopefully, build an enduring superstructure on the foundation of pioneering work.

Continued on page 6

The Case Against Drugs—and for Neurofeedback: The Superior Alternative for Attention Deficit/Hyperactivity Disorder (ADHD)

The majority of practitioners treating ADHD use one or more drugs to treat it. This preference is based on their belief that the drugs are effective and safe in the treatment of ADHD. I will review the abundant evidence that often drugs are ineffective, that they often have unfavorable side effects, and that there are long-term problems associated with the use of stimulants. At best, they do not eliminate ADHD, but temporarily suppress the symptoms. Complications may be quite severe with their long-term use.

In contrast, neurofeedback is usually effective in eliminating ADHD altogether, usually without side effects or long-term complications. It is also useful in eliminating comorbidities associated with ADHD, such as learning difficulties, anxiety, depression, oppositional defiant disorder, sleep disturbances, and anger control issues. There is no problem with withdrawal or drug interactions. It offers a permanent solution in the majority of cases. In the long run it is less expensive than prolonged drug usage.

The alerting and euphoric effects of amphetamines were discovered in the 1920s. College students in the 1930s recognized they could be used to relieve fatigue and increase focus when cramming for final exams. Benedrine inhalers were expensive than prolonged drug usage. Many children develop tics during active treatment. Another long-term effect of stimulant therapy is heart disease, including occasional sudden death. Anxiety and irritability are common side effects, and severe depression may be a consequence. Appetite suppression (1 in 4), in-

ISNR Mission Statement
To promote excellence in clinical practice, educational applications, and research in applied neuroscience in order to better understand and enhance brain function. Our objectives are:
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- Develop clinical and ethical guidelines for the practice of applied neuroscience

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To improve human welfare through the pursuit of its goals. The specific goals are:
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- The promotion of high standards of professional practice, peer review, ethics, and education in neurofeedback.
- The promotion of neurofeedback and the dissemination of information to the public about neurofeedback.
- The division is organized for the purpose of carrying on educational and scientific objectives and is not to be operated for profit.
somnial (1 in 7), and stomach ache (1 in 9) occur in significant numbers of children. Most trials of stimulants have been short-term, acute studies. Only a few long term studies have been done. The best known of these is the NIMH Multimodal Treatment Study (MTA). Subjects remaining on treatment experienced a slight deterioration of medication effect. Only 68% of subjects remained on medication at 24 months. There was a significant worsening of symptoms when the drug (Ritalin®) was stopped. Both parents and teachers rated behavioral therapy as superior to medication. Studies have shown that treatment with stimulant drugs do not reduce the incidence of conduct disorder and antisocial personality disorder seen in many ADHD children as they grow older. A study in Australia found growth retardation, with progressive declines in both height and weight in 86% of the subjects on Ritalin®. In a Yale study of children on Ritalin® for 2 years or more without interruption, 76% of the males and 90% of the females experienced significant height suppression after 3 years of therapy, with an overall height deficit of 3.4 cm (1/2 – 1 1/2 inches). There was an average weight loss of 1.25 kg (2.75 pounds) per year. Unmedicated patients demonstrated above average growth rates when the Ritalin was discontinued.

Most long-term studies have shown a waning of the beneficial cognitive effects of stimulants over time. Seven per cent of stimulant-treated children in one Canadian practice developed clear symptoms of psychosis after the initiation of therapy. The psychosis resolved on discontinuation of therapy in most of these patients. Many ADHD children on stimulants experience withdrawal symptoms (moodiness, excitability, insomnia, and excessive talk). This may result in the child being labeled as “bipolar,” when in fact the problem is iatrogenic.

The psychiatric literature has consistently minimized the addictive potential of psychostimulants. The reinforcing effects of intravenous Ritalin® are identical to those of intravenous cocaine. In a high dose (80 mg.), oral Ritalin® may produce levels of dopamine transporter blockade as quickly as intravenous doses.

Animal studies have documented that stimulant medications sensitize the brain to cocaine. In a study of 492 children begun in 1974, stimulant-treated subjects developed higher rates of cocaine dependence than non-medicated peers diagnosed with either ADHD or behavioral (conduct) disorders. The abuse potential and sensitizing effects of Ritalin® are supported by over 60 studies of nonhuman and human subjects.

In the large MTA study quoted above, medicated and non-medicated children were given behavioral therapy, including classroom training, sports, social skills training, daily group sessions, tasks to promote cooperation, parent training with reinforcement systems, and daily report cards. After eight weeks of the therapeutic camp the two groups showed no differences in overall improvement ratings. Other nonpharmacologic approaches have documented similar benefit, including exercise (martial arts, massage therapy, music therapy, and cognitive therapy).

Direct comparisons of Ritalin® and neurofeedback have shown equivalent efficacies². The effects of neurofeedback persist when the training is completed. When the drug is stopped, the child (or adult) returns to his/her baseline state.

Neurofeedback offers the additional advantage of remediating the comorbidities of ADHD—anxiety, depression, learning disabilities, oppositional defiant disorder, conduct disorder, sleep disturbances, and anger control. QEEG-guided neurofeedback is very helpful in remediating these associated disorders⁴ ⁵. Adverse effects of neurofeedback are extremely rare and no long-lasting complications have been reported⁶. There appear to be no withdrawal effects. Dependence has not been reported. There have been no studies reported of the incidence of drug abuse or criminal behavior in ADHD children remediated with neurofeedback, but we know that proper neurofeedback can be used to reduce drug-seeking behavior and aggression in incarcerated individuals with ADHD⁷. I suspect that we will see a decrease in drug-seeking behavior and criminal behavior in neurofeedback-treated children with ADHD as they grow older. We need to collect data in this regard.

The studies reviewed here indicate that neurofeedback treatment is a superior alternative to stimulant therapy in ADHD. It is usually curative of ADHD. It is extremely safe. Over the course of a lifetime it is less expensive than the drugs. In truth, it is a revolutionary approach to managing ADHD. We urgently need to educate our neurological, psychiatric, and pediatric colleagues about the advantages of neurofeedback.

Jonathan Walker, MD

References on page 6

Letter from ISNR Co-Editor

Dear ISNR and AAPB members,

The present edition and next edition of the NeuroConnections is focused on the Z score training that has been instituted over the last 2 years. Perhaps you have had a similar experience in which you used symptom reduction reports; QEEG and other tests to ascertain that the client and you had reached the optimal training goals. I don’t know if you have had, like me, that twinge of concern that all was not addressed and questioned whether the right work had been done. Then I tried Z score training and I experienced relief at seeing the various assessments of power, asymmetry, coherence, ratios, etc move into normative levels. Also, the changes seem to take place in the client more rapidly than I had seen before. Thus was born the concept to have the manufacturers, software developers and clinicians write up the information and experiences with Z score training so other clinicians and researchers can bring their ideas and questions into the ring. I sincerely hope this edition and the next are only the beginning of examinations of the complexities and simplicities of this type of training.

In the next edition the focus will also be on DC training as well as additional Z score training information and LENS training. Hopefully we will have room for some of the articles that are sitting in the wings waiting for publication such as a very good one on marketing ideas.

After the July edition I hope to see all of you at the ISNR conference in the beautiful city of San Antonio Texas. Having grown up not far from there and having visited the city several times, I can assure you the city itself is worth the trip let alone the fact that the conference committee has already lined up really interesting speakers and presentations.

Have a lovely spring!

Merlyn Hurd PhD, BCIAC/EEG Fellow

ISNR Editor

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Jonathan Walker, MD

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the original pioneers have laid down. The name of this superstructure may well be known as Applied Neuroscience, of which neurotherapy as we know it may become one of several branches.

There are important differences between the way most of us think and have conducted research up to now compared with the way those who follow after us will be required to think. For instance, research is progressively revealing the brain as a nonlinear system engaged in ongoing, life-long change and development, plastic and malleable both in a physical sense and in a psychological sense. That is, we have the potential not only to assist the brain in changing its neural systems, and thereby its functionality, but in assisting its owner in changing the emotional values placed on past events, thereby changing his or her perceptual framework in a cogent way. Both are required for optimal performance in an increasingly complex and fast-moving world.

Moreover, systemic thinking must go beyond individual modes of treating patients/clients. A developing literature is likely to change our way of thinking about treatment from modalities alone to systems of treatment; that is, developing multimodality approaches to enhancing the brain’s ability to manage the physical, mental and emotional functioning of the organism regardless of the starting point as we find it.

These emerging developments also presage a strong look at the levels of professional competence and mastery that may be required in order to practice competently in changing the emotional values placed in an increasingly complex and fast-moving world.

Important, the theme of this year’s Conference in San Antonio echoes the developments I’ve touched upon here and which will concern an increasing proportion of our membership. I encourage each and every one of you to attend and partake of the excellent feast of information prepared by our astute and hard-working Conference Committee, headed by Leslie Sherlin.

Connecting Applied Neuroscience to the World is August 28 through September 1 on the romantic and entertaining San Antonio Riverwalk. Go to the ISNR web site, register and make your arrangements early. It’ll be more than worth it.

Meanwhile, we appreciate your commitment to ISNR and our growing field of practice. We invite your comments and suggestions as always.

Nancy E. White, Ph.D.
President, ISNR

AAPB’s 39th Annual Meeting, themed Expanding the Boundaries of Human Potential, is just around the corner. Make plans to join us in Daytona Beach, May 15th to 18th, 2008 for an outstanding program. Keynote speaker Dalton Dietrich, Ph.D. Scientific Director of the Miami Project to Cure Paralysis, will summarize recent advances in the treatment of brain and spinal cord injuries in civilian and military populations, emphasizing reparative strategies to promote cell survival and neuronal regeneration. Daniel Langelban, MD, will discuss the recent experimental use of functional Magnetic Resonance Imaging to discriminate lie from truth in forensic lie detection. (This parallels work by our own Kirtley Thornton, who has published and patented a lie detection algorithm using QEEG). Eric Peper, Ph.D. brings us Japanese energetic healer, Norhiro Muramatsu who will present an experiential demonstration of his technique. More than 80% of pain patients report immediate pain cessation after receiving Muramatsu’s energetic healing. Others have experienced healing of numerous illnesses such as cancers, infertility, migraine headaches, back problems, rheumatism and other health problems. Muramatsu’s presentation will include an actual live healing energy demonstration, while QEEG and other psychophysiological data is recorded and displayed.

Several symposia are of particular interest to neurofeedback practitioners. Master clinicians Elizabeth Stroebel PhD, Judith Lubar, LCSW, DCSW and Carol Schneider PhD will present a seminar exploring the interface of neurofeedback and peripheral biofeedback interventions in promoting pediatric health. The role of neurofeedback in performance enhancement will be well represented in the program. Steven Radlo will discuss neurofeedback enhancement techniques in Sport and Music. Michael Linden Ph.D. and others will lead a discussion of new directions and research in Neurofeedback in Sports Psychology, while Vietta Wilson will present practical tools for developing a performance enhancement practice.
This, our spring issue of NeuroConnections comes at alarming speed. Spring already—of the year 2008. This year, we have had too many losses in our field; in addition I’ve had personal losses. However, Spring, the season of growth and rebirth promises for this trend to stop. So as not to dwell on the awful, I’ll defer to the letters and articles peppered throughout this issue that address our sorrow.

ISNR continues to make headway into establishing our field. We had some challenging issues this past year – some of our members faced harrowing ordeals with regards to their practice activities. ISNR hopes that our efforts (however limited due to the legal constraints we ascertained from our attorney) proved noble. There were mixed responses to this. But the Board spent many hours in discussion at our meetings and we believe we did what we could, reflecting the hours on the phone and in emails in between the meetings. I hope you appreciate the efforts made by the Board Members, all on a volunteer basis. I certainly do! They keep me working and on my toes, that’s certain. I award each one of them a smiley face lollipop and a gift certificate to Starbucks.

I’d like to part with one refreshing thought: While traveling recently, I was working on a crossword puzzle in the in-flight magazine. One of the clues was “Brain-wave chart: abbr.” I didn’t even have to think of what that 3-letter answer was. For this to end up in a mainstream household word; imagine that.

Cynthia Kerson, PhD, BCIA-EEG
Executive Director, ISNR

Two symposia will focus on the growing body of research and clinical experience to guide neurofeedback based treatment of autism spectrum disorders. Vincent Monastra PhD and Michael Linden PhD will also provide an updated overview of a Comprehensive Neuro-behavioral Model of Care for Patients with ADHD.

Technological innovations continue to transform and expand the range of applications in our field. Two symposia will discuss the emerging role of computer based virtual reality environments, in conjunction with psychophysiological and biofeedback modalities for treatment of PTSD in military veterans. Joel Lubar will update us on the growing body of research supporting the efficacy of LORETA based neurofeedback training. Jay Gunkelman will offer a symposium on DC brain stimulation as a therapeutic adjunct to standard neurofeedback protocols.

The conference program will be rounded out with a strong group of workshops and short courses with a decidedly clinical emphasis, presented in a small group format to optimize learning and opportunities for interaction.

The conference hotel, Hilton’s Daytona Beach Oceanfront Resort, is located on the only traffic free beach in Daytona, in the heart of Ocean Walk Village, across the street from the Daytona Lagoon Water Park and within a short walk of Main Street, The Pier and the Boardwalk. We look forward to seeing you there!

Roger Riss, PhD
AAPB Co-Editor
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Z-Score EEG Biofeedback:
Conceptual Foundations

Robert W. Thatcher, Ph.D.

The fundamental design concept of Z score biofeedback was first introduced in 1998 (Thatcher, 1998; 1999, 2000a; 2000b). The central idea of the instantaneous Z score is the application of the mathematical Gaussian curve or ‘Bell Shaped’ curve by which probabilities can be estimated using the auto and cross-spectrum of the electroencephalogram (EEG) in order to identify brain regions that are de-regulated and depart from expected values in real-time. Linkage of symptoms and complaints to functional localization in the brain is best achieved by the use of a minimum of 19 channels of EEG evaluation so that current source density and LORETA source localization can be computed. Once the linkage is made, then an individualized Z score protocol can be devised. However, in order to make a linkage to symptoms an accurate statistical inference must be made using the Gaussian distribution.

The Gaussian distribution is a fundamental distribution that is used throughout science, for example, the Schrodinger wave equation in Quantum mechanics uses the Gaussian distribution as a basis function without which there would be no microwave ovens or computers, etc. (Robinett, 1997). The application of the EEG to the concept of the Gaussian distribution requires the use of standard mathematical transforms by which all statistical distributions can be transformed to a Gaussian distribution (Box & Cox, 1964). In the case of the EEG, transforms such as the square root, cube root; log, Box-Cox, etc are applied to the power spectrum of the digital time series in order to approximate a normal distribution. The choice of the exact transform depends on the accuracy of the approximate match to a Gaussian distribution. The fact that accuracies of 95% to 99% match to a Gaussian are commonly published in the EEG literature encouraged me and colleagues to develop and test the Z score biofeedback program.

The second design concept is the application of the Gaussian distribution to averaged “instantaneous” time domain spectral measures from groups of normal subjects and then to cross-validate the means and standard deviations for each subject for each instant of time (Thatcher, 1998; 1999, 2000a; 2000b). The cross-validation is directly related to the variance of the distribution. However, in order to achieve a representative Gaussian distribution it is necessary to include two major categories of statistical variance: 1- the moment-to-moment variance or within session variance, and 2- between subject variance across an age group. In the case of the Fast Fourier Transform (FFT) there is a single “integral” of the power spectrum for each subject and each frequency and, therefore, there is only between-subject variance in normative databases that use non-instantaneous analyses such as the FFT. Thus, there is a fundamental and important difference between an instantaneous Z score and an integrated FFT Z score with the former having two sources of variance while the latter has only one source of variance. Figure 1 illustrates the relationship between an FFT based normative database versus an “instantaneous” or Joint Time Frequency Analysis (JTFA) database such as used for the computation of instantaneous Z scores.

The third design concept is simplification and standardization of EEG biofeedback by the application of basic science. Simplification is achieved by the use of a single metric, namely, the metric of the “Z Score” for widely diverse measures such as power, amplitude asymmetry, power ratios, coherence and phase delays. Standardization is also achieved by EEG amplifier matching of the frequency response of the normative database amplifiers to the frequency characteristics of the EEG amplifiers used to acquire a comparison subject’s EEG time series.

A fourth and intertwined clinical concept in the design of Z score biofeedback is “individualized” EEG biofeedback and non-protocol EEG biofeedback. The idea of linking patient symptoms and complaints to functional localization in the brain as evidenced by “de-regulation” of neural populations is fundamental to individualized biofeedback. For example, de-regulation is recognized by significantly elevated or reduced power or...
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Z Score EEG Biofeedback continued from page 9

network measures such as coherence and phase within regions of the brain that subserve particular functions that can be linked to the patient’s symptoms and complaints. The use of Z scores for biofeedback is designed to “re-regulate” or “optimize” the homeostasis, neural excitability and network connectivity in particular regions of the brain. The functional localization and linkage to symptoms is based on modern knowledge of brain function as measured by fMRI, PET, penetrating head wounds, strokes and other neurological evidence acquired over the last two centuries (Heilman & Valenstein, 1993; Braxis et al, 2007; the Human Brain Mapping database of functional localization at: http://hendrix.imm.dtu.dk/services/jerne/brede/index_ext_roots.html). Thus, the false concern that Z score biofeedback will make exceptional people dull and an average individual a genius is misplaced. The concept is to link symptoms and complaints and then monitor improvement or symptom reduction during the course of treatment. For peak performance applications, a careful inventory of the client’s personality style, self assessment of weaknesses and strengths and identification of the client’s specific areas that he/she wishes to improve must be obtained before application of Z score biofeedback. Then, the practitioner attempts to link the client’s identification of areas of weakness that he/she wants improved to functional localization as expressed by “de-regulation” of deviant neural activity that may be subject to change.

As mentioned previously, the instantaneous Z scores are much smaller than the FFT Z scores in the NeuroGuide software program which uses the same subjects for the normative database. Smaller Z scores when using the instantaneous Z scores is expected. One should not be surprised by a 50% reduction in JTFA Z scores in comparison to FFT Z scores and this is why it is best to first use 19 channel EEG measures and the highly stable FFT Z scores to link symptoms to functional localization in the brain to the extent possible. Then use the Z Score program inside of NeuroGuide to evaluate the patient’s instantaneous Z scores as a therapy design process before the biofeedback procedure begins (www.appliedneuroscience.com). This will allow one to obtain a unique picture of the EEG instantaneous Z scores of each unique patient prior to beginning Z score biofeedback. The clinician must be trained to select which Z scores best match the patient’s symptoms and complaints. A general rule for the choice of Z scores to use for biofeedback depends on two factors obtained using a full 19 channel EEG analysis: 1- scalp location(s) linked to the patient’s symptoms and complaints and, 2- magnitude of the Z scores. De-regulation by hyperpolarization produces slowing in the EEG and de-regulation due to changes in inhibition produces deviations at higher frequencies. The direction of the Z score is much less important than the location(s) of the deviant Z scores and the linkage to the patient’s symptoms and complaints.

Figure 2 is an example of the instantaneous Z score screen inside of NeuroGuide™ while the instantaneous Z scores are being reviewed. A free demo of instantaneous Z scores that are used for real-time Z score biofeedback can be downloaded and evaluated at: http://www.appliedneuroscience.com/Contact%20Download1.htm

A P4 and C4 theta and delta deviation from normal is evident as well as bilateral occipital delta deviations from normal. There is diminished alpha and theta in the instantaneous Z scores but on the average the dynamic FFT provides a much clearer picture of the right parietal and right central Z scores. For illustration purposes only, a biofeedback protocol would be to reward Z score values less than and greater than 2 standard deviations in the theta frequency band in P4 and C4 and most of the feedback...
Whole-Head Normalization using Live Z-Scores for Connectivity Training

Part 1 of a 2-Part Series
Look for part 2 in the July, 2008 issue

Thomas F. Collura, Ph.D.

This article relates some of our last 2 years of work with Live Z-score Training (LZT), and how the methods and clinical experience have evolved. Starting with the simple use of live Z-scores to view EEG parameters and do simple training, we have evolved the practice into a comprehensive multichannel whole-head approach with an underlying rationale and a growing set of advanced protocols.

We have been doing live Z-score training (LZT) with 1, 2, and 4 channels, since April, 2006. Our initial implementation gave access to any of the possible Z-scores, through a general, flexible mechanism, called the “Event Wizard.” This was used to construct basic protocols using single Z-scores, Z-score range training, and combined Z-score training such as “all coherences normal.” From there, we moved to “range training,” in which one or more Z-scores can be trained within a range. These provided important starting points for clinical work, which then motivated additional developments.

The LZT DLL (Thatcher, this issue) that underlies this approach provides Z-scores for 6 important metrics: absolute power, relative power, power ratios for each channel, and coherence, phase, and asymmetry for each pair. Thus, 1 channel of EEG provides 26 Z-scores, 2 channels provide 76 Z-scores, and 4 channels provide 248 Z-scores. As we shall see, the use of 4 channels is a significant advancement, as it provides data on 6 simultaneous interconnectivity paths, not just 1, and thus provides a gateway to whole-brain training.

The simple LZT training worked well. By adding the ability to specifically target connectivity measures, clinical benefits were observed (Smith, 2008). In addition, we realized that additional power in the design of complex protocols would be of great value. For example, training a single parameter from a single component band is effective, but may not be optimal. Training all component bands in a given metric ensures a more comprehensive training for purposes of local neuronal activation.
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<th>Start Date</th>
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<tr>
<td>Chicago, IL</td>
<td>July 28 - August 1</td>
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<td>SF/Oakland , CA</td>
<td>December 15-19</td>
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In response to clinician demand, EEGInfo has created the **Protocol Guide: Case Study**. This video case study expands on Sue Othmer’s popular "Protocol Guide," offering the unique opportunity to experience Sue's decision-making process firsthand.

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or relaxation. Similarly, when more than 1 channel of EEG is available, it is beneficial to incorporate all channels into the training, to provide greater coverage and specificity, and to address connectivity. Multiple connectivity training is a significant capability of live Z-Score training, and may be its greatest strength.

Regardless of the number of channels used or the Z-score training strategy, feedback has generally consisted of animations, DVDs, games, sounds, music, and other typical displays. The trainees are not necessarily aware that they are using an entirely new form of training. They are only aware of the brain states into which they are being guided.

The combination of proper QEEG methods, along with a well-planned neurofeedback program of protocols based upon live Z-scores, can provide an accelerated and highly targetable regimen.

Jonathan Walker has emphasized the delicate nature of coherence training and the dangers inherent in overtraining any particular coherence. Z-scores provide an important relief of this concern, by ensuring that coherence targets are appropriate for the individual. We have found that, consistent with Walker’s observations, it is generally difficult to normalize connectivity of the brain. Moreover, it is possible to cause abractions of various types, whenever attempts are made to alter the coherence of one particular band in one particular direction.

An example of the importance of Z-scores connectivity training is presented by Smith (this issue). As experienced in this study, a single coherence between two sites was targeted for traditional neurofeedback coherence training. The band of interest was effectively altered. However, as that coherence normalized, other coherences in the brain became abnormal. Even without the trained connection moving toward hypocoherence, the rest of the brain had mal-adapted to the training.

When I presented this to a former physics professor who had pioneered neural network research, he replied, “I am not aware of any conservation principle that would dictate a response like this.” So that got us to thinking about how and why the brain would respond in this way to the information being fed back. The brain, like any dynamical system, will seek the minimum-energy pathway to satisfy external and internal constraints. Indeed, one may posit a model of “brain hydraulics” in which various constraints are at work. These may variously be regarded as tendencies or pressures, which give rise to the flow of information and control, thus reflecting the cybernetic activity of the brain.

Robert Thatcher has proposed a predator-prey model that describes the mediation between short-range connections and long-range connections in the brain. According to his model, each neuron has a limited resource of inputs and outputs, which it must allocate between the various connections available, including both short-range and long-range connections. As the brain trades off between these connections, changes in coherence and phase metrics will reflect this dynamic reorganization.

Therefore, it is reasonable to set forth a brain model in which the response to neurofeedback training is in the form of a variety of adjustments which, through learning, tend to have a lasting nature. In the case of amplitude-based training, changes take the form of changes in cortical relaxation produced by alternating the strength of individual inhibitory connections, thus modulating cortical excitability, and thalamocortical cortical cycling tendencies, for the affected cortical locations and pathways. Other metrics are more related to connectivity, such as coherence and phase, and the changes they introduce are different in nature. They include the structured rearrangement of the neuronal connection strengths, in order to comply with the training conditions.

When the conditions are limited, then the brain’s response may be similarly limited.

This does not mean that the training effect is limited to the training area. Quite the contrary. Both beneficial as well as adverse responses may occur. Thalamic pathways, as well as various cortical interconnections are involved. Stark (2008) has used Z-scores extensively, and has learned to see patterns and time-dependent shifts in the full complement of Z-scores. He often sees phase as a primary adjuster, then wave of re-organization.

A single z score is just a target re-implemented. Especially in cases of connectivity metrics, it provides a valuable aid to determining and using target values. It can also be useful when used in a ranged fashion (high and low thresholds), to train within a range. However, as we see it, targeting a single connectivity metric, although it may be trained within a normal range, can cause other reactions in the brain, which are not necessarily beneficial.

We therefore believe it is important to use multiple channels with Z-scores, and to use the information effectively. A minimum of 2 channels are needed in order to see the pathway between them, and compute coherence, phase, and asymmetry metrics. But when 4 channels are used, the number of connections is 6, which is significantly more information.

Four channels are sufficient to ensure coverage of the basic interconnections in a given training paradigm. Examples of typical arrangements include F3-F4-P3-P4 and C3-C4-Fz-Pz. With a MINI-Q, it is possible to define predefined layouts of 4 channels that emphasize different brain connections.

![Figure 1: Typical multivariate Z-Score display using 4 channels, providing 248 Z-scores. The sensors happen to be placed at O1, P3, T4, and P4.](image)
Our elementary school is just across the street, less than 100 yards from our house, but because there is no crossing-guard nor stoplight my daughter rides a bus to school. After picking up my daughter, the bus meanders around our little village and passes under the town’s only traffic light not once but twice before depositing its load of children at the back steps of Churchville Elementary. Our house sits on the corner of Main and Schoolville, or so it seems, as bus after school bus rumble by every few minutes each weekday morning. We share schools with a neighboring town and some of the neighborhood children attend schools out of our district, but still it seems absurd to see a string of nine or ten buses service what could be no more than a dozen kids on our tiny street.

A few months ago a bus driver fell ill and the substitute driver accidentally stopped in front of our door, instead of the next door down, and our daughter hopped aboard. You can imagine the look on our faces when moments later, the first bus out of sight, a second bus pulled up to our door -- her bus. We panicked and called home, sure our bundle of joy at her proper destination. Still we needed to see for ourselves so we hurried to the back entrance of the school and waited for our intrepid kindergartener. You can imagine the look on our faces when moments later, the first bus out of sight, a second bus pulled up to our door -- her bus. We panicked and called home, sure our bundle of joy at her proper destination.

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“Mommy,” she said, “There was a whole bunch of new friends on the bus!”

What a way to be: dropped into a group of strangers my five-year-old imagines only friends -- friends she simply doesn’t know.

The late Jeffrey Gray and Neil McNaughton published a seminal work on anxiety and fear that describes how the brain -- the adult brain -- defends itself against strangers on the bus. They consider all clinical disorders defensive and they organize responses into a hierarchy based on type of threat. Why this book is not cited in our field very often may be due to its title, which is a mouthful, “The Neuropsychology of Anxiety: An Enquiry into the Functions of the Septo-Hippocampal System”, Gray & McNaughton (2000). “Septo-Hippocampal Systems” sounds like a how-to guide for plumbers.

According to the model our neural plumbing encounters both potential and actual threats and depending upon whether these threats are detectable or not and avoidable or not, different brain structures become engaged and dominate our response.

<table>
<thead>
<tr>
<th>Threat type</th>
<th>Detectable</th>
<th>Avoidable</th>
<th>Mental strategy</th>
<th>Behavioral Response</th>
<th>Associated clinical disorder</th>
<th>Primary brain system involved</th>
</tr>
</thead>
<tbody>
<tr>
<td>potential</td>
<td>undetectable</td>
<td>avoidable</td>
<td>anticipate</td>
<td>obsession</td>
<td>OCD</td>
<td>cingulate</td>
</tr>
<tr>
<td>potential</td>
<td>detectable</td>
<td>avoidable</td>
<td>assess</td>
<td>anxiety</td>
<td>GAD</td>
<td>septal-hippocampus</td>
</tr>
<tr>
<td>potential</td>
<td>detectable</td>
<td>unavoidable</td>
<td>conserve resources</td>
<td>depression</td>
<td>MDD</td>
<td>NA/5HT</td>
</tr>
<tr>
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<td>detectable</td>
<td>avoidable</td>
<td>flee</td>
<td>fear</td>
<td>phobia</td>
<td>amygdala</td>
</tr>
<tr>
<td>actual</td>
<td>detectable</td>
<td>unknown</td>
<td>fight</td>
<td>anger</td>
<td>rage &amp; related</td>
<td>medial hypothalamus</td>
</tr>
<tr>
<td>actual</td>
<td>detectable</td>
<td>unavoidable</td>
<td>freeze</td>
<td>panic</td>
<td>panic disorder</td>
<td>pariaqueductal gray</td>
</tr>
</tbody>
</table>

Here is the hierarchy, in tabular form:

The entire hierarchy may come into play in a single encounter, for instance, when an animal (human or nonhuman) runs into a possible threat. Imagine ourselves an animal milling about the woods at night:

1. We sense danger (undetectable avoidable potential threat)
2. We see or smell or hear a distant and shadowy figure (detectable avoidable potential threat)
3. As the shadow approaches, we seek clues to its form and intention (detectable unavoidable potential threat)
4. It draws near (possibly avoidable threat)
5. It closes to just outside of our ability to strike at it, but we could be within its range to strike (unknown avoidability)
6. It now closes to within our range (unavoidable)

According to Gray and McNaughton, the last two defenses are fight followed by freeze (bottom two rows of the table). I asked Neil about this peculiar sequence in his behavioral typology: Why would we fight for a bit, and failing to keep a predator at bay, go into a freeze? Only a few creatures succeed at playing possum, and fewer still after a good predatory tussle, and given that most threats -- bigger fish, larger crustaceans, unruly bosses -- have a longer reach than us, a larger zone of attack, why stop fighting once the forces of darkness have finally drawn within reach of our teeth, claws, or tentacles? Why not freeze before we start to fight, and maybe we will be passed over.

Neil responded to what I saw as an apparent misordering of last resorts by arguing that a final freeze enables a victim to leap past an attacker without exposing its flank. But if we could outrun it in close...
Jonathan E. Walker, M.D.

- Board Certified Neurologist
- Board Certified Electroencephalographer
- President of the Neurofeedback Division of AAPB
- President of the American Board of QEEG Technology
- Pioneer in the field of neurotherapy research and treatment, he has used neurofeedback in his medical practice for over 20 years

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Whole-Head Normalization continued from page 15

and activities. Furthermore, these pre-defined “quads” can be used for assessment as well as training, providing a unified approach to whole-brain work.

In the case of F3-F4-P3-P4, for example, we have not only 4 important brain sites, but also 6 important connection pathways. This 4-channel montage allows us to monitor both the left and right frontal areas, and the left and right posterior areas. It also provides information relating to left intra-hemispheric function (language), right intra-hemispheric function (spatial, etc), frontal inter-hemispheric function (attention, planning), and posterior inter-hemispheric function (sensation, perception). This is a very simple, yet comprehensive way to gain access to EEG information for training purposes.

The following figure shows an example of a 4-channel Z-score display from the system. Our software automatically compiles, displays, and computes complex training statistics based on all of the available scores. There are a total of 248 Z-scores available. The indicated Z-scores are dynamically color-coded in a manner that makes it easy to spot deviations. The power-based Z-scores are clustered at the top of the display, and the connectivity metrics are shown at bottom.

It is not possible to understand the dynamics of brain response by watching a single Z-Score, or even a small number of Z-Scores. It is necessary to simultaneously monitor the full range of variables in a suitable number of sites, in order to observe the dynamical brain processes (Stark, 2008). To relieve these concerns, it is necessary to implement a comprehensive brain training method. This method needs to simultaneously address issues of activation and relaxation, connectivity in the form of communication and control, and relative activation.

To this end, we have designed a series of advanced multichannel, multivariate training methods, which are collectively described as “Multivariate Proportional,” or “MVP”. These are comprised of algorithms that automatically incorporate all of the available Z-scores for all channels acquired, and compute continuous output values that are in essence figures of merit for the Z-score set. The MVP score is thus truly a complex measure of “how normal” the EEG is, when accounting for all available information.

This article is the first in a 2-part series that explains the theory behind the use of Z-score training with multiple sites. Look for a practical description of training protocols based upon this in your July issue of NeuroConnections (Ed.).

References:
Many species are extremely dimorphic, with males physically larger than females, sometimes magnitudes larger, so perhaps the last stage of threat response is not defensive but reproductive. Risking death for sex is what animals do for a living.

So a functional typology of mating behavior may be entangled with a defensive one. Lordosis (reproductive behavioral freezing) is not triggered by periaqueductal gray nuclei of the brainstem as fear freezing is, yet a second behavioral hierarchy in competition with defensive behaviors makes sense. Approach weighed against avoidance, a brake next to the accelerator. I can imagine a similar organization laid out by Gray and McNaughton for mating behaviors, using the same terminology but with mating in mind: potential and actual, detectable and undetectable, avoidable and unavoidable... actually those terms generate more humor than insight... something along the line of high school and my Senior ball and all of them, avoidable, unavoidable, and potential mates, sitting at my table, making it a very awkward evening indeed.

As for clinical disorders, symptoms such as phobia, fear, anxiety, panic, and OCD are of maladaptive intensity due to either (1) excessive sensitivity to specific eliciting stimuli or (2) excessive activation of relevant brain structure, according to Neil. In other words, too many resources are being used up in detection or response. It is of course healthy for defensive systems to override higher reasoning during emergencies, but a clinical disorder manifests when primitive systems coup d’etat at the drop of a hat, and refuse to step down once the crisis is over.

“I’m in charge here,” proclaimed Alexander Haig to the press corps after President Ronald Reagan was shot in 1981. The subcortex makes the same claim within a clinical disorder—“I’m in charge here”—and therapy may be necessary to restore cortical leadership to the traumatized brain. But if you remember correctly that Monday in March, 1981, Haig never was in charge. And the subcortex is under similar delusion, despite its many proclamations, when it attempts to wrest control of the human mind.
Z Score EEG Biofeedback continued from page 11

rewards will automatically occur in the delta and theta frequency band. As mentioned previously, the above is an example of an individualized Z score biofeedback procedure after reviewing the patent’s EEG using the same instantaneous Z score program running in BrainMaster, Thought Technology, EEG Spectrum and Deymed.

References:

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Small Group Discussions (formerly Clinical Corners) Plans Moving Forward for ISNR in August

John Carmichael, PhD – SGD Coordinator

Plans are well underway for the ISNR annual Conference this year to be held in San Antonio. Eighteen topics for the SGD portion (small group discussion; formerly clinical corner) have been selected and potential moderators have been approached for each one. The purpose of SGDs is for people with similar research and/or provider activities to meet informally to share experiences and issues surrounding a topic of mutual interest.

Eleven of the current topics have to do with the results of neurofeedback with a variety of populations including athletes, the elderly with memory problems, and those with conditions such as PTSD, Autism, Aspergers, alcoholism, depression, reading disabilities, migraine headache, ADD/ADHD, traumatic brain injury, and chronic pain. Each of these SGDs will begin with a brief overview of the published research to date. Invited moderators for these SGDs include Drs. Carmichael, Coban, Sime, Hamlin, Baehr, Walker, H. Budzinski, Nelson, Carmen, Lubar, and Elliot.

Some of the the remaining SGDs are concerned with fee-setting/billing (Dr. Nash), generalization of the effects of neurofeedback (Dr. Fagerholm), issues in clinical research (Drs. Nelson and Gattis), and strategies for choosing neurofeedback hardware (past-president Judith Lubar).

Finally, originators of QEEG scoring systems have been invited to moderate their own SGD: Dr. Thatcher on NeuroGuide, Dr. Sterman on SKIL, and Dr. Pascual-Marqui on LORETA. Originators of other scoring systems will be invited to the 2009 conference.

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He dropped like a marionette whose strings had gone slack, collapsing on the kitchen floor. Alerted to the fall by the sharp intake of breath of the adult next to me, I turned quickly but only glimpsed it out of the corner of my eye. It wasn’t immediately clear what had just transpired. He bounced back up instantly, my red headed boy, and with his three year old exuberance was back at our Labor Day weekend festivities.

The adults, including myself, were left stunned trying to make sense out of what we had witnessed. This was no ordinary fall, one minute he was standing still manipulating a Sponge Bob toy, the next he was a flaccid puddle on the floor and the moment following, turgor restored, he was running to join his mates as if nothing had happened. We cautioned ourselves not to over-react, but I had seen enough to know that my world had inexorably changed.

There had been disturbing signs for two weeks. Jack’s right big toe looked like hamburger from being serially stubbed. But only his right toe, his left toe was completely unscathed. Jack was born a runner and was as fast as the wind. Falling came with the territory. But the number of bruises he had collected from recent tumbles was unusual even for him. Diaper trained for a year, Jack urinated in his pants at the beginning of this holiday weekend and when asked about the wetness, seemed blissfully unaware.

The day following Jack’s terrifying collapse, he could not stand for several minutes while attempting to pull up his pants. A trip to the emergency room and subsequent visits to a pediatric neurologist confirmed our worst fears. Jack had Epilepsy, Cryptogenic, Benign Rolandic Epilepsy.

Cryptogenic, the name neurologists give to the condition when they make an educated guess as to its cause. Rolandic, delineating a spike focus on the sensory motor strip. Benign, a term used in the hope that the patient will be lucky enough to maintain a less virulent form of the disorder; that it doesn’t bear its life damaging teeth; and disappears quietly after several years of medication. Unfortunately, the disorder quickly became anything but benign.

Jack was an athletically gifted child. He had exquisite timing, unusual balance and speed. “How old is that boy,” adults would ask in wonder, whenever we played any ball game in Central Park. Before he was three he could unerringly kick a soccer ball that was rolled to him, taking care to take one preparatory step before using his left leg to kick the ball farther than seemed possible for a three year-old child. He could swing a bat making the kind of contact with the baseball that had his father dreaming of afternoons in Yankee stadium. Most impressive, he could catch a tennis ball with one hand over and over again.

All his physical gifts disappeared as the seizure disorder worsened. Jack’s seizure frequency increased dramatically. In addition to the atonic (drop seizures), he developed myoclonic and absence expressions of the disorder. He was having many seizures each day. He could not run, kick, throw, bat or catch. He stopped trying. He became sedentary. His personality changed. Our energetic boy with the sunny disposition became by turns sullen and hostile, labile and violent. He physically attacked his mother and brother. The increased doses of anti-convulsant medication did nothing to halt the progression of the illness.

I begged my wife to allow me to train...
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### 2008 Foundations Trainings

**May 12-14, 2008** by Mary St. Clair, MSW, BCIA-EEG. Pre-AAPB Conference, Daytona Beach, FL. Registration: through [www.aapb.org](http://www.aapb.org)

**June 20-22, 2008** by Mary St. Clair, MSW, BCIA-EEG. West Bloomfield, MI. Registration: through [www.ochslabs.com](http://www.ochslabs.com) or (707)823-6225

**Aug 25-27, 2008** by Mary St. Clair, MSW, BCIA-EEG. Pre-ISNR Conference, San Antonio, TX. Registration: through [www.isnr.org](http://www.isnr.org)

**Sept 19-21, 2008** by Cathy Wills R.N., M.S.N., C.N.S. Location TBA (East Coast). Registration through [www.ochslabs.com](http://www.ochslabs.com) or (707)823-6225

**Oct 3-5, 2008** by Len Ochs, Ph.D. Sebastopol, CA. Registration: through [www.ochslabs.com](http://www.ochslabs.com) or (707)823-6225

**Oct 17-19, 2008** by Mary St. Clair, MSW, BCIA-EEG. West Bloomfield, MI. Registration: through [www.ochslabs.com](http://www.ochslabs.com) or (707)823-6225

**Nov 14-16, 2008** by Len Ochs, Ph.D. Sebastopol, CA. Registration: through [www.ochslabs.com](http://www.ochslabs.com) or (707)823-6225

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### 2008 Advanced Trainings

**May 12-14, 2008** by Len Ochs, Ph.D. Pre-AAPB Conference, Daytona Beach, FL. Registration: through [www.aapb.org](http://www.aapb.org)

**Jul 25-27, 2008** by Len Ochs, Ph.D. Sebastopol, CA. Registration: through [www.ochslabs.com](http://www.ochslabs.com) or (707)823-6225


**Sept 19-21, 2008** by Len Ochs, Ph.D. Location TBA (East Coast). Registration: through [www.ochslabs.com](http://www.ochslabs.com) or (707)823-6225

**Nov 7-9, 2008** by Len Ochs, Ph.D. Sebastopol, CA. Registration: through [www.ochslabs.com](http://www.ochslabs.com) or (707)823-6225
our son with neurofeedback. With a ferocious maternal instinct, her desire to protect her wounded cub precluded any intervention. Neurofeedback with all its electronic gadgetry was difficult to understand at best and threatening at worst. She jokingly referred to me as Dr. Frankenstein and vowed her boy would never be my monster.

One day, during one of my wife’s cripplingly painful bouts of monthly menstrual pain, she gave in to my pleading and allowed me to train her with neurofeedback. She was astonished that within minutes she was free of the pain that had plagued her for decades. Nothing except the most powerful narcotics had ever helped her and the medication left her unable to function. She was a convert. Neurofeedback removed the proverbial thorn from the lioness’ paw. It couldn’t have come at a more opportune time.

Jack had reached the dose limit of his medication for his body weight. Still seizing daily, his neurologist wanted to add a second medication. I started neurofeedback by collaborating with a more experienced clinician, eventually taking over the training myself. Jack managed to gain periods of seizure control within months. But despite several different approaches the seizures always broke through. We would train through them and find homeostasis once again. This cycle repeated itself several times. In the autumn of the year following Jack’s seizure onset, we were watching football together. Jack’s physical gifts had begun to return and with it the swagger of the young athlete. He was once again taking physical risks that were well within his pre-seizure abilities. Mimicking a diving tackle, Jack ran full speed toward our couch. He leapt, his body becoming horizontal in the air, a linebacker poised to spear the fluffy recesses of our couch. But instead of a soft landing on an over stuffed pillow, he smacked his head on the arm rest of the couch causing swelling and bruising in the right orbital region. The seizures returned with alarming frequency and intensity.

Nothing that had worked in the past was working now. I was observing three to four hundred microvolt spikes in the raw trace. We turned to qEEG and Jonathan Walker. Dr. Walker recommended a two channel inhibit approach and I was astonished to observe an EEG without inter-ictal epileptiform discharges the day following our first training. (Illustration 1) The seizures ceased within days only to return when we began coherence training. So began a series of qEEGs and trainings, two channel inhibit protocols followed by coherence training. The cycle of control followed by seizures hued to the sequence of inhibit protocols followed by coherence training. The coherence training was making Jack worse but the inhibit training by itself did not seem to have staying power. If I just trained magnitude, Jack would eventually begin to produce inter-ictal epileptiform discharges followed shortly by seizures. The literature suggested that the combination of coherence and magnitude training was the key. But I could not train coherence for a session or two and do another qEEG. My four year old son was barely tolerating all the neurofeedback training. It was clear to me that I needed a different way to train coherence.

True to form, in the spring of 2006 the last round of coherence training had ushered in a new round of seizures. The seizure activity was generalizing, moving from a parietal focus to expressions in the central and temporal regions. Our neurologist urged an immediate change in medication. I was desperate. It was at this time that Tom Collura at Brainmaster introduced Z score training. On the first day it was available in early April, I acquired the software and began to use it with Jack.

At first I attempted to train coherence to zero. That is, the software would only reward Jack when he raised his mostly hypocoherence from negative 2 or 3 standard deviations to 0. It did not occur often
enough to keep Jack interested in the feedback. More importantly, it was a close facsimile of the failed linear coherence training that had already caused such problems. It pushed coherence in one direction and the worry was that once again Jack would be moved from one coherence abnormality to another. Dr. Collura had programmed a range function into the software and I began to use it. It allowed coherence to be trained within the limits of positive and negative standard deviations, a ceiling and a floor. It exercised coherence in a range. By early May, Jack’s seizures had stopped. A final qEEG confirmed the clinical results by revealing dramatic, positive changes in the connectivity maps. (Illustration 2)

Despite all the training, Jack’s frequent spike activity continued. Fortunately, it no longer progressed to seizures but our concern led to a twenty-four video EEG monitoring. The test revealed that Jack was spiking about 50% of the time while he was sleeping. A review of his previous overnight monitoring revealed that his brain was discharging approximately eighty percent of the time during slow wave sleep. This was enough to meet the diagnostic criteria for Electrical Status Epilepticus during Slow Wave Sleep (ESES), a devastating disorder that causes severe cognitive deficits in 60% of children diagnosed. We were concerned, but not alarmed, as the spike activity had diminished in frequency and also in magnitude. The spikes were now about half as powerful rarely topping fifty microvolts. In fact, they might be better described presently as sharp waves rather than spikes. Most reassuring, however, was that Jack was meeting all his mental developmental milestones ahead of his cohort.

Thanks to neurofeedback, Jack is thriving today. He has been seizure free for over a year and one half. His renewed ebullience has brought many friends and much social activity. We are working on eliminating his anti-convulsant medication. Most important, Jack has not suffered cognitive decline from his disorder. He is doing well after being selected for a gifted and talented program in his school.

In the meantime, Jack’s physical gifts have returned. As his soccer coach this fall, I was thrilled to watch my now six year-old son dribble the length of the field through opposing players to single-handedly bury a shot in the goal. The opposing coach sidled up to me and asked, “Is the red head your boy? He’s quite a gifted athlete.” He had no idea how much that meant to me.

ACROSS
4. Pioneer of biofeedback with spinal cord injury
6. A left intra-hemispheric function-Collura
7. JTFA Z scores are _____ in comparison to FFT Z scores-Thatcher
8. Training within the limits of positive and negative standard deviations (two words)-Smith
9. Drop seizures - Smith
13. “Mr. Coherence”
15. Skin conductance, temperature, and heart rate, to name a few-Saab
17. Training for peak performance-Collura
20. Measure of distance from the mean (two words)
22. A right intra-hemispheric function-Collura
23. Connectivity metric
25. She was first to use NF to bring individuals out of level two coma (two words)
27. Statistical distribution; the basis for Z-score training-Thatcher

DOWN
1. A frontal inter-hemispheric function-Collura
2. Choice of training sites should always be guided by both Z-score values and these-Thatcher
3. Multichannel, multivariable training (two words)-Collura
5. Slow wave sleep epileptic disorder (acronym)-Smith
10. New Zealand blue marlin namesake (two words)
11. Training to approximate population average values-Collura
12. A posterior inter-hemispheric function-Collura
14. z-score training developer
16. This reference should always be used when working with z-scores (two words)-Saab
18. Minimum number of channels to compute coherence-Collura
19. Has shown equivalent efficacy as Ritalin for symptoms of ADHD-Walker
21. These drugs may sensitize the brain to cocaine-Walker
24. On the sensory motor strip-Smith
26. Appetite suppression, insomnia and anxiety are common side effects of this-Walker

Crossword Puzzle Answer on Page 39
The Behavioral Medicine Research & Training Foundation offers distance based courses in Neurofeedback, General Biofeedback, A&P, Pain, UI, and many others

NEW COURSE: **Neurofeedback (EEG biofeedback)**
36 CE credit, BCIA approved, distance education course on the Basics of Neurofeedback:
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Z-Score Biofeedback with Thought Technology’s Infiniti System

*Marc Saab, Thought Technology Ltd.*

Until recently, the normative database of electroencephalogram (EEG) recordings compiled over the last 20 years by Applied Neuroscience Inc. (ANI) had only been available as part of the company’s NeuroGuide EEG analysis system. This normative database has now been packaged and made available to neurofeedback system manufacturers in the form of the Z-Score Biofeedback Library. This library provides real-time comparisons to the normative values in the database, reporting almost instantly on how much deviation from the normative values exists in the subject’s EEG. The use of these normative values, defined by the subjects included in the database, is not meant as a diagnosis of either health or pathology, but rather serves as a useful guideline and a powerful tool in QEEG-guided neurofeedback.

The amount of deviation, or the *z*-score, is achieved with a simple mathematical computation which compares the measured value of EEG to the normative value in the database (also referred to as the mean, or norm), and reports the difference in multiples of standard deviation. This is done for 6 different metrics, within 8 bands and 10 band ratios. These metrics are coherence, phase difference, amplitude asymmetry, absolute power, relative power and power ratios. For example, in a twenty-four year old subject, with eyes open, the phase difference of 32 degrees between the alpha band EEG at two sites on the scalp, might yield a z-score of 1.5. This means that for the locations in question, within the age group of the subject, and frequency band of the EEG, the phase value of 32 degrees differs from the mean value in the database by one and a half times the standard deviation of the data set. Or simply put, the value of 32 degrees is 1.5 standard deviations from the mean.

The result is that training strategies are simplified, by allowing the clinician to train the subject towards the norm rather than towards an arbitrary value that may be difficult to determine. In the example given above, the clinician may decide to train the phase of 32 degrees upward or downward depending on the goal, but the question always remains, “Towards what value?” Normative training always answers the question the same way: “Train towards norm.” This is of course one strategy of many, but it is quickly becoming popular because of the simplicity of the method and the appar-
ent clinical efficacy that is to date being reported by users.

**Simple approach to assessment and training**

The Z-Score Biofeedback Library provides all the aforementioned metrics for each frequency band, which translates into seventy-six different output values for two channels of EEG (and 248 for 4 channels of EEG!). While the task of selecting metrics for training strategies may seem daunting at first, the recommended strategies are actually quite simple.

There are several ways to use these values to achieve the desired clinical outcomes. One method is analogous to the traditional approach of QEEG assessment and guided training, in which EEG is measured and underlying values are noted for subsequent regulation. Using the Z-score Biofeedback Library, deviations from norm are evident on the recording screen and the need for external software or reporting is eliminated. Outliers (in this case large z-score values) are easy to recognize, and can then be trained in several ways: they can be selected and trained together, each can be trained individually, or they can be targeted by a global training of all z-scores simultaneously.

This is not exactly the same approach as using the NeuroGuide-based assessment. For instance, NeuroGuide assessment z-scores will always be larger due to certain statistical factors (it is not uncommon to see a ratio of 2:1 between NeuroGuide offline z-scores and instantaneous z-scores from the library). The real-time method should nonetheless lead to the same conclusions about which aspects of brain function deviate significantly from the norms in the database, and hence which ones could perhaps benefit from self-regulation training. To paraphrase Dr Robert Thatcher of ANI, often in the z-scores that come from the Z-score Biofeedback Library, an abnormality will show a high, fairly steady z-score while the other z-scores tend to vary more but with lower magnitude. The steady deviations that do not vary much are the same ones that contribute most to the FFT z-scores in the NeuroGuide report, and reflect a chronic or continuous de-regulation which can be modified by neurofeedback. When using the real-time z-scores, the ability to keep track of mean z-scores, both overall and at discrete intervals, to show the trend in the session, allows this type of assessment to be possible.

The other very practical approach is to simply start a session and give rewards as the z-scores approach the norm, essentially performing the assessment and training simultaneously.

In both cases, the percentage of time in condition is reported, both in real-time and in post-session reports, as a measure of the success of the training session. Depending on the choice of the user, this variable can be related to a single z-score, a combination of z-scores or the entire set of z-scores. Useful configurations may include all z-scores across a metric (for example, percentage of time the coherence is within condition for FFT z-scores in the NeuroGuide report, and reflect a chronic or continuous de-regulation which can be modified by neurofeedback. When using the real-time z-scores, the ability to keep track of mean z-scores, both overall and at discrete intervals, to show the trend in the session, allows this type of assessment to be possible.

**Continued on page 30**
So Many Choices

Only One Software...

CONNECTIVITY TRAINING

**Thatcher’s Z-score Biofeedback**
Uses the feedback power of BioGraph to train from norms on-the-fly, or for pre- and post-session assessment.

**Industry-Standard Coherence**, phase and amplitude asymmetry computations.

**Dual Threshold Instruments** to allow clients to train within a predefined range.

ADVANCED EEG

**JTFA - Gabor and Adaptive Spectrograms** allow training specific bands using JTFA frequency separation: faster and more accurate than filtering or FFT frequency separation.

**SCP – Slow Cortical Potentials**
Train SCP in DC or slow AC modes using our new EEG-Z3 sensor. Assess SCP using dual-stimuli Go/No-Go evoked potential protocols.

**EP/ERP – Evoked and Event-Related Potentials**
Record and train audio or visual evoked potentials, including P300 individual responses or multi-trial averages. User-programmable protocols can be any combination of mixed-mode (audio, visual or both), single or dual-stimuli, Go/No-Go, and motor response.

**Reaction Time Measurement** for assessment of attention, and focus using our AV-Sync interface and software with millisecond accuracy. Report on errors of omission, errors of commission, success rate and failure rate, on-the-fly or post-session.
HEART RATE VARIABILITY (HRV)

**Programmable Respiration Pacer:** "Follow the bouncing ball" display shows a dot moving along a template line of the respiration cycle. Choose respiration rate for inhalation, hold, exhalation, hold - with automatic pacing from the starting to target rate over a chosen time.

**Artifact-Free Wrist-to-Wrist EKG** uses a new algorithm to compute IBI and HR - designed to function in the presence of heavy movement and EMG interference.

**Pulse Transit Time:** The Pulse Transit Time algorithm calculates the time between the EKG R-Spike and the blood volume pulse – useful in investigating relative changes in BP.

**Heart Rate Variability pNN50 Computation** (ratio of consecutive RR-interval differences greater than 50 ms - or any user defined time period) was added to expand on BioGraph’s heart rate variability (HRV) assessment tools.

OTHER FEATURES

**Frequency Band - Peak Amplitude:** For magnitude of the tallest bin in the FFT array. Used with the breathing pacer can help detect the resonant frequency.

**Improved MIDI Option** provides more pleasant tones by offering a choice of major & minor scales over several octaves.

**Binaural beat Audio Feedback** provides audible feedback of a varying frequency (ex. Left = 400Hz; Right = 408Hz = 8Hz).

**Volume Level Feedback** to select one MIDI, Wav or MP3 file for feedback and define threshold condition levels between 0 and 100%.

**Connection Instrument:** Allows network based communication between BioGraph and third-party multimedia applications, including games and educational software.

**Area under the curve Statistics:** For session, segment, and script reports

**Dual Screen Support** with control of client screen from clinician screen on-the-fly.

**Session Replay:** Replay at 2x, 4x or 8x speed or jump to specified time, activity or event marker.

**OVER 70 NEW FEATURES...**
Z-Score Biofeedback
Continued from page 27
all bands), a group of metrics (percentage of
time the connectivity metrics are in condi-
tion, for example coherence, phase and am-
plitude asymmetry for all bands), and all z-
scores across a band (for example, the alpha
band of all metrics).

Another way to track progress is with
the percentage of z-scores that are within
condition at any given moment. This is
useful when working with a large number
of z-scores, to show moment to moment
changes in overall brain state.

BioGraph Infiniti features
related to z-score
biofeedback

Several new features have been added to
BioGraph Infiniti 4.0 to complement z-
score biofeedback. Dual thresholds allow
the necessary range-training functionality,
meaning feedback is given inside or out-
side of a threshold range instead of above
or below a given threshold. The ranges are
fully programmable on-the-fly and condi-
tion logic can be changed directly from an
easily accessible right click menu. These
features, combined with the ability to right
click directly on a screen instrument and
change the source channel, allows the use
of a single screen to train any individual
z-score. At any time, the user can pause
the session and change the z-score being
trained directly from the main screen.

Real-time trending is a powerful
feature when working with either the tra-
ditional assessment and training strategy
or simultaneous training and assessment in
real-time. A trend graph is included during
training and displays statistics of the ses-
sion at discrete intervals, to show progress
as it is occurring. This graph is also includ-
ed in the pre-session assessment screens
and post-session reports to show overall
trends. The time interval is user-program-
mable, also within a right click menu, to
provide a short-term or long-term snapshot
of the session.

BioGraph 4.0 is compatible with
ANI’s NeuroGuide analysis software.
Color changing numerals have been added
to emulate the way z-scores have histori-
cally been presented in NeuroGuide re-
ports. These can be used in training as well,
and programmed to change colors as the
z-score values go in and out of condition.
One-step exporting has also been added so
that EEG data recorded in BioGraph Infiniti
can be easily imported into NeuroGuide for
further analysis.

Thought Technology’s new line of
gold-plated EEG electrodes includes a kit
specifically designed for making two-chan-
nel measurements. This kit allows electrode
sets to be combined, such that multiple
channel recordings include the same active

Continued on page 38
QEEG / TOPOGRAPHIC BRAIN MAPS:
Generalized Anxiety Disorder Subtypes

High Beta Subtype: Anxiety, Insomnia, Alcohol / Drug Abuse

High Alpha Subtype: Anxiety, Depression, ADD

Low Alpha Subtype: Anxiety, Insomnia, Alcohol / Drug Abuse

Cingulate Dysfunction: Anxiety, Ruminations, Obsessive Compulsive Disorder

High Mean Frequency Beta: Anxiety, Alcoholism, Insomnia

High Mean Frequency Alpha: Anxiety, Insomnia

SINGLE-BAND MAGNITUDE TOPOGRAPHIES

AVAILABLE SERVICES

Full Package: #s 1-7: minimum recommended for Neurotherapy
Includes electronic copy. Priority mail is $20 extra.

Full Package: #s 1-6: Without report (1-5 only)
Includes electronic copy. Priority mail used the minimum is $75.00

01) NX Link - NYU/E. Roy John Normative Database (Eyes Closed)
   Al NX Link Discriminant Analyses: ADD, LD, Depression, Memory/Dementia, Substance Abuse, Head Injury, Schizophrenia/Thought Disorders
   $70.00

02) EureKa3! - Nova Tech EEG LORETA Analysis System and Adult Normative Database - Eyes Closed
   $70.00/each

03) Neuroguide - R. Thatcher Normative Database
   A) Eyes Closed Linked Ears Z-scores // Eyes Closed LaPlacian Z-Scores
   $70.00/each

04) Neurorep - W. Hudspeth QEEG Analysis System
   A) Eyes Closed - Weighted Average, Z-scores, Magnitude, % Power, LaPlacian, Average Spectrum, coherence, connectivity
   $70.00

05) Thatcher TBI Discriminant Analysis and Severity Index

06) Thatcher Learning Disabilities Discriminant Analysis and Severity Index

07) Clinical Correlations and Neurotherapy Recommendations by Bob Gurnee
   $70.00
   $70.00
   $70.00
   total value: $630

08) Conventional Medical EEG - Read by Neurologist

09) EureKa3! – NovaTech EEG LORETA Analysis - Eyes Open-Non Database

10) Neurorep - W. Hudspeth QEEG Analysis System: Task
    Weighted Average, Z-scores, Magnitude, % Power, LaPlacian, Average Spectrum

11) Supervision and Training Hourly Rate

12) Extra set of Printed Maps sent priority mail
    (Standard package rates only include electronic or paper copies of maps, not both)
    Extra set of Maps $35.00

13) Electronic (sent via FTP or E-mail) and Paper Copies of Maps sent priority mail with package purchase
    Electronic Maps $20.00

14) Overnight Shipping & Handling (Price varies with carrier, destination, & package weight)

$Varies

ROBERT L. GURNEE
MSW, BCIA:EEG, QEEG Diplomate, Director
Dr. Margaret E. Ayers

March 14, 1946 – March 12, 2008

Dr. Margaret Ayers passed away on March 12, 2008 two days before her 62nd birthday. Her death was a major loss for ISNR, AAPB, and all of the Neurofeedback community.

Margaret was born in Albuquerque, New Mexico, the oldest of four children of Ernest and Gladys Ayers. Her father was a lawyer and her mother was a teacher. At a very early age Margaret was known as a gifted and spirited child. She was reading at the age of two and a half as documented through testing at Columbia University. Her understandings of the laws of nature were taught to her by her Native American playmates in Estanca, New Mexico where she lived until the age of seven years.

Raised a Methodist she was kicked out of Sunday School when she was eight for pointing out to the teacher that genetics supports the idea that since there are black people in the world at least Adam or Eve had to be black.

Margaret was frequently asked how she came up with the idea to create the all digital real time EEG feedback machine. She related that while in high school, she read the Autobiography of a Yogi noting descriptions of yogis who spent 25 years in a cave to become perfected. They reported hearing their heartbeats and their brain waves. She understood that the cave served as an amplifier.

In her first year of college, she was given an assignment to design an original research project. Her paper described the use of a machine that allowed individuals to train their brainwaves to replicate those of the yogis to attain perfection without spending 25 years in a cave. The professor, giving her an A plus, noted that while it showed great imagination, it was too bad that such a machine did not exist. She often wished she could find that professor to show her that it does exist now.

Graduating from Seattle Pacific University with a Bachelor of Science in Microbiology as well as a Master of Arts in Counseling Psychology, Margaret became a brain researcher at UCLA Medical School. She completed her formal education with a Doctorate in Alternative Medicine from Rio Verdi University in Provo, Utah.

She was the first person to establish a private clinical practice devoted exclusively to Neurofeedback (NF). She was the first to publish using NF for the management of symptoms of traumatic brain injury and the first to use NF to bring individuals out of level two comas.

She wore many hats during her lifetime. She worked as chief chef at Lowry’s in Los Angeles. Known for her exquisite palate among restaurant chefs and owners, she made suggestions that were heeded regarding their menus and wine lists. There were times she provided fresh lemons and fresh avocados from her own trees at no cost to restaurants in the LA area to help improve their cuisine. Her family and friends looked forward to her gourmet cooking.

She was a rancher in Paso Robles where she kept her race horses and planted a vineyard to produce chardonnay grapes in the rich soil of the Paso Robles area. She took great pride in her colt, Endless Winner, who won first place at Hollywood Park.

She carried a lariat in her jeep which came in handy when a cattle truck overturned on a LA freeway. She was on her way to work, stopped her car, pulled out her lariat (the only car that had one in it) and helped the police clear the road by roping some of the frightened animals and leading them from the road.

As an avid fisherwoman, her greatest moment came while in New Zealand; she caught, tagged and released a 220 pound blue marlin. The government of New Zealand awarded her a patch to wear on her fishing vest along with a certificate stating somewhere in the cold waters of New Zealand, there is a marlin carrying the name “Maggie Ayers.”

As an art collector, she acquired her first serious piece while in high school, a Christ Head, and went on to collect elegant Japanese art, signed first editions, and original Disney cells. She never settled for mediocrity in any aspect of her life.

She was a visionary who invented and developed the only EEG technology that reveals the language of the brain. In her recent book, Whispers from the Brain, she stressed the value of primary data in the EEG and described how to read and interpret the important information it contains.

After notifying over 250 people of her death, the prevailing comment stated by those called is “my life changed for the better the day that I met Margaret Ayers.” She was a true prophet in her own land.

A research fund has been established to further her work. Contributions, if desired, may be sent to the “Margaret Ayers Research Fund” at 427 North Canon Drive, Suite 105, Beverly Hills, California 90210.
ISNR Funded Projects Are Great Investments

David Trudeau, M.D.

As promised, this column is an update of research funded by ISNR currently underway. But first a word about our unexpected loss of a great ally of the research fund, Joe Horvat, Ph.D. Joe was an energetic booster of research and had enthusiastically supported the research fund through all the years that he served ISNR in many capacities. He and Jonathan Walker, MD are recipients of current research funding and Joe worked very hard to make this project a reality. More details about that project appear in the progress report below. At the recent ISNR board meeting in Houston on February 2nd President Elect John Nash suggested that a special research award be named in honor of Dr. Joe Horvat and the board resoundingly approved. Many of us have already had an opportunity to contribute to that special award fund. We will be visiting attendees at the next ISNR annual meeting in San Antonio to encourage a gift to research to honor this wonderful man who gave so much of himself to ISNR and to our research efforts.

Many of you must wonder where the money goes when you buy a raffle ticket, or bid on a donated auction item, or just make an outright gift to the research fund. In the following paragraphs I’ll detail how those dollars are spent. You will be able to see that each ISNR research dollar procures at least two more dollars on the average making each dollar you give worth three in a research effort. Furthermore, the ISNR research funds are seed money and enable awardees to pursue much larger grants, often ten to a hundred times greater than the ISNR awards. In these days of hedge fund collapse and credit crisis this is one kind of leverage that is still working.

When making awards the research committee considers many factors, including the likelihood that the research will be executed as planned and the likelihood that significant publications will come out of the research. Each awardee promises at least one paper to a Journal of Neurotherapy, but is also encouraged to publish to a wider readership. Because award moneys are very limited they cannot be used to cover indirect costs of institutions or incidental expenses such as travel and meeting reimbursement. Every dollar must be spent pursuing the research project itself. The committee merits each research project on the basis of other direct and indirect funding, so that the ISNR dollar effects are magnified by a factor of three or more. The research committee routinely turns away projects that appear to be creating a salary opportunity for the Principal Investigator – our awarded PI’s give freely of their time, using awarded funds to offset some overhead requirements for collaborators. Most importantly, the projects ISNR funds – limited as they are financially – become stepping-stones for many of our investigators. They are able to complete pilot and feasibility studies that place them in better competitive advantage for large awards from major funding sources such as NIH. In summary ISNR research dollars are judiciously awarded where we will get “the most bang for the buck.” Every dollar you give becomes three dollars, and makes it possible to snowball that effect into much larger grants.

Accountability of grants is ensured by the ISNR board through several means. Due to the wise efforts of Roger deBeus and others ISNR has in place a contracting mechanism with each awardee that spells out funding disbursements based on performance criteria, including time lines for performance goals. Non performance requires full refunds of moneys awarded. All ISNR funded research (with very few exceptions) must be under the auspices of an IRB that ensures the safety and human rights of the subjects involved.

Now for the progress reports:

**Pilot Project to Ascertain Utility of the Tower of London Test (TOL) to Assess Outcomes of Neurofeedback in Clients with Asperger’s Syndrome. Bojana Knezevic (PI), Lynda Thompson, and Michael Thompson.**

This project assesses the utility of the Tower of London (TOL), an individually administered neuropsychological instrument designed to assess higher-order problem solving – specifically executive planning (EP) abilities – in children and adults. The goal of the current study is to investigate the effects of neurofeedback and training in metacognitive strategies on EP in children with Aspergers Syndrome (AS) as tested by TOL. In addition, these changes are expected to correlate with improvements in AS clients noted in the previous research on IVA, TOVA, and questionnaire data. Preliminary results show that AS individuals seem to improve their planning and problem solving performance, approach to the task, problem solving speed, response to failure and frustration ability, and flexibility in altering problem-solving efforts. Currently, 30 consecutive AS clients have been tested and 14 comparison group participants in order to obtain pre-NFB data. Post-NFB data has been obtained on 14 AS clients. Another 6 AS clients and 16 comparison group participants are expected to be tested by April 2008. Current trends of decreased symptomatology on questionnaire data and performance improvements on IVA and TOVA are expected to reach significance once the sample size increases.

To date direct research expenses have amounted to $1,960 and indirect expense have amounted to $1,079. The ISNR award of $1,000 is exceeded by these expenses (so far) by a factor of 3, the remaining expenses being supported by the ADD Centre in Toronto. Completion date is estimated to be August 2008.

**Neurofeedback and Motivation Enhancement Therapy Based Bio-Behavioral Treatment in Psychosubstance Use Disorder (PSUD) Estate (Tato) M. Sokhadze, Ph.D., University of Louisville, Louisville, KY 402929.**

Cocaine addicts are very difficult-to-treat having features of low motivation to change and reluctance to enter inpatient treatment. Motivational Interviewing (MI)
Z-Score Biofeedback Continued from page 33

(referred also as Motivation Enhancement Therapy [MET]) is designed to increase the compliance and probability of treatment entry and abstinence. Due to its brevity, MI is best suited to enhance compliance and facilitate treatment engagement. This project proposes that a combined application of neurofeedback and motivational interviewing techniques will be an effective intervention for cocaine addiction. It also studies the application of cognitive ERP and qEEG for post-treatment assessment. The overall goal of this project is to utilize electrocortical (dense-array ERP, qEEG) variables and measures of behavioral performance on mental tasks (RT, accuracy) to explore the cognitive functions in patients with cocaine abuse/dependence diagnosis and compare recovery of these functions during brief biobehavioral intervention in an outpatient population. This research also proposes to characterize changes in CNS functioning associated with success rate of three arms for addiction treatment (MET, NFB, combined MET + NFB).

As of December 2007 26 subjects have been enrolled in this project. To date some significant results are reportable and a paper has been submitted to Journal of Neurotherapy, “Event-Related Potential Study of Executive Dysfunctions in a Speeded Reaction Task in Cocaine Addiction.” This paper will appear in a forthcoming focal issue of JN that will deal with addictions. It is anticipated that several other papers will emerge from this study that examines many electrophysiological and behavioral variables. Research will likely be finalized by the end of 2008. The PI is actively pursuing NIDA funded study based on success with this project. This proposal will incorporate fMRI, and will have as a co-PI Rex Cannon, another ISNR research awardee.

The total estimated costs for this project are $31,687, $12,000 of which is from ISNR funding, which has been received. The remainder of the costs is provided by the University of Louisville. To date actual costs retrieved from sources other than ISNR have been $27, 307. This is a very successful study that once again demonstrates the multiplying advantages of ISNR research fund dollars and the use of funded research to garner larger resources.

Effects of Neurofeedback Training on Spatiotemporal Patterns of Response Inhibition in AD/HD Children: A Magnetoencephalography Study. Beauregard and Lévesque, University of Montreal.

This study cross correlates outcome of neurofeedback training on performance tests, QEEG and magnetoencephalography (MEG.) Like previous studies by Dr. Beauregard who employed PET scanning and MRI correlates of QEEG and performance changes, this study offers to strengthen ADHD neurotherapy validation using an image technology other than QEEG to display neurophysiologic evidence of remediation of performance deficits. Six subjects have been enrolled (two are completed). The recruitment process is relatively slow given the stringent nature of the inclusion/exclusion criteria. A total of ten subjects completed is anticipated by Fall of 2008, when the second half of the $20,000 will be due. An electrophysiology technician working for the research center where the project is conducted at the University of Montreal (Centre de Recherche en Neuropsychologie et Cognition - CERNEC) is helping with the recording and processing of MEG data, substantially reducing overall costs to the project. Other in kind funding from the University and MEG lab has yet to be computed, but is likely substantial simply on the basis of costs for fMRI pre and post studies.

I look forward to providing more information on this project as it progresses.

A Randomized Double Blind Placebo Controlled Clinical Trial of Neurofeedback for Autistic Spectrum Disorder. Rob Coben.

This project is being revised and requires a reapplication and recontracting. Since the original award Dr. Coben has rethought the scope of the project and is seeking additional collaboration and funding, to expand the project to include a neurologist and MRI engineer with funding through Autism Speaks. This new project proposes integration of EEG/ERP measurements with MRI/Diffusion Tensor Imaging as pre and post measurements for NF effect.
The Happy Warrior
December 3, 1942 to January 23, 2008

As many of you already know, Joe Horvat passed away last month. I have had the privilege to compile this story of Joe from those who felt close to him. I knew him mostly through Ann Marie, my friend and compatriot at ISNR. I have watched her, along with her daughter and Joe’s son turmoil over the loss. May he find peace in his travels and may his family do their best in his loss.

Joe Horvat’s bubbling enthusiasm for his work and his life overrode adversities at every turn. He reminded me in many ways of one of my other heroes – the late Hubert Humphrey of Minnesota – whose nickname was “The Happy Warrior.” This could be Joe’s nickname as well. I will always think of his staunch dedication to ISNR, and I am sure the organization stands today in large part due to his efforts. We honor Joe as the past President of ISNR, but for me his most heroic efforts came as his alter-personality “Angus” during the difficult years he served as our treasurer and kept us solvent. Looming deficits and conference expenses threatened our fledgling organization, and Joe rescued us from our own enthusiasm to be bigger and better without thought to costs. “Angus” sent us memo after memo that herded us into fiscal responsibility - something no one wants to hear about – but did so with such a great sense of humor that we all had to cheerfully follow his “suggestions.” And as a result of his negotiations and discipline and leadership we got through another year—and another one –and another one and ISNR was able to not only survive, but grow.

Joe has always been one of the stalwarts of ISNR, stepping up to serve our organization when ever asked, and even when not asked but needed. He did this cheerfully even when faced with physical pain and disability from surgery after surgery for his many orthopedic problems from old athletic injuries. He did this even when faced with job changes and relocations and personal setbacks. He spent many years on the board as either Treasurer, or President, and served on committees including the conference committee and the research committee.

Joe’s passion for research and clinical science was inspiring. Many have taken his popular workshops on using QEEG coherence aberrations to guide TBI neurofeedback. While president he proposed a research network to do methodical multi-site controlled trials, writing an article in the newsletter. When nobody stepped up to the plate to do just that, he agreed to head the project up himself and was awarded an ISNR research grant to help him support the work. Much of his effort was directed towards soliciting equipment and funding to supplement the grant from ISNR so that he could recruit a group of clinician researchers. For all this effort Joe got to do the dirty work, and his collaborators got the supplemental funding and equipment to help support their overhead for doing clinical research. This selflessness was typical of Joe. It will be a great honor to Joe’s memory to see his project carried through by all of his collaborators.

We all remember Joe as a teacher, a colleague, an astute clinician, a research coordinator, an enthusiastic and selfless leader, and as a man who gave of himself to the clinical and scientific advancement of neurofeedback and research. I will always remember him as a Happy Warrior. My image is that of Joe alternately smiling and wincing as he leans into his cane charging into the foray of his busy and dedicated life.

My heart goes out to Ann Marie, his soul mate, the strength behind this great man. Karen and I have spent many happy hours visiting with Joe and Ann while we wintered in Corpus Christi and working together on the board of ISNR and at conferences. We fondly remember Joe and he will always have a special place in our hearts.—David Trudeau

This is unbelievably sad news. Joe was a great mentor for me and went above and beyond the call of duty to help me with my dissertation. He loaned me equipment, put me up at his house, and spent hours of his time in training me on the mapper he was loaning me. I am sure this is no surprise to anyone that knew him but I tell the story of how good he and Ann Marie were to me a lot.

Susan Santarpia

In 1994, my wife and I moved to Corpus Christi, TX. We took our licensing exams in Austin where Joe was the administrator. Afterwards, he encouraged us to call, have lunch, and he would help us get started in our practice. Joe became a friend, and he was always there to answer questions. He was one of the reasons we investigated neurofeedback, and he was always available to help us, to teach us, and have patience when his vocabulary got way past ours. We knew a few things about any presentation that Joe would give. He knew the answer to any question asked, and he was passionate about his work. Turning on my e-mail tonight and seeing this announcement I was, am stunned. One of the stars in our world has gone out.

Burton A Kittay

I met Joe last year at his workshop on coherence. What struck me there was an anecdote about a young professor who suffered from a motor accident and fell into a deep depression and who experienced all kinds of psychopathology since then, that could not be treated by psychotherapy. It soon became clear that the story would end with the success of coherence training. Being new to Joe, however, I did not expect that professor to be him, as he revealed somewhat later. It really impressed me, the sincere way he presented his own case, providing the evidence about the opportunities of neurofeedback so clearly and personally. Since then I have changed my approach in neurofeedback, applying coherence designs more often.

Rien Breteler

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Happy Warrior Continued from page 35

One of my fondest memories of Joe was an incident that was expressive of his supportive nature. It occurred at a professional conference at an IBM center in New York State. A number of clinicians were describing their protocols, specifically frequency choices and electrode placements. After I presented a description of my whole brain protocol, several participants objected to my method. After a bit of a debate among members, Joe gently declared, “Why can’t we do both? There is a place in our field for protocols that aim for specificity and ones that are meant for a generalized effect.” His open and inclusive remarks stopped all debate. He will be missed.

Les Fehmi

We are filled with deep sadness upon hearing of Joe Horvat’s passing. We will miss him very much. He meant so much to us and it is difficult to imagine the field of neurofeedback going on without him. Although he left the field in a much stronger position and due to his contributions, go on it will. He was inspirational, loyal to the neurofeedback mission of changing the world with neurofeedback one person at a time. Joe offered much needed humor at times when humor was the best antidote to a situation and offered guidance to so many. As Past President of ISNR (as well as holding other officer positions), Joe was a beacon of light to the industry of neurofeedback and a major contributor to the field. Joe, along with his wife Ann Marie, has devoted many years to assuring the growth, success and strength of ISNR. We are all deeply saddened and will miss Joe very much. We send our love, prayers and thoughts to Ann Marie as she continues on this earth journey without the physical presence of her husband, her soul mate, her partner and her friend.

Terri and Tom Collura

I am so sad about Joe leaving us. Always in good humor, and what a blessing to this life. He gave us so much. I will miss him a great deal. Know that his life was a good one, and he helped so many people. There is nothing better than that. We all have loved him in SNR. What a great soul!

Larry Thomas

I share your loss. Joe was one of the really kind persons who took time out to understand the woes of the Asians who attended the ISNR conferences. He was so kind to listen to concerns of new practitioners like I was some three or four years ago. I pray that his soul rest in peace. We in the Philippines will always have his memory in our minds and hearts.

Leticia Penano-Ho

I about fell out of my chair, with tears in my eyes, when I got the email that Joe died. It can’t be true. He was so important to ISNR, a comrade in Head Injury, and a leader we all need and don’t want to live without. I’m so sorry for this loss and feel we’ve all lost a dear family member. Both Joe and Ann Marie are important to our mission to help change the mental health of the world.

Daniel Hoffman

Joe represented a warm welcoming embrace to those new to ISNR and to anyone who had contact with him. I count my time talking to him and Ann Marie over dinner at the San Diego zoo as one of the highlights of the ISNR week. When I recently dropped by his Dallas office to discuss research ideas between our two Dallas locations he was again a wealth of knowledge and willing to help move the NF field forward. I sure will miss him and want to extend my help in any way to Ann Marie and his family.

Dave Hagedorn

It’s just unbelievable sad news. I will always remember how heartfully you and Joe met me in Ft. Lauderdale when I arrived for my very first ISNR conference as a newbie. His friendly and humorous nature made me always feel very comfortable. Take my deepest condolences.

Bruno Gasser

I am so saddened to hear of Joe’s passing. I am so sorry for your loss. He was a very special person. More than anything else, I will miss his humor and that great laugh of his.

Ann Frick

The 2009 Joe Horvat Research Fund is still collecting donations and will continue to do so until just prior to the conference in August. At that time, we’ll tally the income and the funds we gained from the auctioning of a NeuroGuide Deluxe License (valued at $3,295). This total will be reserved for the Joseph Horvat 2009 Research Grant, which will be awarded during the 2009 research funding cycle. If you’re interested in bidding on the NeuroGuide Deluxe, which was donated by Robert Thatcher in Joe’s honor, please watch your emails for instructions on doing so through EBay. The silent auction will occur in May.

To date the following contributions have totaled $3,755.00

David Trudeau……………………………………………………. $1,000
The ISNR Board Members and Executive Director each made a $50 donation and the general fund matched it …………………………………………………………………………………… $1,000
Richard Davis donated his travel reimbursement for the Houston Board meeting……………………………………… $290
Dave Siever and Mind Alive……………………………………… $250
Helen and Tom Budzynski……………………………………… $200
Victoria Ibric, BCIA, Dee Edmonson, Mary St. Clair, Ed Freedman, Les Fehmi, Aharon Shulimson …………………………… $100
Alan Fischer, Jeannette Lawson, Vicki Jansen, Linda Brownback, Nancy White…………………………………. $50
Anthony DeLong, Pamela Bell………………………………….. $25
Judson McCune…………………………………………………… $15
Session Protocols

We use 4-channel z-score training and the 4 electrode placements at 10/20 sites usually form a square, rectangle, parallelogram, rhombus, or trapezoid depending on our interpretation of head maps and connectivity figures derived from NeuroGuide analyses. Our training sessions last about an hour, which includes electrode placement. We execute 10 or 11 ‘runs,’ each lasting 3 minutes with variable pauses between ‘runs’ for brief discussions with clients. We set a 2-second void between audio/visual rewards and we record Standard Deviation (SD), % z-scores required within the SD target (%ZIT), and the % time in reward (%TIR) for each ‘run’ on paper data sheets for each session. We use this scoring system as well as available BrainMaster session data and periodic QEEGs to follow training progress.

Available Z-score Data

Anyone who has done 4-channel z-score training will be familiar with the data array present throughout the training session. It consists, in part, of text number displays for the SD settings, the % z-scores required within the SD target in order for the client to receive an audio/visual signal that the criterion has been achieved, and the % time in target (in our paradigm the % time in target for the 3-minute run) shown in the upper left screen area. To the right of those numbers the client and trainer see a line graph showing the SD setting line, the time line for the ‘run,’ and a line that traces time-in-the-SD-target across the 3-minute ‘run.’ To the right of that graphic display the client and trainer see a number showing the % time in the SD target.

Just below the above-mentioned numbers and graphic display the client and trainer see large z-score arrays for channels 1 and 2 on the left side of the screen as well as channels 3 and 4 on the right side of the screen. For each channel pair and each channel within the pairs the arrays show z-scores for absolute power and relative power for delta, theta, alpha, beta, beta 1, 2, 3, and gamma frequency bands as defined in NeuroGuide software. To the right the display shows z-score values for various ratios for delta, theta, alpha, beta, and gamma frequency bands as defined in NeuroGuide software.

A third array band along the screen bottom shows z-scores at each frequency band for each possible two-electrode combination. Three columns under each two electrode combination show z-scores for asymmetry, coherence, and phase as defined in NeuroGuide software at each frequency band.

In all, the client and trainer see 248 z-scores that change instantaneously according to instantaneous changes in brain function. At first this number mélange appears as a baffling, apparently randomly changing number array. After watching it intently for

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Consistent Dynamic Z-Score Patterns Continued from page 35

run after run and session after session, however, the number changes reveal patterns that follow systematic changes (shaping) in the % z-scores-in-the-SD-target (independent) variable (%ZIT).

The Observations

For the 40+ training sessions that I have conducted over the past several months I have noted several very consistent, dynamic, recurring z-score patterns. When I raise the %ZIT, a challenge that asks the client to alter brain function toward the comparison population z-score mean, a consistent, dynamic change pattern flows through large z-score subsets of the total 248 z-score array. Typically, for any given electrode or electrode pair I see immediate z-score increases in absolute power, to levels above 2 SD, in delta and other frequency bands, but frequently only in the delta band. Sometimes the relative power array follows suit with less abrupt and less dramatic changes. Almost always the power increases start in the delta band and progress to higher frequencies but occasionally absolute power “turns on” at all frequencies and then decreases from higher toward lower frequencies as a run progresses. Absolute delta power may stay high for long time periods but relative power usually returns to normal first.

After the absolute and relative power display changes, the ratio z-score array may show aberrations. Usually, the ratio aberrations return to normal (white) before any other aberrations. Shortly after the absolute power, and sometimes relative power increases in any given electrode, the phase z-score in the connectivity array with that electrode in it turns to red (the z-score exceeds 2 SD) at any given frequency that has registered an aberrant coherence z-score. After that, the aberrant coherence z-score may change to a more ‘normal’ value, or it may not change. If it does not change in a more ‘normal’ direction, the ‘power cycle’ described above may repeat or it may not repeat. If the power cycle does not repeat, I find that raising % ZIT, i.e., challenging the client’s brain to change in the desired direction, may re-awaken the power cycle and, ultimately after several challenges and several power cycle re-awakenings, the aberrant z-score coherence may normalize. Thus, by noting the power cycles and associated connectivity changes the trainer can pace specific shaping maneuvers to maintain steady progress in converting specific aberrant connectivity z-scores to normal.

I have also observed that retreating, lowering %ZIT (sometimes drastically) and then escalating %ZIT as rapidly as the client can maintain adequate reward response rates, can ‘tell the client’s brain’ the right direction to change and ignite a significant positive change in brain function as measure by z-score changes and clinical responses. Absolute %ZIT levels do not seem to count as much as giving the client’s brain a hint about the right direction to go (I may be wishing that to happen more than it actually happens—more study needed).

Follow up QEEGs show changes consistent with the conclusion that the techniques used have validity. Further, more rigorous study will add needed validity. Meanwhile, I would like to hear from anyone willing to duplicate the set up and techniques described. Adding confirmatory anecdotal data to anecdotal data has considerable strong-influence power if enough clinicians pay attention to enough details and if the findings replicate often enough across widely different clinical conditions. Please contact me at dickstark@mac.com if you want to try to replicate these findings.

Z-Score Biofeedback Continued from page 30

ground and linked ear reference in both channels (a linked ear reference should always be used when working with z-scores). This translates to fewer connections and more reliable EEG measurements.

Additional features of the Infiniti system

BioGraph Infiniti is designed to be modular, such that necessary components exist as building blocks that can be used wherever desired. This means z-score biofeedback can be performed on its own or in parallel with other modalities.

The metrics for which z-scores are computed in the Z-Score Biofeedback Library are also explicitly available in BioGraph Infiniti. Industry-standard computations of coherence, phase and amplitude asymmetry have been implemented as they are in ANI’s NeuroGuide software, and absolute power, relative power and power ratio data are available as well. This allows the user, for example, to train the z-scores and review them in parallel with the actual metrics during post-session analysis, or to use the z-scores for pre- and post-session assessment and to train directly on the metrics themselves.

There are many other combinations available to further enhance the treatment strategy of the clinician. Included with the z-scores can be standard EEG amplitude and frequency metrics, and peripheral physiology including skin conductance, temperature, and heart rate (from blood volume pulse or EKG) to name just a few. These parallel measurements can be included in the training environment or they can be left out of the training, but using the reviewing and reporting functions, they can be included in pre- and post-session analysis.

For users who enjoy developing their own screens to combine modalities and analysis methods, BioGraph Infiniti provides the tools necessary to design and combine the building block required to suit individual needs. For users who prefer something off-the-shelf and ready to use immediately, the Biofeedback Foundation of Europe www.bfe.org invites practitioners worldwide to register for an online course to introduce the use of BioGraph Infiniti software for the clinical use of Z-Scores. To register for this online course, or for more information, please send an email to education@bfe.org. For more information on the Infiniti system and Z-Score Biofeedback library please visit www.thoughttechnology.com.

Marc Saab holds a Bachelor of Applied Science from the University of Waterloo, with a major in Electrical Engineering and a minor in Biology, and a Masters of Biomedical Engineering from McGill University and the Montreal Neurological Institute. His published research includes automatic early detection of epileptic seizures and other neurophysiological events in scalp and depth EEG. Professional work includes research and development, biosignal algorithm design and product development. He is currently the EEG product manager at Thought Technology Ltd in Montreal, Canada. Marc is also an instructor, having lectured on bioengineering concepts in a simple, easy to understand manner for non-technical audiences. His most recent workshop describes the theory and clinical applications of neurophysiology and EEG signal processing for use in neurofeedback.
Research Notes
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“Because this has never been done before, Autism Speaks would like us to collect some preliminary data on this before approving a larger grant,” says Dr. Coben. “I would like to propose that the ISNR research grant be used for these purposes. This would change what I had proposed slightly. We ultimately would do a larger study of NF efficacy (randomized, blinded), to likely include 160 subjects in total (80 active vs 80 passive NF). However, I would like to use the ISNR funding to collect only on a small number of these (10 - 20) and then seek Autism Speaks funding for the rest.” Needless to say this would be an important project and an efficient use of ISNR research funds, providing these changes meet with research committee and board approval.

A Multicenter RCT of Neurofeedback for TBI. John Walker and Joe Horvat

This study involves 40 subjects who suffered a traumatic brain injury and have evidence of post-concussive syndrome. Taking place in 10 different sites throughout the United States, each site has an experienced neurofeedback provider with QEEG capability. All treatment is done on donated Infiniti treatment modules. The sites have been selected and clinicians have been trained on their new (unfamiliar) neurofeedback equipment and computerized cognitive tests. According to Jon Walker, the ten clinician scientists are now enrolling subjects and he estimates that the study will be completed by the end of the year (2008). “We have adequate fund in hand to complete the first half of the group. We will probably need an equal amount for the second half in July or August.”

This study includes request for funding of $20,000 per year for two years and includes services and equipment donations or in-kind donations of an additional $160,000. Dr. Joe Horvat was the prime mover behind this study and now Dr. Walker will take the helm. It will be a great tribute to Dr. Horvat to carry this project to completion.
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