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Abstracts of Conference Presentations at the 2008 Society for the Advancement of Brain Analysis (SABA) 7th Annual Conference, Sarasota, Florida

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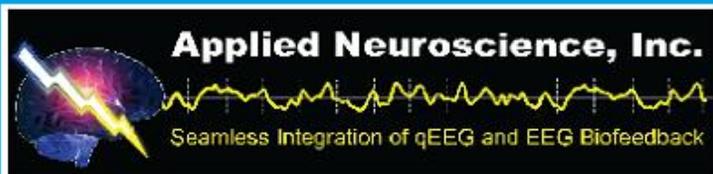
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*PROCEEDINGS OF THE 2008 SABA
CONFERENCE*

**Abstracts of Conference Presentations
at the 2008 Society for the Advancement of Brain
Analysis (SABA) 7th Annual Conference,
Sarasota, Florida**

The 7th annual conference for the Society for the Advancement of Brain Analysis (SABA) was held in Sarasota, Florida, April 30 to May 3, 2008. This group is an outgrowth of ISNR and quantitative EEG research, and their proceedings have been published in this journal in the past. As its name suggests, this society was founded to advance methodology and practice of brain wave analysis, particularly for use in neurotherapy, and this year's conference focused on an issue of interest to many neurotherapists: assessment of frontal lobe function and the role of EEG operant conditioning in addressing executive dysfunction.

*David A. Kaiser, PhD
Editor*

**Effects of Psychoneurotherapy on Brain
Electromagnetic Tomography in Individuals
with Major Depressive Disorder**

Mario Beauregard, PhD

Recent advances in quantitative electroencephalography (QEEG) and brain-computer interface technology provide unique and powerful tools that may significantly contribute to the development of psychoneurotherapies. The main goal of this study was to test the effect of a QEEG-guided psychoneurotherapy (PNT) on brain electromagnetic tomography in 22 individuals with major depressive disorder (MDD). Based on the results of QEEG analyses, depressed

participants were taught during the PNT to modify their negative thoughts and emotional states while learning to reduce high-beta (18–30 Hz) activity in right fronto-temporal/paralimbic regions. Brain changes were measured through standardized low resolution brain electromagnetic tomography. Following treatment, there was a significant reduction of BDI–II scores ($p < .001$), and 20 out of 27 (74%) participants did not meet the *DSM–IV* criteria for MDD. Absolute power of high-beta (18–30 Hz) activity showed a significant reduction in the right lateral prefrontal cortex, right orbitofrontal cortex, right insula, right subgenual cingulate cortex, and right anterior temporal pole.

These findings suggest that the PNT used in this study can significantly improve brain activity and reduce depressive symptoms in individuals with MDD.

Functional Homogeneity and Heterogeneity of the Frontal Lobes

Elkhonon Goldberg, PhD

Recent advances in understanding how the prefrontal cortex accounts for the wide variety of abilities categorized as executive function has led to a detailed study of the functional units of the prefrontal cortex. Using studies based on functional imaging technologies and neuropsychological tools, I summarize both broad and granular subdivisions of the frontal lobes. This summary includes an overview of orbital frontal and dorsolateral roles in executive function. I demonstrate how the full range of executive functions corresponds to the functional heterogeneity of the prefrontal cortex.

The Brainstem and the Frontal Lobes in Attention Deficit Disorder and Memory Loss

Elkhonon Goldberg, PhD

This presentation addresses how traditional approaches to understanding attention deficits and memory disorders that have focused on the subcortex, the mesial temporal lobes, and the cingulate gyrus are incomplete. My studies and writings have illuminated central roles in attentional and memory impairments of both the frontal lobes and the brain stem as well as the areas just listed. I demonstrate how executive functions controlled by the prefrontal cortex interact with systems responsible for arousal in the brain stem to play as integral a role as the subcortical structures, the cingulate gyrus, and the hippocampi in understanding attentional and amnesic phenomena.

Periodicity Table

David Kaiser, PhD

Spectral properties are organized into a general framework based on number of

signals, frequencies, and other features. The Periodicity Table, as it is called, surveys the wide range of synchronies inherent to EEG activity and connectivity measures. General spectral properties such as number of frequencies, number of sites, and whether phase or magnitude are being evaluated, are represented by dynamic as well as static versions of each property in this table (e.g., comodulation, magnitude asymmetry), and each version is further represented by a mathematical function (e.g., Pearson product moment, coherence function). This table was used to generate the indices known as site-centered comodulation and site-centered coherence. Site-centered comodulation is mean comodulation of all electrode partners (19 pairings minus 1 auto-comparison), an estimate of network traffic or common activity at a site, and site-centered coherence is mean coherence of all electrode partners, a phase-based estimate of network traffic. Posterior site-centered coherence and comodulation were found to increase with age for frequencies below 30 Hz in a database of 101 participants from ages 5 to 35 years. Anterior site-centered comodulation also increased with age for this group. The Periodicity Table was proposed as a means to categorize synchrony manifestations and as a tool for generating new and potentially relevant psychophysiological indices. Furthermore, by contrasting cells within this table, impairments missed by measures in isolation may be revealed by their composite. Three examples of cross-table comparisons are *corticality*, a *z* score contrast of magnitude consistency to phase consistency; *focality*, activity compared to connectivity measures; and *cordance*, a comparison of relative to absolute power (Leuchter et al., 1994).

REFERENCE

- Leuchter, A. F., Cook, I. A., Lufkin, R. B., Dunkin, J., Newton, T. F., Cummings, J. L., et al. (1994). Cordance: A new method for assessment of cerebral perfusion and metabolism using quantitative electroencephalography. *Neuroimage*, 1, 208-219.

Client History, QEEG and Neuropsychological Assessment: When the Data Speak Together

William A. Lambos, PhD

I demonstrate how the clinical interview and relevant neuropsychological testing serve as independent and convergent sources of data in producing a complete and accurate evaluation of a client's condition. Client history and neuropsychological abnormalities help disambiguate EEG findings, further strengthening the instrumental power of quantitative analysis of EEG. Tendency for practitioners of EEG biofeedback to rely solely on QEEG data, or less, in developing treatment approaches has substantial limitations. I argue that for neurotherapy to gain wider acceptance by both prospective clients and other practitioners, an integrated approach that incorporates personal, neuropsychological, and psychophysiological data should become a standard of practice.

fMRI Correlates of Neurofeedback Treatment for Attention and Learning Disorders

Johanne Levesque, PhD

Electroencephalogram (EEG) biofeedback, also known as neurofeedback, has been used as a promising alternative treatment for patients with attention deficit/hyperactivity disorder (AD/HD) since the beginning of the 1970s. This technique has also been utilized in the treatment of learning disabilities (LD). Over the years, many different EEG biofeedback protocols for AD/HD and LD have been developed. Single-channel protocols and interhemispheric protocols are widely used with notable success. Recently, studies have shown that self-regulation of slow cortical potentials for children with AD/HD can also be "possibly efficacious" in alleviating symptoms of AD/HD. The objective of this presentation is to provide a comprehensive review of the literature with regard to cerebral, cognitive, and behavioral changes induced by neurofeedback in children with AD/HD or LD.

What I Have Learned About ADD: QEEG and Neurofeedback Studies

Joel Lubar, PhD

I review the history of studies regarding quantitative EEG, LORETA, and neurofeedback as they pertain to attention deficit/hyperactivity disorder (AD/HD). I also show how work done to date has fallen short of establishing a coherent framework for understanding the many symptoms and subtypes classified under the label AD/HD. I also offer suggestions for a unifying paradigm of research using neurofeedback, research modes for controlled and clinical studies, and a summary of our research in the area of ADD/HD and some new work using LORETA neurofeedback.

A Remarkable Neurofeedback Outcome with Severe Brain Damage and Seizures

Denise Malkowitz, MD

Neuroplasticity is the intrinsic ability of the brain to change itself in response to input, resulting in learning and formation of related functional neural networks. In the case of brain injury or dysfunction, neuroplasticity allows for the reintegration and formation of neural networks. This process can take place with relevant stimulation and learning experiences over time. However, it appears that this can be significantly enhanced, in terms of extent of recovery and time to recovery, when the individual receives an appropriate neuro-rehabilitation program. Quantitative EEG (QEEG)-neurotherapy, or neurofeedback, appears to be a powerful tool for neuro-rehabilitation in patients with a number of neurological, psychiatric, and cognitive disorders. QEEG-neurotherapy applies operant conditioning principles, rewarding and reinforcing desirable self-regulated EEG activity and inhibiting or suppressing undesirable activity. The changes in EEG toward normalcy appear to reflect changes in underlying neurophysiology, with reintegration of neural circuits and networks. Our intensive QEEG-Neurofeedback protocol to treat refractory seizures in patients with acquired epilepsy

and neurological deficit from traumatic brain injury yielded a remarkable recovery both in terms of extent of recovery and time to recovery, even 10 years after the brain injury, despite failure of many other therapies. QEEG-Neurofeedback appears to work through utilizing neuroplasticity, retraining the brain, building neural circuits and networks. This therapy is self-directed, is noninvasive, and lacks any significant adverse effects. Maximizing these therapeutic effects will require a search for the most effective diagnostic and treatment protocols. Appropriate standardized QEEG-Neurotherapy protocols must be sought and adhered to. The future of QEEG-Neurofeedback thus lies in cooperative scientific research and accountability.

Methodology and Clinical Applications Relevant to Frontal Lobe Issues

*Barry Sterman, PhD,
and David Kaiser, PhD*

Functional connectivity is a central principle of brain maturation and it may be assessed partly by coherence and comodulation functions. We examined coherence and comodulation of low and moderate frequencies and found that there was an increase in these indices with age at most sites in a sample of 101 children and adults. Of interest were frequencies modulated by thalamocortical and corticothalamic collaboration (4–30 Hz). Site-centered comodulation increased consistently with age at all sites, whereas site-centered coherence only increased with age at posterior sites. Site-centered comodulation was found to be a better index of frontal lobe maturation than coherence. No significant age-connectivity relationship was found for anterior sites during childhood but significant ones emerged during adulthood, a finding that parallels callosal myelination between frontal lobes. For both measures, it would be useful to investigate whether age-based functional connectivity increases

evenly throughout the lifespan or whether coupling rates asymptote or accelerate during later years. Assessment of frontal lobe connectivity might identify functional impairment prior to clear-cut behavioral or cognitive symptoms of executive dysfunction.

The Work of Neurologist Wen Qing Wu with Neurofeedback and Seizures

Lynda Thompson, PhD

Dr. Wu Wenqing, Friendship Hospital & Capital Medical University of Beijing, has treated about 100 patients with seizure disorder using neurofeedback (NFB). He is presently assisting other doctors and hospitals to set up neurofeedback units for the treatment of seizures and other disorders by raising sensorimotor response. We were honored to have him study at our center in Toronto for 6 months in 2007. In 2006 the Chinese national television network asked him to present a patient. We show the DVD that played on Chinese television. The woman chosen for this demonstration was 23 years of age. Before NFB training she experienced approximately 35 grand-mal seizures a day. She had been treated with many different combinations of medications and had surgery for the seizure disorder twice before NFB was attempted by Dr. Wu. Enuresis accompanied each seizure episode. Two years after NFB training, in 2007, she had only one seizure a day, and it was without enuresis. Now, in 2008, she has only one seizure every 1 to 2 days. She still takes two kinds of antiepileptic drugs, but we understand that the dosage of medications is substantially less than before NFB training. Dr. Wu concluded in his latest e-mail to us that “neurofeedback influenced her seizure, and had a long term effect.”

It is both a dramatic and a convincing film, and we are very thankful that Dr. Wu has given us permission to show his work to you.