

# Neuro-Eastern

**BI-MONTHLY Neurofeedback Newsletter** 



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"The 2nd APNA Annual Conference will be held at Hotel Park Royal in Penang from 21 to 23 July 2016."

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This is the second issue of NeuroEastern. As it is a bi-monthly newsletter of APNA, this second issue is for March and April 2016. To start with, I would like to invite all of you to attend the 2nd APNA Annual Conference which will be held at Hotel Park Royal in Penang from 21 to 23 July 2016.

The authors will be presenting their papers on the first two days of the conference, i.e. 21st and 22nd July. Third day will be reserved for tutorials and hands-on training on neurofeedback and HRV feedback. For those of you who would like to learn Neurofeedback or HRV feedback; this will be a good opportunity to start the learning process.

It will also be an opportunity to network with the biofeedback and neurofeedback clinicians and researchers. The main article in this issue is on the various applications of the neurofeedback.

Over the last few decades, neurofeedback has been used for epilepsy, addiction, autism, ADHD, depression, etc. In this article written by Hafeezullah, he briefly introduces some of these applications of the neurofeedback. In addition, he provides good references that can be used for further exploration of any of the

# EDITOR-IN-CHIEF'S NOTE

Assoc. Prof. Dr Aamir Saeed Malik The Editor-in-Chief, NEURO-EASTERN aamir\_saeed@petronas.com.my

"The 2nd APNA Annual Conference will be held at Hotel Park Royal in Penang from 21 to 23 July 2016."

neurofeedback application. It is important for the researchers and clinicians in neurofeedback to get involved in the various research activities with proper experiment design, sampling of the population and blind studies so that this field can grow and become acceptable in the medical fraternity.

The resources page discuss the Neuroguide software. It is one of the important tools for Quantitative EEG analysis. Chai discusses the various features of the software and how it can be useful in QEEG analysis.

The event page contains news of the neurofeedback course that was jointly organized by Spectrum Learning and Universiti Teknologi PETRONAS. We hope more of such courses will be organized in future.

We look forward to your feedback on this issue.

Aamir



# Asia Pacific Neuro-biofeedback Association (APNA)

## **President Message**

## Dr. Kenneth Kang

Head of Spectrum Learning

It is my sincere pleasure to welcome you to join APNA.

APNA is established to provide an oversight of the field of neurofeedback and biofeedback so as to promote and expand it as well as to safeguard consumer interests.

I would like to express my deepest gratitude for the practitioners and researchers who have come together to help making the establishment of APNA possible. With that, I also want to extend my warmest invitation to anyone who is passionate about this field to come join us and grow this field hand in hand with the community for the benefit of mankind.

## **Brief Description**

APNA is non-profit organization for the purpose of joining the expertise of clinicians and researchers who are involved in the health care research and clinical applications of neurofeedback and biofeedback for serving the society. There is a growing number of professional clinicians, biomedical and computing engineers who have expertise in medicine, psychology, therapy, engineering and development of new advanced computing solutions to biomedical problems.

These diverse experts started sharing their expertise, joint research collaboration, organizing joint events, and developing their professional network under the umbrella of APNA. These activities are at initial stages and expected to be at the peak in future including all the countries in the Asia Pacific region. It is very encouraging that the growing network of these professionals is promoting the clinical use of neurofeedback and biofeedback interventions to the general public for getting maximum benefits. Consequently, it will help people to consult certified practitioners of neurofeedback rather than non-certified consultants.

## VISION

- To deepen our understanding of Asian mindfulness and meditation techniques and its health benefits with rigorous science
- To promote its application in society to improve health, performance and quality of life

## MISSION

- To promote research collaboration between researchers, clinicians and community
- To promote professional clinical use of neurofeedback and biofeedback in the AP region
- To promote awareness of the benefits of neurofeedback and biofeedback to the general public.

# Articles



# **Neurofeedback Applications**

By Hafeez Ullah Amin Email: <u>hafeezullah.amin@petronas.com.my</u>

# Introduction

Neurofeedback (NFB) is a technique in which the brain is trained to improve its ability and regulate bodily functions such as sleep, motor response, and learning. Besides, NFB also helps health professionals such as psychologists, therapists, and doctors as a powerful health care tool to train the patients' brain and minimize brain disorders for example Attention Deficit Hyperactivity Disorder (ADHD), autism, stress & anxiety, depression, epileptic seizures etc.

The aim of NFB is to change brain activity and improve clinical symptoms associated with psychiatric disorders. Electroencephalographic-neurofeedback (EEG-NFB) training aims to teach selfregulation of measures of the scalp EEG through biofeedback. For example, a participant may be asked to intentionally up or downregulate the amplitude of a certain EEG frequency component from a specific scalp location. This article will highlight the significant role of NFB and its various applications in health care.

## **NFB AND EPILEPSY**

Epilepsy is a common brain disorder that affects people of all ages. It is a chronic neurological disorder in which recurrent seizures occur due to abnormal neuronal activity within the human brain and affect the sensorium, mood and/or movement of the human body [1]. An Epileptic seizure occurs when there is a burst of electrical abnormal pulses in the brain. The abnormal electrical pulses spread to neighboring areas inside the brain are the cause of generating an uncontrolled storm of electrical activity. The seizure spikes can be detected in EEG by visual inspection and/or automatic diagnostic systems which occur in certain frequencies. The visual inspection needs clinical expertise but the automatic diagnostic systems are based on computational intelligence and machine learning algorithms, which can be used by medical doctors as a supporting tool.

Epilepsy treatment via neurofeedback in humans was initiated by Barry Sterman and colleagues in 1972 [2]. After their initial clinical report published in 1972, they expanded their investigations and conducted a series of controlled studies with progressively larger sample sizes of epileptic patients. Besides the Barry Sterman experimentations, other researchers also worked on epilepsy treatment via NFB and reported significant seizure reductions regardless of the EEG feedback contingencies rewarded [3]. However, it is clear from the previous literature that majority of epilepsy patients responded when SMR activity (sensory motor rhythm 12-15 Hz) was rewarded. For interested readers, see the review [4].

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This graph shows the response of patients to cognitive therapy (CT), antidepressant medication (ADM) or placebo after 8 weeks and 16 weeks of treatment (image taken from DeRubeis et al.,2008).







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#### **NFB AND DEPRESSION**

Depression is one of the most prevalent psychiatric disorders and can be defined as both a syndrome and a disorder. This is because it involves episodes of sadness, loss of interest, negative beliefs about self, lack of motivation, passive behavior, pessimism, disturbance in sleep, appetite and suicidal thoughts and impulses [5]. The clinical symptoms of depression are grouped into emotion regulation, cognition, motivation, and homoeostasis; for more detailed symptoms, see table 1 in [6]. The current treatment for depression involves antidepressant medication (ADM), cognitive therapy (CT), psychotherapy, electrical stimulation and the relatively new intervention of neurofeedback.

EEG based neurofeedback studies reported that hypoactivity that appetitive and aversive emotional behaviours are sub-served by the left and right frontal cortex [6]. Furthermore, hypoactivity of left frontal areas would be related to depression because alpha activity of EEG is commonly associated with lower metabolic activation, this relative left hypo -activity would be linked with relatively higher right than left frontal alpha power (alpha asymmetry). Thus, when training patients using neurofeedback, they would be required to decrease in lefthemispheric alpha and increase right-hemispheric alpha [6]. Other clinical protocols for EEG-NFB are reduction of theta activity in relation with beta activity in left prefrontal cortex (theta/beta ratio on the left prefrontal cortex), and simultaneously training the alpha asymmetry and theta/beta ratio.

#### **NFB AND AUTISM**

Autism is a complex neurodevelopmental disorder that affects the development of children especially their language, behavior, social interaction, and communication capabilities. The main symptom of autism is the lacking of social communication and interaction. Currently, the exact causes of autism are not clear, however, scientists believe that genetic or mitochondrial disorders, environment and atypical brain development are the variety of factors related to autism. The human mirror neuron system (MNS) is the set of neurons which are active both when a participant does an action and when he/she observes another person doing the same action [7]. The dysfunction of the MNS is believed to be a causal factor in poor social cognition of autism. For details about the MNS, see the review [8]. The detection of dysfunction of MNS related brain oscillations using EEG techniques is reported in previous studies [9, 10]. The scalp EEG patterns occurring in the range of alpha (8-12 Hz) and beta (15-25 Hz) are most evident at central regions (sensorimotor cortices) and are modulated by motor action.

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The NFB is based on operant conditioning technique and results in self-regulation of the brain's electrical oscillations. It is considered a powerful method for recovering the MNS functions and the behavioral deficits. Statistics on autistic individuals reported that 50% of the affected numbers demonstrated significant EEG abnormalities. These abnormalities have led clinicians to employ EEG-based interventions, for example NFB training (NFT). As a result, this passive brain training technique has proven to be a useful health care tool for autistic patients.

#### **NFB AND DYSLEXIA**

Dyslexia is a common condition that affects the brain in reading, speaking and writing processes. It is linked with many undesirable outcomes such as reduced educational performance and academic self -esteem. The process of reading involves multiple linguistic, visual and attentional processes; any weakness may lead to reading difficulty in children. There are various causes of dyslexia, but the most well-known cause is weakness in phonological awareness for spoken language which predicts dyslexia, for interested readers, see [11, 12]. The associated brain regions with dyslexia reported in previous studies are the F7 activity for phonological tasks. P3 and P4 which are involved in mathematical and semantic tasks, and the region between T5 and P3 (angular gyrus).

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Despite of many known associated locations, it is not easy to diagnose dyslexia on the bases of neurophysiological assessment. However, intervention techniques such as neurofeedback are reported as useful for dyslexia [13].

#### **NFB AND ADHD**

Attention Deficit Hyperactivity Disorder (ADHD) is one of the most common childhood disorders and can continue through adolescence and adulthood. The major symptoms include difficulty staying focused, paying attention, controlling behavior, and hyperactivity. ADHD persists in adolescence and adulthood can causes several problems such as poor academic performance, poor socialization, and traffic accidents. The primary treatment for AHDH is medication (psychostimulants), but around 20% of all the ADHD children fail to respond to medication and reduced growth, sleep disorders and decreased appetite are reported as side effects [14].

EEG-neurofeedback (EEG-NFB) training in ADHD involves the reduction of theta (4-8 Hz) activity and increasing the production of beta (16-20 Hz) oscillations. Another EEG based protocol for ADHD treatment is simultaneously suppressing theta activity and increasing the sensorimotor rhythm.

Besides, the above mentioned applications, NFB training plays significant role in the treatment of stress & anxiety disorders, working memory, attention improvement, and enhancing the cognitive performances of dementia & Alzheimer's patients. It is obvious that the NFB may not reverse the structural damage of the brain, as in the case of Alzheimer's disease, but it can maximise the healthy parts of the brain, resulting in delayed onset of some symptoms of these diseases.

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# Resources



# NEUROGUIDE

By Chai Meei Tyng Email: <u>meeityng@hotmail.com</u>

**NeuroGuide** is an informative and comprehensive digit EEG and QEEG analysis system developed by Applied Neuroscience, Inc. It provides Automatic Artifact Rejection, Dynamic Lifespan Eyes Open and Eyes Closed Reference Normative Database, covering the age from 2 months to 82 years.

NeuroGuide is designed for use with the LORETA Key Institute Source Localization software for registration with the Talairach MRI Atlas from the Montreal Neurological Institute which provides 3D Source Localization. Joint-Time-Frequency-Analyses (JTFA) is available for normative database analyses and instantaneous power, coherence and phase delays EEG features can be computed and visualized.

NeuroGuide also has some others add-on programs including the NeuroGuide Discriminant Functions (DIS), NeuroGuide Brain Performance Index (BPI), NeuroStat (NS), Neuro-Batch (NB), LORETA Normative Reference Database (LOR), LORETA Normative Source Correlation Database (SC), LORETA Normative Coherence and Phase Database (LCP) and LORETA Phase Reset Normative Database (LPR) for mild head injury and Learning disabilities measures. Besides, statistical analysis, batch processing, 3D Z-scores, 3D Source Localization options are available.

## **EEG Format of Importing Files**

Importing EEG files are very easy in NeuroGuide. The common file formats such as .edf, .edf+ and Text file (ASCII) are used as input data file to NeuroGuide. Meanwhile, new file formats and features are constantly being added to NeuroGuide. For up-to-date list of EEG formats which are supported by NeuroGuide, visit this

http://www.appliedneuroscience.com/EEG%20Formats.htm

#### Artifact Removal

EEG recordings are often contaminated with artifacts such as eye-blinks, eye-movement, and muscle tensions, and head movement. In NeuroGuide, these artifacts can be rejected by Automatic Editing option with the use of 10-20 linked ear montage. At least 2 minutes artifact free EEG recordings will be selected, preferably with >0.90 test-retest reliability. Upon artifact rejection, scan the EEG record and select real and valid EEG only follows by saving the EEG data in .ng file format for further analysis such as NeuroBatch (NB), NeuroStat (NS) and LORETA.

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## **Topographic Color Maps**

The color maps and connectivity maps of absolute power, relative power, power ratio, amplitude asymmetry, coherence, and phase lag can be selected under Report Selections window. All slices in the LORETA Viewer to examine source correlations between the ROI can also be generated.

#### Linking QEEG Results to Symptoms

A Symptom Check List (SCL) was developed with the goal of linking structure to function based on the spatial overlap of functional and clinical studies using fMRI, PET and EEG/MEG as well as the clinical neurological science of strokes, tumors and lesions.







## **Connectivity Suite (SC)**

The Connectivity Suite (SC) includes the full 171 electrode combination topographic maps of cross-spectra, in-phase spectra, out-of-phase spectra, correlation, coherence, phase lag, phase reset, etc. There are 19 small topographic maps corresponding to the 10-20 system location inside a single head display.

## **EEG-based Z Score Neurofeedback**

Recorded EEG activity is used for QEEG analysis and Z Score Neurofeedback training. There are two types of Z Score Neurofeedback training supported by NeuroGuide – 1) Surface 1-19 Channel Z Score Neurofeedback (NF1) allows Neurofeedback of Average Reference, Linked Ears and Laplacian montages, 2) LORETA Z Score Neurofeedback (NF2) provides Neurofeedback of 88 different Brodmann areas for absolute and relative power, power ratios, amplitude asymmetry, coherence, phase differences, phase shift and phase lock duration. Both Neurofeedback modules include a Symptom Check List. A list of amplifiers that can be used with the surface and LORETA Neurofeedback encompasses ANT eegosport, BrainMaster Discovery, MITSAR, etc.

## Conclusion

In a nutshell, NeuroGuide is a comprehensive analysis tool ranging from EEG acquisition, artifact removal, frequency domain and time domain integration (JTFA), source localization up to neurofeedback. All are available in NeuroGuide Deluxe.

# News

# Neurofeedback Training organized by Spectrum Learning & CISIR at Universiti Teknologi PETRONAS (UTP)

A short course on Neurofeedback: Neurofeedback Techniques and Applications [Neurofeedback Certification for Research (SBCIA)] has been successfully organized by the Centre for Intelligent Signal and Imaging Research (CISIR), UTP in collaboration with Spectrum Learning. The NFB short course was held from 25th – 29th January 2016 at CISIR UTP, Bandar Seri Iskandar, Perak.

This five day short course was conducted by chief trainer Dr Kenneth Kang and trainer AP Dr Aamir Saeed Malik, from Spectrum Learning and UTP, respectively. The course attracted 17 participants from various universities in Malaysia.

Aims of this course are to establish an in-depth understanding about the concept of biofeedback, neurofeedback and its research paradigm. It also equips researchers with knowledge of neurofeedback instrumentations, clinical applications of neurofeedback, types of neurofeedback available and provides hands-on experience in setting up and conducting neurofeedback sessions such as monopole and bi-polar montage training. The course also briefly reviews the application of neurofeedback for intervention in ADHD, Epilepsy, etc.



# Upcoming Event

# Neurofeedback Applications

- Attention Deficit Disorder
- Autism
- Anxiety & Post Traumatic
  Stress Disorder
- Bipolar Disorder
- Chronic Fatigue
  Syndrome
- Chronic Pain
- Cerebral Palsy
- Dissociative Disorders
- Depression and Mood Disorders
- Epilepsy
- Head Injury
- Hyperactivity Disorder
- Learning Disorders
- Myoclonic Dystrophy
- Obsessive-Compulsive
  Disorder
- PMS
- Peak Performance
- Sleep Disorders
- Stroke
- Substance Abuse and Addiction
- Violence

# Upcoming Events



## Asia's Second Neurofeedback Conference

Asia's Second Neurofeedback Conference 21-23 July, 2016Hotel Park Royal, Penang, Malaysia For more information kindly visit the conference website: http://www.apna.asia/conferences.html

