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# Neuro-Eastern

BI-MONTHLY Neurofeedback Newsletter


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# EDITOR-IN-CHIEF'S NOTE


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The Asia Pacific Neuro-biofeedback Association (APNA) was formed in January 2015 during Asia's First Neurofeedback Conference in Singapore. APNA brings together biofeedback and neurofeedback clinicians and researchers with similar interest on a single platform in the Asia - Pacific region.

Neuro-Eastern is the newsletter for APNA and this is the first issue, which is being published in January 2016. Being the first editor-in-chief of Neuro-Eastern, there are challenges that need to be faced and overcome for consistent and successful publication, which is going to be bimonthly.

To start something new takes lot of effort from the initial team. However, it takes much more effort and energy to sustain it. We hope that this newsletter will become the voice of APNA for many years to come with the dedication and devotion of the editorial team.

APNA is unique as it fills in the vacuum in this region for such a society. Currently, there are no set rules and quality measures in place for the certifications and practices in biofeedback and neurofeedback in this part of the world.

Further, there is a lack of research on Asian populations related to this area which also results in non-availability of any Asian database. Hence, APNA aspires to fill this gap by bringing both the clinicians and the researchers together on to one platform.

> "APNA brings together biofeedback and neurofeedback clinicians and researchers with similar interest on a single platform in the Asia-Pacific region. Neuro-Eastern, will be the voice of APNA "

The APNA members come from various countries in the region including Bangladesh, Indonesia, Malaysia, Singapore and Thailand. This newsletter, Neuro-Eastern, will be the voice of APNA.

We have structured it in such a way that it will cover the news of APNA activities, upcoming APNA activities, APNA flagship conference, contributions from the members and biofeedback and neurofeedback resources.

In this issue, we dedicate one page to the introduction of APNA. In addition, two pages cover the past APNA member activities and the upcoming APNA conference in Penang Malaysia in May 2016. The center pages discuss the various types of neurofeedback techniques and the resources page provides details of the EEGLab which is a freeware that can be used with MATLAB software for EEG data analysis.

We look forward to your feedback for improving Neuro-Eastern as it evolves over time.

*Aamir*

Asia Pacific Neuro-biofeedback Association

**EAST meets WEST**

Understanding Asian Mindfulness and Meditation with Science

# Introduction to Asia Pacific Neuro-biofeedback Association (APNA)

## The APNA Story

More and more people in the general public are now aware of the enormous benefits of Neurofeedback and Biofeedback in restorative and preventive health interventions. This has led to the opening of many centers that offer neurofeedback and biofeedback interventions or services in the Asia Pacific. APNA was formed out of the concerns of the following groups:

### CLINICIANS

There is a growing number of professional neurofeedback and biofeedback practitioners in the Asia Pacific region. These practitioners are also Medical doctors, Psychologists, Counsellors, Naturopaths and other certified health practitioners. They offer clinical neurofeedback and biofeedback services in hospitals, medical centers or private practices.

These practitioners got together in Asia's First Neurofeedback Conference in January 2015 in Singapore. This was a historic event where almost all of the practitioners in the Asia Pacific region got together for the first time to learn from each other, to share their experiences and to build a network to support the professional development of the field. Represented countries included:

a. Bangladesh
b. Malaysia
c. Singapore
d. Indonesia
e. Hong Kong
f. Japan

**Concerns:**

All practitioners noted the increased awareness of the health benefits of neurofeedback/biofeeback among the general public. As such, the demand for this type of intervention has increased. This seems to have led many enterprising business people to set up centers that claim to provide neurofeedback and biofeedback services, to make a quick profit from the increasing demand. These centers are even promoting their services for people with disorders and other clinical conditions.

The concerns that practitioners have are that these business setups:

a. Do not have the proper qualifications in health science
b. Do not have certified neurofeedback/biofeedback practitioners
c. Do not have supervised experience
d. Use low cost equipment that is not validated

Very often, people who sought help from these non-certified centers become worse off. This is a very serious concern for the certified professional neurofeedback/biofeedback practitioners.

Therefore, the main goals of APNA are to promote the professional and clinical use of neurofeedback and biofeedback, and to provide information to the general public on neurofeedback and biofeedback interventions.

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## VISION

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

## MISSION

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

## APNA Target Group

1. Clinicians
2. Researchers
3. Community

NEXT

### RESEARCHERS

Researchers are also becoming aware of the enormous health benefits of neurofeedback and biofeedback. There is a growing number of medical, cognitive/behavioral, psychological and other healthcare researchers who are doing research in the field of Asian mindfulness and meditation techniques and its applications to health improvements. Many are using scientific methods that includes the use physiological measures such as EEG and ECG.

Biomedical and computer engineers are also attracted to this field of research, especially those in the field of brain imaging and signal analysis. These biomedical and computer engineers are into research and development in the field of brain-computer-interface (BCI). With the knowledge that they have acquired over the years of research, they intend to apply their knowledge to develop useful clinical applications in the field of neurofeedback and biofeedback for interventions.

**Concerns:**

Many biomedical and health science researchers were also present at Asia's First Neurofeedback Conference in January 2015 in Singapore.

These bio-medical and computer engineers are different from the healthcare researchers. They are not trained in the clinical aspects of healthcare. As such, their R&D efforts to develop clinical applications will lack the clinical perspective. However, the work of these biomedical and computer engineers is crucial as R&D in this field will bring about game changing breakthroughs in clinical applications.

Their main concern is to establish close collaboration with practitioners and the community so that they can incorporate the clinical and community aspects into their R&D work. APNA will promote close collaboration between researchers, practitioners and the community in the Asia Pacific region, so as to further advance the field of neurofeedback and biofeedback.

### COMMUNITY

The community is the general public who read about the benefits of neurofeedback and biofeedback for health interventions. Many have tried medication and other forms of treatment but have limited progress. They sought Neurofeedback and biofeedback interventions to help improve their conditions further.

However, they do not know what neurofeedback and biofeedback is and how it works. They are not aware of the limitations and how it should be carried out. As such, they are at the mercy of centers or individuals who are not trained in health sciences and do have certification in neurofeedback and biofeedback (see Clinician's concerns above)

**Concerns:**

Many members of the community were also present at Asia's First Neurofeedback Conference in January 2015 in Singapore. The community is concerned about where they can find information about:

a. Neurofeedback and biofeedback intervention and how it can help them

b. Healthcare practitioners who are certified neurofeedback and biofeedback providers

APNA plans to provide information about neurofeedback and biofeedback and where they can find certified practitioners.

# Diversity in Non-Invasive Neurofeedback Approaches

By Rauf Subhani
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## Neurofeedback

Neurofeedback is the training of the brain waves in which the brain learns to alter its behaviour according to certain goals. The brain achieves this learning through defined mechanisms. The most commonly used mechanism in this respect is the operant conditioning. Operant conditioning is rewarding the brain to produce certain behaviour or punishing it, in case of failure, to produce the behaviour. In neurofeedback, the behaviour is the production of a particular type of EEG wave or waves. By increasing the deficient brain waves or decreasing the excessive brain waves, the brain is encouraged to enter into a desired state of behaviour.

### Types of Neurofeedback

By now, neurofeedback has evolved into various types. In its founding days, the neurofeedback practice was limited to symptom-based training that mainly relyied on the frequency bands. But the contemporary neurofeedback training has been adopted in many forms that have been defined following decades of research and practice. In the contemporary form, neurofeedback has seen evolution in symptom-based training as well as new defined approaches notably QEEG-based training.

#### Symptom-based Training

This approach depends on applying the suitable training protocols to the particular reported problems. Symptom-based approach is applied by making distinction among experience, client condition and target location in the brain. In the commencement of neurofeedback training, the symptom-based approaches were constrained to frequency training by enhancing/inhibiting a certain frequency band in the target location. The most notable trainings in this regard are alpha band training, SMR and alpha/theta training. In the advanced form, symptom-based approaches have incorporated alpha asymmetry training, slow cortical potential (SCP) training and infra-slow fluctuation/infra-low frequency training.

#### Alpha Training

Alpha training is used in the complaints of relaxation [1, 2], pain relief [3], peak performance [4] and psychological conditions[5-7]. Most recently, alpha training has been reported to improve strategic and controlled recollection [8]. It is usually performed in eyes-closed fashion where the subject is encouraged to sit in a relaxed position or lay down on a reclined chair. This training targets to increase the alpha power and reduce the power in lower or higher frequency bands at one or more brain locations. Mostly alpha training is performed at the parietal lobe where the alpha power is dominant.

#### SMR Training

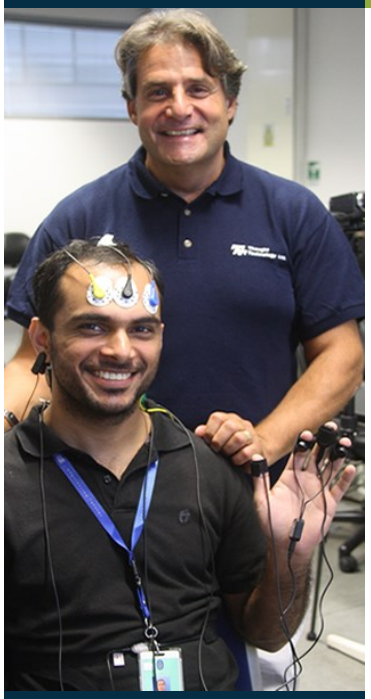
The SMR training enhances the sensori-motor rhythm of the brain by rewarding the frequency 12-15 Hz to increase its amplitude. The SMR training involves the electrodes on the sensorimotor region, C3, C4 and Cz, in a monopolar or bipolar arrangement. SMR training was started for the treatment of seizures. After that it was also tested for the case of attention deficit disorders (ADD) followed by attention deficit hyperactivity disorder (ADHD). After the successful treatment of seizures and ADHD, SMR training has been tested in many other clinical treatments and is probably the most often used and researched neurofeedback training which has successfully improved attention, restlessness and motor related problems.

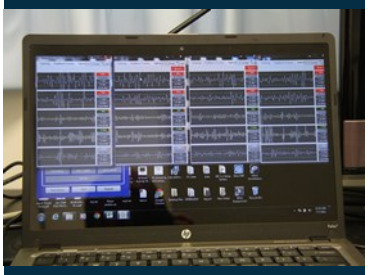
Alpha/theta Training

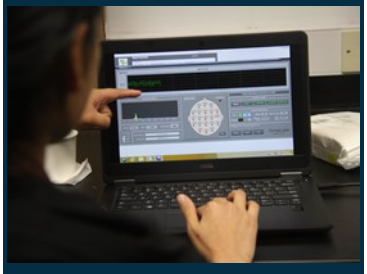
Alpha/theta training, third in the series of neurofeedback training, was developed in late 1970s [9]. Alpha waves represent relaxation [10] and theta waves reflect positive emotional state [11]. Clinically alpha/theta training has been investigated to improve cognition [12, 13] and attention deficit hyper activity disorder (ADHD) [12, 14] as well as reduced relapse in alcohol recovery [15].

### Types of Neurofeedback

1. Symptom-based Training
2. Alpha Training
3. SMR Training
4. Alpha/theta Training
5. Alpha Asymmetry Training
6. QEEG-based Training
7. Z-Score Training
8. Topographical Training







NEXT

Its effects on healthy subjects have also been tested by Egner et al. who applied the training to music performers who showed improvement in their performance [12]. Alpha/theta training targets to achieve a crossover state in which theta tends to increase in amplitude from alpha band, thus entering into hypnogogic state (a state just before sleep) that is believed to be highly thought provoking, as well as a creative state of mind. In alpha/theta training, mostly the posterior region of the brain is selected for its execution in monopolar or bipolar fashion usually with eyes closed condition.

### Alpha Asymmetry Training

Alpha asymmetry training is established on the assumption that the alpha rhythm reflects hypoactivation. Therefore, a greater alpha magnitude in the left frontal region indicates diminished approach-related behaviours mediated by that region. This asymmetric assumption is similar to Davidson's withdrawal/approach model of emotion [16]. However, alpha asymmetry training was developed later in mid-1990s by Peter Rosenfeld and Elsa and Rufus Baehr [17] while investigating correlates of mood disorders. They found out that left and right anterior activations are related to approach- and withdrawal-related behaviours, respectively. They used a two-electrode montage at F3/F4 referenced to Cz.

### QEEG-based Training

QEEG analysis involves transforming the raw EEG data into mathematical representation to generate a summary. QEEG analysis generally involves full head EEG signals unlike symptom-based approach that can include as minimum as one electrode. QEEG-based NFB is based on the conventional form of NFB that relies on rewarding and punishing the brain for the change in behaviour. QEEG NFB makes use of normative database to identify any deviation of results from the norm. Many databases are available for clinical and research purposes, such as BrainDX, neuroguide, skil, WinEEG/HBI and BRID. Many mathematical and statistical approaches have extended QEEG based trainings into new directions and provided a completely new way to analyse the EEG signals. The most important QEEG-based trainings are z-score training and topographical training.

### Z-Score Training

Z-score training is a more recent development in NFB training that makes use of statistical normal distribution to change EEG measures into z-scores, i.e., the measure of standard deviation from the mean. The mean is generally taken from a normal population. The normal data of population is assessed through databases. Z-score training makes use of two, four or nineteen EEG electrodes positioned on the scalp. The feedback to the client is provided based on moment-to-moment statistical comparisons of current EEG to norms for the client's age. As with qEEG-guided training, the feedback is designed to guide the brain toward normalized function. Despite being new, z-score training has found variety of clinical applications in which it proved to be effective such as anxiety assessment of athletes before participating in games [18], and improvement in cognitively impaired man [19].

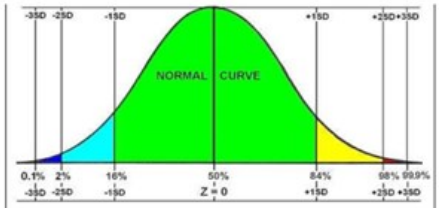



**Figure 1 Z-Scores, standard deviation from the mean interpreted in colors**

### Topographical Training

Topograms makes it possible to visualize spatial changes in the brain. Introducing topographical information as the methodology of neurofeedback makes specificity of neurofeedback better. It gives spatial changes in additional to the temporal changes in case of traditional use of neurofeedback. Topographical training becomes possible by applying mathematical techniques of low resolution electromegnatic tomographical analysis (LORETA) to EEG signals of the whole brain.

However, the LORETA-based technique is computationally complex, consuming a significant amount of time and requiring all 19 10-20 electrodes to be employed on the scalp. This problem of delay has been addressed in two ways. One is by selecting a subset of voxels for computation as recently described in [20]. Another approach to deal with high computations is using high speed advanced computers which are available for gaming or other media requirement [21].

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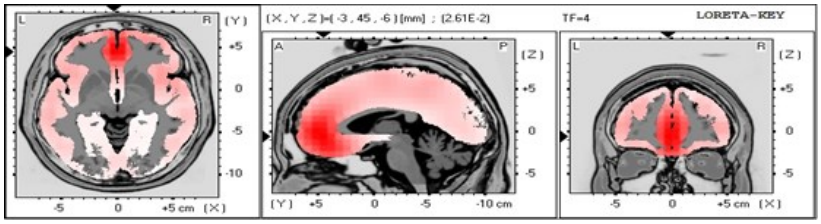
A very recent application of LORETA-based NFB has been demonstrated in a controlled study on ADHD subject in [22]. Clinical conditions such as substance abuse [23], pain management [24] and thought disorders [25] have also got advantage of LORETA-based training.

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# EEGLAB (MATLAB)

By Wajid Mumtaz
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**The EEGLAB** is a Matlab-based open-source toolbox, and facilitates the researchers/users/students to analyze electroencephalogram (EEG) and event-related potential (ERP) data with a built-in set of analysis tools such as Independent component analysis (ICA) for noise removal, power spectrum analysis, topographic maps of activations, etc.

The EEGLAB can be downloaded from an online website addressed as 'http://sccn.ucsd.edu/eeglab/install.html'. In addition, an extensive help and online tutorials for EEGLAB can be downloaded from the web link 'http://sccn.ucsd.edu/eeglab/'. The downloaded EEGLAB package from the given web link can be saved in a folder. After decompressing the downloaded EEGLAB package, it can be copied to the Matlab workspace folder.

The Matlab folder path can be updated by using the Matlab command 'editpath' or 'addpath' and providing the path where the EEGLAB package is saved. Furthermore, the EEGLAB can be invoked from the Matlab command line by typing 'eeglab'.

## The Formats Supported by EEGLAB

EEGLAB can read different file formats for EEG data as input data. For example, the most common EEG formats such as .edf, .sat, .cnt are supported as input data to EEGLAB. In addition, the EEG data with different montages or recording references can be read and converted to an average reference.

## Visualization of the EEG/ERP Data loaded by EEGLAB

As shown in Figure, once the EEG data is successfully loaded in the EEGLAB, it can be visually inspected by using the command (please add command here). The data can be observed with different scales and amplitudes. The scale and amplitudes are adjustable.

## Noise Removal with EEGLAB

Noise-free EEG data is indispensable for authentic interpretations of EEG data. Activities such as eye-blinks, eye-movements and muscular heart beats may confound the EEG recordings. In EEGLAB, two different methods are implemented for the removal of noisy data: 1) EEG noise removal with visual inspection, 2) ICA-based noise removal.

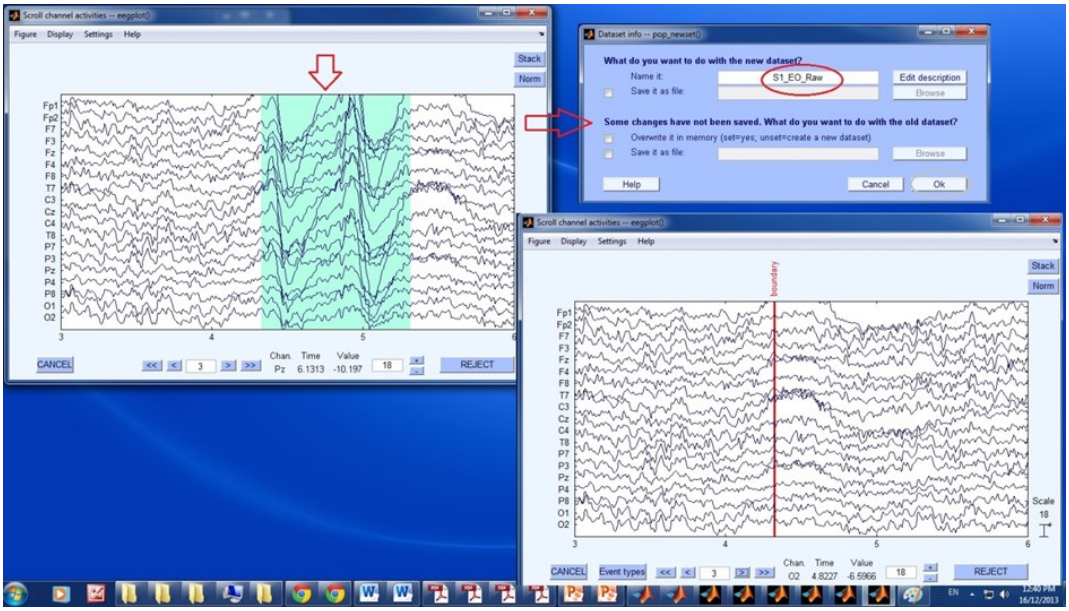
## Topographical plots of Activations and De-activations

Construction of topographical maps is a well-known method to show activations of the brain regions in association with different experimental activities. The activations and de-activations can be catered based on the color coding. For example, the activations are coded with red, and the de-activations are color-coded as blue.

## Frequency Analysis with EEGLAB

EEG is specifically designed to support the EEG based analysis. The frequency analysis is a common method for investigating the spectrum plots constructed from the EEG data.

## Conclusion



# NFB Training course organized by Spectrum Learning

Participants attending a practitioner's certification training course by Spectrum Learning in Singapore (www.spectrumlearning.com.sg)

The practitioner's certification course is recognized by the Asia Pacific Neuro-biofeedback Association (APNA). The certification courses offered by Spectrum Learning/SBCIA started in 2005 and have been refined over a decade. The certification involves lectures, practicum and supervised client hours. The four main foci of the training are knowledge, skills, experience and good clinical practice. These are qualities that a competent practitioner must possess.

The chief trainer is Dr. Kenneth Kang. He is Asia's first neurofeedback practitioner who started providing clinical neurofeedback in Singapore in 1995. Dr. Kang is also involved in research and development in the field of neurofeedback and QEEG, both in-house and in collaboration with universities in the region. Dr. Kang has trained many practitioners since 2005. Many of his students are now practicing in hospitals and clinics around the region.

For more information, please visit www.sbcia.org or www.spectrumlearning.com.sg.

Next certification training: 23 February 2016 (Singapore)

# QEEG Course organized in KL by UTP

A Short Course on Quantitative Electro Encephalogram (EEG) Analysis: Methods and Clinical Applications has been successfully organised by Sentre for Intelligent Signal and Imaging Research (CISIR). The EEG short course was held from 15th - 17th August 2015 at Universiti Teknologi Malaysia, Kuala Lumpur.

The course attracted 10 participants from various professions i.e: lecturers, researches, medical doctor and students. This 3 days short course was conducted by two main instructors; AP Dr Aamir Saeed Malik and AP Dr Nidal Kamel. From the participants' response, it was seen that they recognised CISIR's expertise and gave positive feedback. In addition, they were willing to do joint collaboration in future. Few consultancy requests were received right after the short course.

## Neurofeedback Applications

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

## Upcoming Events


**• Asia's Second Neurofeedback Conference**

May, 2016

Penang, Malaysia

For more information kindly visit the conference website:
http://www.apna.asia/conferences.html