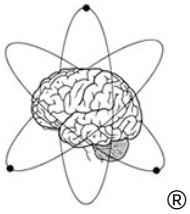

Low Frequency Bipolar Neurofeedback Protocol Guide

or
How to perform (a therapeutic trial of) neurofeedback in the absence of a quantitative electroencephalogram (QEEG).

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"*From the brain and the brain alone arise our pleasures, joys, laughter and jests, as well as our sorrows, pains and griefs*" – Hippocrates

"*Archie, the brain has a mind of its own!*" – Edith Bunker

The average client does not need expensive laboratory tests, genetic profiling, and biopsies in order to eat, exercise, and live better. A little time (a therapeutic trial of healthy lifestyle) usually shows whether the effort was worth it or not. If good results are not forthcoming, it is prudent to find the most accurate and comprehensive evaluation possible. In the realm of neural dysregulation and sub-optimum performance, this evaluation may begin with the quantitative electroencephalogram (QEEG).

Only recently has the QEEG become so affordable, available, and accurate as to be nearly routine in the evaluation of human cerebral performance. Nevertheless, it may still be inconvenient or unattainable for some.

Before QEEGs were even feasible, neurofeedback pioneers successfully and routinely ameliorated disturbances such as epilepsy, attention deficit disorder, addictions, migraine, post traumatic stress disorder, and many others. The techniques were often deceptively simple. Only now, in the 21st century, are we beginning to understand that the awareness and self-regulation of neurophysiological states through neurofeedback shares crucial neurological circuitry with the mindfulness meditation practiced for millennia throughout the world. Neurofeedback also ties in with the forces that guide the neurological development in a child's brain under the influence of secure social attachment.

This brief text is dedicated to all of you who would use any means possible to relieve human suffering.

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1. Introduction

The Technology

This manual describes the use of single-channel neurofeedback. Such a setup can be used to do traditional amplitude training. One example would be placing the ground on the right ear, the black reference electrode on the left ear, and the red exploratory electrode over the region where the amplitude training is desired. The above example is best referred to as "single-channel amplitude training (with one exploratory electrode)." Amplitude training, in most cases, will train to increase or decrease the amplitude of a particular target frequency, such as alpha or SMR.

This manual describes a different setup for single-channel neurofeedback, which is best described as "single-channel bipolar neurofeedback." In this setup, the ground remains in a convenient location while both the black and red electrodes are placed on the head. The black and red placement may be inter-hemispheric or intra-hemispheric. When using bipolar neurofeedback in this fashion, many practitioners have found that the reward frequency can be varied over a wide range, even in a single session, in an effort to find the optimal client response.

An increasing number of neurofeedback practitioners are finding exceptional results training in the low frequencies, even in the infra-slow frequencies such as 0.01 – 1.0 Hz. Some practitioners have an aversion to training at a low delta frequency that is traditionally associated with sleep or head injury. What must be remembered is that this is *not* amplitude training. With traditional amplitude training, your black electrode is on an EEG-silent area such as the ear. Thus, the only activity that is measured and rewarded is the amplitude under the single exploratory electrode.

With bipolar training, say with black at T3 and red at T4, you are automatically rewarding the difference in amplitudes between the two sites. Literally, the amplifier is subtracting the amplitude at T3 from the amplitude at T4. The reward bar graph on your screen rewards the *difference* between the two sites. If at two sites, say T3 and T4, the EEG activity is very similar, then when they are subtracted (by the amplifier), they cancel each other out and your reward bar shows a low "difference" amplitude. If the brain spontaneously shifts the phase or timing of the EEG activity at T3 and/or T4 so that they become less similar, then they will not cancel out as much and your reward instrument will show an increased "difference" amplitude. This is a technique for reducing coherence between two sites.

The Rationale

This bipolar low-frequency technique strives to enable the two sites to have more independence and autonomy at whatever frequency you are training. This is generally a good thing. This is a powerful technique for training increased robustness in the client's neural networks.[1]

In The Journal of Neuroscience, August 2008, Monto, et al wrote: [2]

> "We examined the dynamics of human behavioral performance and its correlation with infraslow (0.01–0.1 Hz) fluctuations in ongoing brain activity. …The subjects' ability to detect the sensory stimuli was strongly correlated with the phase, but not with the amplitude of the infraslow EEG fluctuations. These data thus reveal a direct electrophysiological correlate for the slow fluctuations in human psychophysical performance. We then examined the correlation between the phase of infraslow EEG fluctuations and the amplitude of 1–40 Hz neuronal oscillations in six frequency bands. Like the behavioral performance, the amplitudes in these frequency bands were robustly correlated with the phase of the infraslow fluctuations. These data hence suggest that the infraslow fluctuations reflect the excitability

[1] Othmer SE & Othmer S. Interhemispheric EEG Training: Clinical Experience and Conceptual Models. In Evans JR (Ed) - Handbook of Neurofeedback. Haworth Press, NY, 200, p. 109-136.
[2] Monto S, et al Very Slow EEG Fluctuations Predict the Dynamics of Stimulus Detection and Oscillation Amplitudes in Humans The Journal of Neuroscience, August 13, 2008, 28(33):8268-8272.

dynamics of cortical networks. We conclude that ongoing 0.01–0.1 Hz EEG fluctuations are prominent and functionally significant during execution of cognitive tasks."

This new research done in Finland gives additional support to the efforts of pioneers like Siegfried and Sue Othmer, John Anderson, and others, who explore and harness these newly discovered powerful rhythms for the benefit of their clients. It has only been in the last several years that affordable neurofeedback amplifiers and software have been capable of functioning reliably at the infra-slow frequencies.

Multiple Inhibit Bins

Another feature of the low-frequency work, as originally implemented by the Othmers, is the use of multiple inhibit bins. In traditional amplitude training, it is common to have a "high inhibit" instrument to discourage excessive beta activity or EMG activity. Suppose you have a high inhibit which is set for the range of 18-30 Hz. You observe that your client has 20 Hz activity that is usually above 5 microvolts but occasionally above 10 microvolts. You could set an alarm threshold so that any signal above 10 microvolts between 18 and 30 Hz gives a warning signal. However, your client may also have a repeated 4 microvolt activity at some other frequency, say 28 Hz, that is more clinically significant. Unfortunately, it will not trigger the "high inhibit" because the high inhibit is set to 10 microvolts across the entire 18-30 Hz range. Unfortunately, in order to capture the 28 Hz 4 microvolt signal, you can't just lower the general 18-30 Hz threshold from 10 microvolts down to 4 microvolts because the 20 Hz signal is usually above 5 microvolts and would set off the alarm all the time.

One way to capture more rogue excursions is to have multiple inhibit bins, each spanning 4 Hz. For example, you could have an 18-22 Hz bin, a 22-26 Hz bin, and a 26-30 Hz bin. The 18-22 Hz bin could have a threshold of 10 microvolts to catch its rogue excursions, and the 26-30 Hz bin could have a threshold of 4 microvolts to catch its rogue excursions as well.

Bad Reactions and Side Effects

Remember the Finish study above that concluded: "the subjects' ability to detect the sensory stimuli was strongly correlated with the phase, but not with the amplitude of the infraslow EEG fluctuations". It is possible that, at a particular infra-slow frequency, your client might suddenly detect his or her own sensory stimuli more acutely. This could happen suddenly and distress your client. It is your job to watch your client carefully and alter your reward frequency as needed. Much of this booklet will help you do this.

Some incidences where people have claimed to have been harmed by low-frequency bipolar training are ones where they were self training and did not orient to the development of altered arousal or sensation, which then became distressing. In other cases, the trainer may have not have been paying attention to subtle changes in client behavior (breathing, appearance, tone of voice, etc.). The inclusion of peripheral measures of autonomic stress, such as GSR or heart rate variability (HRV) power spectrum, can often provide advanced warning.

In general, most practitioners who have taken the time to understand the rationale and implementation of this technique expect to observe some sort of change in their clients within the first 1-3 visits. If positive change seems elusive, you might need to consider breathing, HRV, a closer look at diet (excitotoxins) and addictions, or the possibility of PTSD. You might consider alpha-theta "deep states" training to help with client integration and development of self-consciousness and narrative.

Always, if there has been a history of head trauma, epilepsy, brain surgery, stroke, or poor results with neurofeedback, you should have a QEEG done.

Conclusions

The author is unaffiliated with the Othmers and is solely responsible for the content of this book. I hope all your clients are ones you can help. Please contact me at mind@growing.com for more information.