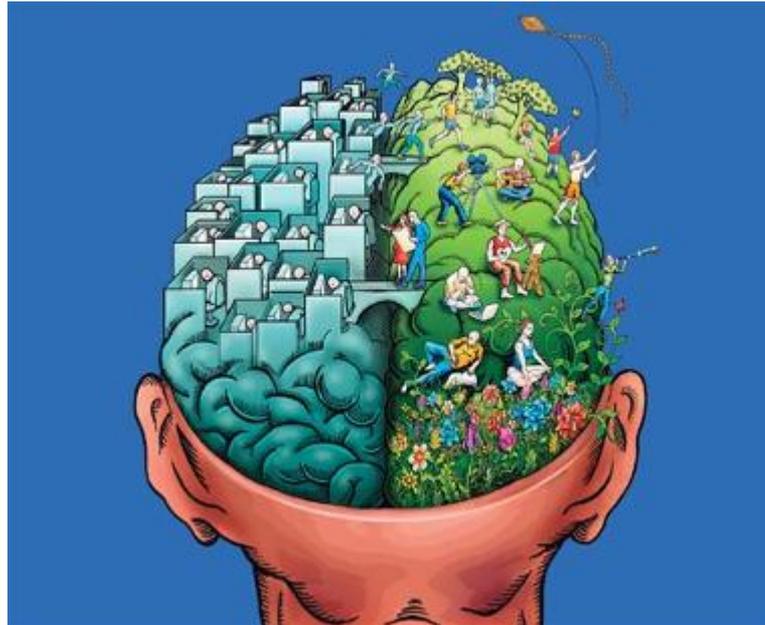


Introduction to Neurofeedback



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Our World is The Marvelous World of the Brain



*Senses, Perception, Cognitions,
Images, Emotions, Executive functions
etc.... Are all regulated by the brain.*

Neurofeedback

Is also called Electroencephalogram (EEG) biofeedback.

EEG (EEG) is the recording of electrical activity along the scalp.

During Neurofeedback external sensors are connected (with paste) so that the brain activity can be monitored.

The clinician, the neurofeedback software and hardware help the client change their brain waves by rewarding shifts toward a more regulated and stable brain state.

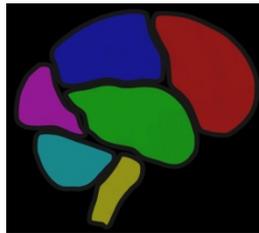
Neurofeedback is a gradual learning process

What is Neurofeedback?

- Neurofeedback is direct training of brain function, by which the brain learns to function more efficiently.
- The neurofeedback clinician observes the brain in action from moment to moment. The information is shown back to the person (biofeedback). And the brain is rewarded for changing its own activity to more appropriate patterns.

What is Neurofeedback?

- Neurofeedback is a gradual learning process. It applies to any aspect of brain function that we can measure with encephalography EEG.
- Neurofeedback is also called EEG Biofeedback, because it is based on electrical brain activity, the electroencephalogram, or EEG.
- Neurofeedback is training in self-regulation. It is simply biofeedback applied to the brain directly.
- Self-regulation is a necessary part of good brain function. Self-regulation training allows the system (the central nervous system) to function better.

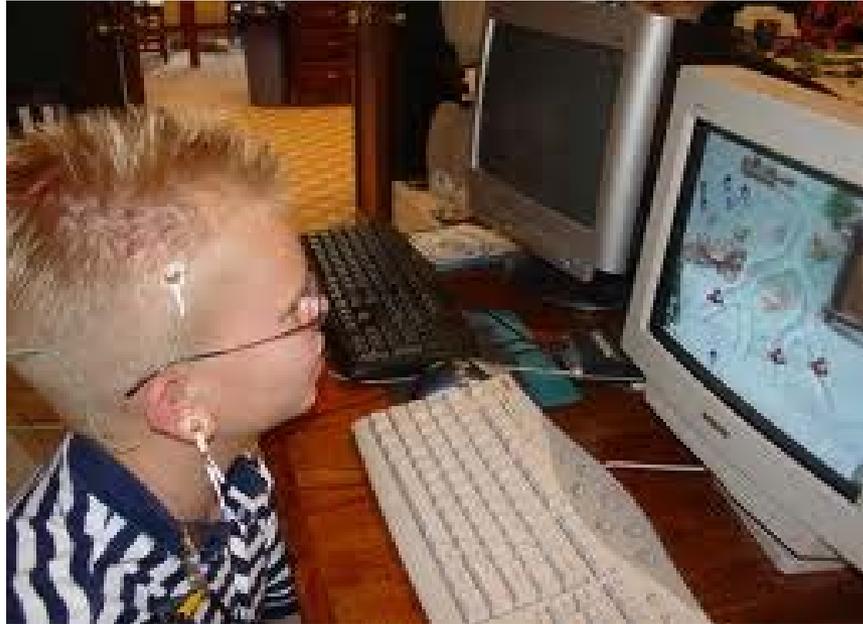


Neurofeedback (NFB) is non invasive. Nothing is entered into the brain. It is painless.

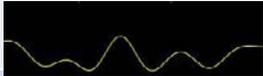
The process involves training the brain to respond appropriately according to the goals of the treatment. The brain is reinforced to stay within a framework of upper and lower brainwaves. Treatments are based on clinically standardized protocols.



Most Research that has been done shows tha NFB improves sleep, nightmares, inability to focus, ADD, ADHD, problematic behaviors and learning difficulties.



Basic Brainwaves

Delta 1-4 Hz	Theta 4-7 Hz	Alpha 8-10 Hz 10-12 Hz	SMR 12-15 Hz	Beta 15- 18Hz	High Beta 19-40 Hz	Gamma ≥ 40 Hz
Sleep	Drowsy	Relaxed Focused	Relaxed Thinking	Active Thinking	Excited	Problem Solving
						
Sleep states	Creativity emotions	Meditate daydream relaxation	Sensory motor rhythm controlled relaxed focus	focus, analyze calculate	fear, anxiety, excess thinking	Aid in Learning & Mental Acuity

Hz = cycles per second of a periodic phenomenon

Amplitude = height of wavelength

Frequency = number of occurrences of a repeating event per unit time

Delta 1-4Hz



- Delta brain waves are commonly associated with deep sleep patterns. Dominant brain-wave pattern among infants.
- High-amplitude rhythmic delta brain waves in adults are often found to accompany **brain injury or disorders**.
- Delta brain waves may also be observed in the EEG of children with **attention-deficit hyperactivity disorder (ADHD)** accompanied by Theta.
- Loss of physical awareness is accompanied by delta waves. If you got **knocked-unconscious**, delta brain waves would be observed in your E.E.G. reading.

Theta 4-7 Hz



Theta brain waves may be rhythmic or arrhythmic. Theta brain waves are commonly linked to enhanced levels of creativity, emotions, and spontaneity.

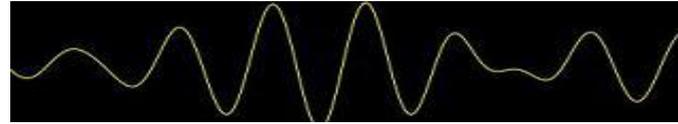
When your brain is producing excessive amounts of theta brain waves, you may feel **depressed**, be daydreaming, have **attention-deficit disorder** and **feel distracted**.

Fuzzy thinking, **poor decision making**, **impulsivity**, and **slowed reaction time** have been linked to excessive theta wave activity.

Children generally have considerably higher theta brain wave activity in comparison to adults.

Associated with long-term memories, repressed memories and **repressed emotions**.

Alpha 8-12 Hz



Associated with daydreaming & relaxation. When we close our eyes, alpha activity increases.

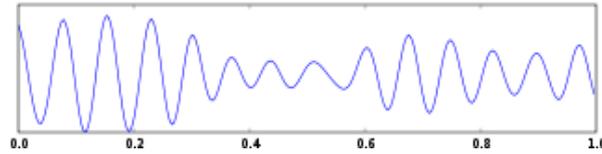
Children who have **depression** or commonly daydream are known to have high amplitudes of alpha waves.

Alpha brain waves are commonly observed in the rear parts of your brain, while less common in your frontal parts.

If you are depressed, you may have excessive alpha brain waves in the left-hemisphere of your brain.

If alpha is found to be high in frontal parts of your brain, it may be causing **depression, ADD/ADHD**, or another disorder.

SMR 12-15 Hz;



Sensory motor rhythm = low beta. Barry Stermann PhD 1970s

First observed in physically still cats.

How do we train the Brain?

The trainee is asked to watch a video (game, short film etc). When the brain stays within the desired framework of brain waves then the brain is reinforced positively.



A positive "reward" feedback is given to the individual, and if the change is in the opposite direction from what was intended, then either different feedback is given or "positive" feedback is inhibited (or blocked). These ideas can be applied in various combinations depending on the protocol decided upon by the trainer.

Some approaches believe that conscious understanding and mediation of that information is important for the training process; however, this claim has never actually been verified. Those approaches also believe that neurofeedback training can be understood as being based on a form of operant and/or classical conditioning. In that frame of reference, when brain activity changes in the direction desired by the trainer directing the training, a positive "reward" feedback is given to the individual, and if the change is in the opposite direction from what was intended, then either different feedback is given or the provision of otherwise attained "positive" feedback is inhibited (or blocked). These ideas can be applied in various combinations depending on the protocol decided upon by the trainer. Rewards/Reinforcements can be as simple as a change in pitch of a tone or as complex as a certain type of movement of a character in a video game. This experience could be called operant conditioning for internal states even though no research has yet demonstrated that clear operant response curves occur under those scenarios.

Suggested Bibliography

James R. Evans Ph.D and Andrew Abarbanel, MD, Ph.D
(1999) Introduction to Quantitative EEG and
Neurofeedback. Academic Press, London, UK

Jim Robbins (2008). A Symphony in the Brain. The
Evolution of the New Brain Wave Biofeedback. Grove Press,
N.Y. New York

Mark Steinberg Ph.D and Siegfried Othmer Ph.D (2004)
ADD: The 20-Hour Solution. Training Minds to
Concentrate and Self-Regulate Naturally Without
Medication. Robert Reed Publishers, Bandon Oregon, U.S.A.

R.Coben, M. Linden and T. Myers Neurofeedback for
Autistic Spectrum Disorder: Review of the Literature
Applied Psychophysiological Biofeedback (2010) 35:83-
105