

History of Neurofeedback

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Neurofeedback, variously known as EEG Biofeedback, or Neurotherapy, is a form of biofeedback. Biofeedback is a straightforward procedure: For example, if you want to raise the temperature in your finger, all you need is a thermometer that is sensitive enough to show temperature fluctuations, in this case, 0.1 degrees. Almost all people will be able to raise the temperature in their finger by several degrees within 15 minutes. With practice a person can become proficient in this ability, which can be very useful for people who tend to have cold extremities. Neurofeedback is an extension of biofeedback to the training of the Electroencephalogram (EEG) or brainwaves.

The first experiments in neurofeedback were actually done on cats, in a neurophysiology lab¹. Barry Sterman (UCLA) demonstrated that the EEG of cats can be conditioned. Using the operant conditioning paradigm, he rewarded the cats for producing a 14hz EEG rhythm across their motor strip, and the amplitude of the EEG increased; he then rewarded the cats for producing less EEG at the same spot, and they did; and lastly, he rewarded the cats for producing more EEG at the same spot, and they did.

This was an interesting result, but did not launch the field until Sterman serendipitously discovered that these same cats, trained to produce a 14hz rhythm across their sensory-motor strip, resisted seizures. Sterman investigated this phenomenon and concluded that the EEG training reduced seizure activity significantly^{2,3}.

Over the next ten years^{4,5,6,7,8,9,10}, Professor Sterman researched the effects of neurofeedback on humans with intractible seizures, most of whom were waiting for split brain surgery. He trained them to produce a 14hz rhythm on their motor strip in the dominant hemisphere. The seizure sufferers received large numbers of training sessions (in the hundreds). The results summarised in a later paper³ indicated that 82% demonstrated significant (>30%) seizure reduction, with an average reduction exceeding 50%; studies reported reduction in seizure severity, with about 5% of subjects showing complete control of seizures for up to one year, even when anticonvulsants were reduced or entirely withdrawn.

Following this very significant success with one of the most severe disturbances in brain function, researchers began to notice that various other symptoms changed for the better as a result of neurofeedback training^{11,12}. They noted improvements in hyperactivity, sleep and mood. Also, many of the seizure patients had developed seizures as a result of traumatic brain injury, and their condition improved nevertheless.

Professor Joel Lubar, University of Tennessee, began treating children with ADHD and found that Neurofeedback was effective in reducing their symptoms^{11,12,13,14,15,16}. His work has been developed and expanded by many other researchers. To date at least 89 papers have been published in this area. A comprehensive Neurofeedback bibliography of professional papers on Neurofeedback and ADHD, as well as other disorders, can be found on the website of the International Society for Neurofeedback and Research – isnr.org, the professional organization of neurofeedback practitioners¹⁷. Of these, 11 involve comparisons with control groups, 39 involve group outcome studies, 16 are single case studies and 23 are review and theoretical articles. The dependent variables in the group studies are quite diverse, and include parent report^{18,19,20}, continuous performance tests^{20,21,22,23,24,25,26,27,28,29}, changes in IQ scores^{16,23,30,31}, EEG and event related potential changes^{32,33,34}, and fMRI changes^{35,36}, to name some. Meta-analyses of the outcome studies indicate that improvement rates for Neurofeedback treatment of ADHD are in the 70-80% range³⁷.

Today, Neurofeedback is being used successfully to treat a wide variety of disorders, including PTSD, anxiety, addictions, Autistic Spectrum disorders, depression, ADHD, and epilepsy, as well as being used in Peak Performance training. For a full listing, please see the Neurofeedback bibliography, mentioned above¹⁷.

Frank H. Duffy, M.D., Professor and Pediatric Neurologist at Harvard Medical School, stated in an editorial in the January, 2000 issue of the journal *Clinical Electroencephalography* that the professional literature suggests that neurofeedback should play a major therapeutic role in many difficult areas. "In my opinion, if any medication had demonstrated such a wide spectrum of efficacy it would be universally accepted and widely used" (p. v). "It is a field to be taken seriously by all" (p. vii).

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