

## Neurofeedback for treating tinnitus.

Progress in brain research (Prog Brain Res) 2007; 166: 473-554

Additional Info: Netherlands

ISSN: 0079-6123 (Print); NLM Unique Journal Identifier: 0376441

### **Abstract:**

Many individuals with tinnitus have abnormal oscillatory brain activity. Led by this finding, we have developed a way to normalize such pathological activity by neurofeedback techniques (Weisz et al. (2005). PLoS Med., 2: e153). This is achieved mainly through enhancement of tau activity, i.e., oscillatory activity produced in perisylvian regions within the alpha frequency range (8-12Hz) and concomitant reduction in delta power range (0.5-4Hz). This activity is recorded from electrodes placed on the frontal scalp. We have found that modification of the tau-to-delta ratio significantly reduces tinnitus intensity. Participants who successfully modified their oscillatory pattern profited from the treatment to the extent that the tinnitus sensation became completely abolished. Overall, this neurofeedback training was significantly superior in reducing tinnitus-related distress than frequency discrimination training.

**Record Type:**

Index Medicus

**Article Type:**

Journal Article

**Citation:**

Status: In-Data-Review Owner: NLM

**Date of Entry:**

20071024

**Accession No:**

PMID: 17956812

**Database:**

MEDLINE

[Dohrmann K](#) ; [Elbert T](#) ; [Schlee W](#) ; [Weisz N](#)

Affiliation: University of Konstanz, Department of Psychology, Box D 25, 78457 Konstanz, Germany. Tel.: +49 (0)7531 884612.

**Title:**

Tuning the tinnitus percept by modification of synchronous brain activity.

**Source:**

Restorative neurology and neuroscience (Restor Neurol Neurosci)  
2007; 25(3-4): 371-8  
Additional Info: Netherlands

**Standard No:**

ISSN: 0922-6028 (Print); NLM Unique Journal Identifier: 9005499

**Language:**

English

**Abstract:**

**Purpose:** Tinnitus, the perception of sound without the presence of a physical stimulus, provides the opportunity to study neural codes of percepts without simultaneous processing of stimuli. Previously, we have found that tinnitus is associated with enhanced delta- and reduced tau-power in temporal brain regions. By operantly modifying corresponding aspects of spontaneous EEG activity, the aim of the present study was to corroborate the assumption that tinnitus should be reduced if patterns of ongoing synchronous brain activity are normalised. **Methods:** In response to different variants of neurofeedback, a total of twenty-one patients produced significant changes in EEG frequency bands. **Results:** Simultaneous alteration of both frequency bands was strongly related to changes in tinnitus intensity matched before and after the intervention ( $r=-0.74$ ). In those two patients with the greatest modulatory success, the tinnitus sensation resided completely in response to the treatment. Comparing the neurofeedback-treated patients with a group of patients trained with a frequency discrimination task ( $n=27$ ), the tinnitus relief in the neurofeedback group was significantly stronger. **Conclusions:** This study supports the notion that altered patterns of intrinsic ongoing brain activity lead to phantom percepts and offer new routes to the treatment of tinnitus.

**Record Type:**

Index Medicus

**Article Type:**

Journal Article

Status: In-Data-Review Owner: NLM

20071018

PMID: 17943012

MEDLINE

**Citation:**

**Date of Entry:**

**Accession No:**

**Database:**

[Leins U](#) ; [Goth G](#) ; [Hinterberger T](#) ; [Klinger C](#) ; [Rumpf N](#) ; [Strehl U](#)

Affiliation: Department of Psychiatry and Psychotherapy, University Hospital of Tübingen, Osianderstrasse 24, 72076, Tübingen, Germany. Ulrike.leins@med.uni-tuebingen.de

**Title:**

Neurofeedback for children with ADHD: a comparison of SCP and Theta/Beta protocols.

**Source:**

Applied psychophysiology and biofeedback (Appl Psychophysiol Biofeedback) 2007 Jun; 32(2): 73-88  
Additional Info: United States

**Standard No:**

ISSN: 1090-0586 (Print); NLM Unique Journal Identifier: 9712383

**Language:**

English

**Abstract:**

Behavioral and cognitive improvements in children with ADHD have been consistently reported after neurofeedback-treatment. However, neurofeedback has not been commonly accepted as a treatment for ADHD. This study addresses previous methodological shortcomings while comparing a neurofeedback-training of Theta-Beta frequencies and training of slow cortical potentials (SCPs). The study aimed at answering (a) whether patients were able to demonstrate learning of cortical self-regulation, (b) if treatment leads to an improvement in cognition and behavior and (c) if the two experimental groups differ in cognitive and behavioral outcome variables. SCP participants were trained to produce positive and negative SCP-shifts while the Theta/Beta participants were trained

to suppress Theta (4-8 Hz) while increasing Beta (12-20 Hz). Participants were blind to group assignment. Assessment included potentially confounding variables. Each group was comprised of 19 children with ADHD (aged 8-13 years). The treatment procedure consisted of three phases of 10 sessions each. Both groups were able to intentionally regulate cortical activity and improved in attention and IQ. Parents and teachers reported significant behavioral and cognitive improvements. Clinical effects for both groups remained stable six months after treatment. Groups did not differ in behavioural or cognitive outcome.

[Caria A](#) ; [Veit R](#) ; [Sitaram R](#) ; [Lotze M](#) ; [Weiskopf N](#) ; [Grodd W](#) ; [Birbaumer N](#)

Affiliation: Institute of Medical Psychology and Behavioral Neurobiology, Eberhard-Karls-University of Tübingen, Tübingen, Germany. [andrea.caria@uni-tuebingen.de](mailto:andrea.caria@uni-tuebingen.de) <[andrea.caria@uni-tuebingen.de](mailto:andrea.caria@uni-tuebingen.de)>

**Title:**

Regulation of anterior insular cortex activity using real-time fMRI.

**Source:**

NeuroImage (Neuroimage) 2007 Apr 15; 35(3): 1238-46  
Additional Info: United States

**Standard No:**

ISSN: 1053-8119 (Print); NLM Unique Journal Identifier: 9215515

**Language:**

English

**Abstract:**

Recent advances in functional magnetic resonance imaging (fMRI) data acquisition and processing techniques have made real-time fMRI (rtfMRI) of localized brain areas feasible, reliable and less susceptible to artefacts. Previous studies have shown that healthy subjects learn to control local brain activity with operant training by using rtfMRI-based neurofeedback. In the present study, we investigated whether healthy subjects could voluntarily gain control over right anterior insular activity. Subjects were provided with continuously

updated information of the target ROI's level of activation by visual feedback. All participants were able to successfully regulate BOLD-magnitude in the right anterior insular cortex within three sessions of 4 min each. Training resulted in a significantly increased activation cluster in the anterior portion of the right insula across sessions. An increased activity was also found in the left anterior insula but the percent signal change was lower than in the target ROI. Two different control conditions intended to assess the effects of non-specific feedback and mental imagery demonstrated that the training effect was not due to unspecific activations or non feedback-related cognitive strategies. Both control groups showed no enhanced activation across the sessions, which confirmed our main hypothesis that rtfMRI feedback is area-specific. The increased activity in the right anterior insula during training demonstrates that the effects observed are anatomically specific and self-regulation of right anterior insula only is achievable. This is the first group study investigating the volitional control of emotionally relevant brain region by using rtfMRI training and confirms that self-regulation of local brain activity with rtfMRI is possible.

**MESH Subject(s) below:**

**Descriptor:**

(Minor): [Adult](#)  
[Biofeedback \(Psychology\) -- physiology](#)  
[Brain Mapping -- methods](#)  
[Cerebral Cortex -- physiology](#)  
[Computer Systems](#)  
[Evoked Potentials -- physiology](#)  
[Humans](#)  
[Image Interpretation, Computer-Assisted -- methods](#)  
[Magnetic Resonance Imaging -- methods](#)  
[Male](#)  
[Volition -- physiology](#)

**Record Type:**

Index Medicus

**Article Type:**

Journal Article; Research Support, Non-U.S. Gov't

Status: MEDLINE Owner: NLM

20070409

20070612

PMID: 17336094

MEDLINE

**Citation:**

**Date of Entry:**

**Date Completed:**

**Accession No:**

**Database:**

[Cannon R](#) ; [Lubar J](#) ; [Congedo M](#) ; [Thornton K](#) ; [Towler K](#) ; [Hutchens I](#)

Affiliation: Psychology Program, University of Tennessee, Brain Research and Neuropsychology Lab, Knoxville, Tennessee 37996, USA. rcannon2@utk.edu

**Title:**

The effects of neurofeedback training in the cognitive division of the anterior cingulate gyrus.

**Source:**

The International journal of neuroscience (Int J Neurosci) 2007 Mar; 117(3): 337-57

Additional Info: United States

**Standard No:**

ISSN: 0020-7454 (Print); 1563-5279 (Electronic); NLM Unique Journal Identifier: 0270707

**Language:**

English

**Abstract:**

This study examines the efficacy of neurofeedback training in the cognitive division of the anterior cingulate gyrus and describes its relationship with cortical regions known to be involved in executive functions. This study was conducted with eight non-clinical students, four male and four female, with a mean age of twenty-two. Learning occurred in the ACCd at significant levels over sessions and in the anterior regions that receive projections from the AC. There appears to be a multidimensional executive circuit

that increases in the same frequency in apparent synchrony with the AC and it may be possible to train this sub-cortical region using LNFB.

[Angelakis E](#) ; [Stathopoulou S](#) ; [Frymiare JL](#) ; [Green DL](#) ; [Lubar JF](#) ; [Kounios J](#)

Affiliation: Department of Psychology, Drexel University, Philadelphia, PA 19102-1192, USA.

**Title:**

EEG neurofeedback: a brief overview and an example of peak alpha frequency training for cognitive enhancement in the elderly.

**Source:**

The Clinical neuropsychologist (Clin Neuropsychol) 2007 Jan; 21(1): 110-29

Additional Info: Netherlands

**Standard No:**

ISSN: 1385-4046 (Print); NLM Unique Journal Identifier: 8806548

**Language:**

English

**Abstract:**

Neurofeedback (NF) is an electroencephalographic (EEG) biofeedback technique for training individuals to alter their brain activity via operant conditioning. Research has shown that NF helps reduce symptoms of several neurological and psychiatric disorders, with ongoing research currently investigating applications to other disorders and to the enhancement of non-disordered cognition. The present article briefly reviews the fundamentals and current status of NF therapy and research and illustrates the basic approach with an interim report on a pilot study aimed at developing a new NF protocol for improving cognitive function in the elderly. EEG peak alpha frequency (PAF) has been shown to correlate positively with cognitive performance and to correlate negatively with age after childhood. The present pilot study used a double-blind controlled design to investigate whether training older individuals to increase PAF would result in improved cognitive performance. The results suggested that PAF NF improved cognitive processing speed and

executive function, but that it had no clear effect on memory. In sum, the results suggest that the PAF NF protocol is a promising technique for improving selected cognitive functions.

**References:**

Number: 50

**MESH Subject(s) below:**

**Descriptor:**

(Major): [Alpha Rhythm](#)  
[Electroencephalography](#)  
(Minor): [Aged](#)  
[Biofeedback \(Psychology\) -- physiology](#)  
[Cerebral Cortex -- physiopathology](#)  
[Cognition Disorders -- physiopathology](#)  
[Cognition Disorders -- rehabilitation](#)  
[Double-Blind Method](#)  
[Female](#)  
[Humans](#)  
[Male](#)  
[Memory -- physiology](#)  
[Neuronal Plasticity -- physiology](#)  
[Neuropsychological Tests](#)  
[Pilot Projects](#)  
[Problem Solving -- physiology](#)  
[Reaction Time -- physiology](#)  
[Reference Values](#)

**Note(s):**

Grant Number: DC-04818; Grant Info: DC; Agency: NIDCD

**Record Type:**

Index Medicus

**Article Type:**

Journal Article; Randomized Controlled Trial; Research Support, N.I.H., Extramural; Review

**Citation:**

Status: MEDLINE Owner: NLM

**Date of Entry:**

20070316

**Date Completed:**

20070530

20070601

PMID: 17366280

MEDLINE

**Date of Update:**

**Accession No:**

**Database:**

**Author(s):**

[Heinrich H](#) ; [Gevensleben H](#) ; [Strehl U](#)

Affiliation: Child & Adolescent Psychiatry, University of Erlangen-Nürnberg, Germany. hheinri@arcor.de

**Title:**

Annotation: neurofeedback - train your brain to train behaviour.

**Source:**

Journal of child psychology and psychiatry, and allied disciplines (J Child Psychol Psychiatry) 2007 Jan; 48(1): 3-16

Additional Info: England

**Standard No:**

ISSN: 0021-9630 (Print); 1469-7610 (Electronic); NLM Unique Journal Identifier: 0375361

**Language:**

English

**Abstract:**

BACKGROUND: Neurofeedback (NF) is a form of behavioural training aimed at developing skills for self-regulation of brain activity. Within the past decade, several NF studies have been published that tend to overcome the methodological shortcomings of earlier studies. This annotation describes the methodical basis of NF and reviews the evidence base for its clinical efficacy and effectiveness in neuropsychiatric disorders. METHODS: In NF training, self-regulation of specific aspects of electrical brain activity is acquired by means of immediate feedback and positive reinforcement. In frequency training, activity in different EEG frequency bands has to be decreased or increased. Training of slow cortical potentials (SCPs) addresses the regulation of cortical excitability. RESULTS: NF studies

revealed paradigm-specific effects on, e.g., attention and memory processes and performance improvements in real-life conditions, in healthy subjects as well as in patients. In several studies it was shown that children with attention-deficit hyperactivity disorder (ADHD) improved behavioural and cognitive variables after frequency (e.g., theta/beta) training or SCP training. Neurophysiological effects could also be measured. However, specific and unspecific training effects could not be disentangled in these studies. For drug-resistant patients with epilepsy, significant and long-lasting decreases of seizure frequency and intensity through SCP training were documented in a series of studies. For other child psychiatric disorders (e.g., tic disorders, anxiety, and autism) only preliminary investigations are available. CONCLUSIONS: There is growing evidence for NF as a valuable treatment module in neuropsychiatric disorders. Further, controlled studies are necessary to establish clinical efficacy and effectiveness and to learn more about the mechanisms underlying successful training.

**MESH Subject(s) below:**

[Pop-Jordanova N](#) ; [Markovska-Simoska S](#) ; [Zorcec T](#)

Affiliation: Department of Pediatrics, Faculty of Medicine, University of Skopje, R. Macedonia.

**Title:**

Neurofeedback treatment of children with attention deficit hyperactivity disorder.

**Source:**

Prilozi / Makedonska akademija na naukite i umetnostite, Oddelenie za biološki i medicinski nauki = Contributions / Macedonian Academy of Sciences and Arts, Section of Biological and Medical Sciences (Prilozi) 2005 Aug; 26(1): 71-80  
Additional Info: Macedonia

**Standard No:**

ISSN: 0351-3254 (Print); NLM Unique Journal Identifier: 101189513

**Language:**

English

**Abstract:**

**BACKGROUND:** Biofeedback is a modern computer-related technique used for assessment and therapy of many psychophysiological disorders, especially stress-related ones. After a short overview of the basic concepts of biofeedback, in this study the application of EEG biofeedback (neurofeedback) in the assessment of and therapy for attention deficit hyperactivity disorders (ADHD) is presented and discussed. **METHODS:** The study comprised 12 children diagnosed as ADHD, selected according to ICD-10, and assessed by WISC-R, Q-EEG, neurofeedback and Conner's questionnaire for parents and teachers. The mean age was 9.5 years (7 to 13), both sexes. Each of them participated in a five-month programme of neurofeedback training, performed two times weekly with Biograph/ProComp 2.0 protocols. **RESULTS:** Post-treatment results showed an improved EEG pattern expressed in increased 16-20 Hz (beta) activity and decreased 4-8 Hz (theta) activity. In parallel, higher scores on WISC-R, better school notes and improved social adaptability and self-esteem were obtained. **CONCLUSIONS:** EEG biofeedback operant conditioning is a good choice for treatment of ADHD children. The method is non-invasive and has high cost-benefit. Optimal results are obtained in children of higher age. Cooperation with family members and teachers is crucial.

**MESH Subject(s) below:**

**Descriptor:**

(Major): [Electroencephalography](#)

(Minor): [Attention Deficit Disorder with Hyperactivity -- therapy](#)

[Biofeedback \(Psychology\) -- methods](#)

[Child](#)

[Female](#)

[Humans](#)

[Intelligence Tests](#)

[Male](#)

**Record Type:**

Index Medicus

**Article Type:**

Journal Article

Status: MEDLINE Owner: NLM

20050824

20070327

PMID: 16118616

MEDLINE

**Citation:**

**Date of Entry:**

**Date Completed:**

**Accession No:**

**Database:**

**Author(s):**

[Leins U](#) ; [Hinterberger T](#) ; [Kaller S](#) ; [Schober F](#) ; [Weber C](#) ; [Strehl U](#)

Affiliation: Universitätsklinik für Psychiatrie und Psychotherapie,  
Universität Tübingen. ulrike.leins@med.uni-tuebingen.de

**Title:**

Neurofeedback der langsamen kortikalen Potenziale und  
der Theta/Beta-Aktivität für Kinder mit einer ADHS: ein  
kontrollierter Vergleich.

Translated Title: [Neurofeedback for children with  
ADHD: a comparison of SCP- and theta/beta-protocols]

**Source:**

Praxis der Kinderpsychologie und Kinderpsychiatrie (Prax  
Kinderpsychol Kinderpsychiatr) 2006; 55(5): 384-407  
Additional Info: Germany

**Standard No:**

ISSN: 0032-7034 (Print); NLM Unique Journal Identifier: 0404246

**Language:**

German

**Abstract:**

Research groups have consistently reported on behavioral and  
cognitive improvements of children with ADHD after neurofeedback.  
However, neurofeedback has not been commonly accepted as a  
treatment for ADHD. This is due, in part, to several methodological  
limitations. The neurofeedback literature is further complicated by  
having several different training protocols. Differences between the  
clinical efficacy of such protocols have not been examined. This

study addresses previous methodological shortcomings while comparing the training of theta-beta-frequencies (theta-beta-group) with the training of slow cortical potentials (SCP-group). Each group comprised of 19 children with ADHD that were blind to group assignment. The training procedure consisted of 30 sessions and a six months follow-up training. Pre-/post measures at pretest, the end of the training and the follow-up included tests of attention, intelligence and behavioral variables. After having already reported intermediate data (Strehl et al. 2004), this paper gives account on final results: Both groups are able to voluntarily regulate cortical activity, with the extent of learned self-regulation depending on task and condition. Both groups improve in attention and IQ. Parents and teachers report significant behavioral and cognitive improvements. Clinical effects for both groups remain stable six months after training. Groups do not differ in behavioral or cognitive outcome variables.

**MESH Subject(s) below:**

**Descriptor:**

(Major): [Beta Rhythm](#)

[Electroencephalography](#)

[Theta Rhythm](#)

(Minor): [Adolescent](#)

[Attention Deficit Disorder with Hyperactivity -- diagnosis](#)

[Attention Deficit Disorder with Hyperactivity -- physiopathology](#)

[Attention Deficit Disorder with Hyperactivity -- therapy](#)

[Biofeedback \(Psychology\) -- physiology](#)

[Cerebral Cortex -- physiopathology](#)

[Child](#)

[Double-Blind Method](#)

[Female](#)

[Follow-Up Studies](#)

[Humans](#)

[Male](#)

[Outcome Assessment \(Health Care\)](#)

[Personality Assessment](#)

**Record Type:**

Index Medicus

**Article Type:**

Comparative Study; English Abstract; Journal Article; Randomized Controlled Trial

**Citation:**

Status: MEDLINE Owner: NLM

**Date of Entry:**

20060727

**Date Completed:**

20061019

**Date of Update:**

20061115

**Accession No:**

PMID: 16869483

**Database:**

MEDLINE

**Author(s):**

[Bazanova OM](#) ; [Aftanas LI](#)

**Title:**

[The use of individual EEG peculiarities for increase of neurofeedback efficiency]

**Source:**

Zhurnal nevrologii i psikiatrii imeni S.S. Korsakova / Ministerstvo zdravookhraneniia i meditsinskoi promyshlennosti Rossiiskoi Federatsii, Vserossiiskoe obshchestvo nevrologov [i] Vserossiiskoe obshchestvo psikhiatrov (Zh Nevrol Psikhiatr Im S S Korsakova) 2006; 106(2): 31-6

Additional Info: Russia (Federation)

**Standard No:**

NLM Unique Journal Identifier: 9712194

**Language:**

Russian

**Abstract:**

An aim of the study was to demonstrate efficiency of neurofeedback in using individual frequency ranges of electroencephalogram (EEG). The sessions of theta/beta decreasing

and alpha simulating trainings were carried out in 2 outpatients: one of them with attention deficit disorder (a schoolboy) and another one with functional pain contraction (a professional musician). The neurofeedback with standard frequency did not result in any improvement of psychometric and EEG characteristics of both patients. The neurofeedback training with individual frequency of maximal peak and alpha band width improved these characteristics that suggest efficiency of the approach used.

**MESH Subject(s) below:**

**Descriptor:**

(Major): [Biofeedback \(Psychology\)](#)

[Electroencephalography](#)

(Minor): [Alpha Rhythm](#)

[Attention Deficit Disorder with Hyperactivity -- diagnosis](#)

[Attention Deficit Disorder with Hyperactivity -- pathophysiology](#)

[Beta Rhythm](#)

[Brain -- physiology](#)

[Child](#)

[Humans](#)

[Male](#)

[Middle Aged](#)

[Occipital Lobe -- physiology](#)

[Theta Rhythm](#)

**Record Type:**

Index Medicus

**Article Type:**

English Abstract; Journal Article

**Citation:**

Status: MEDLINE Owner: NLM

**Date of Entry:**

20060321

**Date Completed:**

20060418

**Date of Update:**

20061115

**Accession No:**

PMID: 16548372

**Database:**

MEDLINE

**Author(s):**

[Lévesque J](#) ; [Beauregard M](#) ; [Mensour B](#)

Affiliation: Centre de Recherche en Neuropsychologie Expérimentale et Cognition (CERNEC), Département de psychologie, Université de Montréal, Canada.

**Title:**

Effect of neurofeedback training on the neural substrates of selective attention in children with attention-deficit/hyperactivity disorder: a functional magnetic resonance imaging study.

**Source:**

Neuroscience letters (Neurosci Lett) 2006 Feb 20; 394(3): 216-21  
Additional Info: Ireland

**Standard No:**

ISSN: 0304-3940 (Print); NLM Unique Journal Identifier: 7600130

**Language:**

English

**Abstract:**

Attention Deficit Hyperactivity Disorder (AD/HD) is a neurodevelopmental disorder mainly characterized by impairments in cognitive functions. Functional neuroimaging studies carried out in individuals with AD/HD have shown abnormal functioning of the anterior cingulate cortex (ACC) during tasks involving selective attention. In other respects, there is mounting evidence that neurofeedback training (NFT) can significantly improve cognitive functioning in AD/HD children. In this context, the present functional magnetic resonance imaging (fMRI) study was conducted to measure the effect of NFT on the neural substrates of selective attention in children with AD/HD. Twenty AD/HD children--not taking any psychostimulant and without co-morbidity-participated to the study. Fifteen children were randomly assigned to the Experimental (EXP) group (NFT), whereas the other five children were assigned to the Control (CON) group (no NFT). Subjects from

both groups were scanned 1 week before the beginning of the NFT (Time 1) and 1 week after the end of this training (Time 2), while they performed a Counting Stroop task. At Time 1, for both groups, the Counting Stroop task was associated with significant loci of activation in the left superior parietal lobule. No activation was noted in the ACC. At Time 2, for both groups, the Counting Stroop task was still associated with significant activation of the left superior parietal lobule. This time, however, for the EXP group only there was a significant activation of the right ACC. These results suggest that in AD/HD children, NFT has the capacity to normalize the functioning of the ACC, the key neural substrate of selective attention.

**MESH Subject(s) below:**

**Descriptor:**

(Major): [Biofeedback \(Psychology\)](#)

(Minor): [Attention -- physiology](#)

[Attention Deficit Disorder with Hyperactivity -- physiopathology](#)

[Attention Deficit Disorder with Hyperactivity -- psychology](#)

[Brain Mapping](#)

[Cerebral Cortex -- physiopathology](#)

[Child](#)

[Female](#)

[Functional Laterality -- physiology](#)

[Humans](#)

[Magnetic Resonance Imaging](#)

[Male](#)

[Neuropsychological Tests](#)

[Psychomotor Performance -- physiology](#)

**Record Type:**

Index Medicus

**Article Type:**

Journal Article; Randomized Controlled Trial; Research Support, Non-U.S. Gov't

**Citation:**

Status: MEDLINE Owner: NLM

**Date of Entry:**

20060130

**Date Completed:**

20060330

**Date of Update:**

20061115

**Accession No:**

PMID: 16343769

**Database:**

MEDLINE

**Author(s):**

[Barnea A](#) ; [Rassis A](#) ; [Zaidel E](#)

Affiliation: Bio-Keshev Center, Kibutz Givat Chaim Ichud, Israel.

**Title:**

Effect of neurofeedback on hemispheric word recognition.

**Source:**

Brain and cognition (Brain Cogn) 2005 Dec; 59(3): 314-21

Additional Info: United States

**Standard No:**

ISSN: 0278-2626 (Print); NLM Unique Journal Identifier: 8218014

**Language:**

English

**Abstract:**

We applied SMR/theta neurofeedback (NF) training at central sites of 20 Israeli children aged 10-12 years, half boys and half girls. Half of the subjects received C3 training and the other half C4 training, consisting of 20 half-hour sessions. We assessed the effects of training on lateralized lexical decision in Hebrew. The lateralized lexical decision test reveals an independent contribution of each hemisphere to word recognition (Barnea, Mooshagian, & Zaidel, 2003). Training increased accuracy and sensitivity. It increased left hemisphere (LH) specialization under some conditions but it did not affect interhemispheric transfer. Training did affect psycholinguistic processing in the two hemispheres, differentially at C3 and C4. Training also increased hemispheric independence. There were surprising sex differences in the effects of training. In boys, C4

training improved LH accuracy, whereas in girls C3 training improved LH accuracy. The results suggest that the lateralized NF protocol activates asymmetric hemispheric control circuits which modify distant hemispheric networks and are organized differently in boys and girls.

**MESH Subject(s) below:**

**Descriptor:**

(Minor): [Analysis of Variance](#)  
[Child](#)  
[Feedback, Psychological -- physiology](#)  
[Female](#)  
[Functional Laterality -- physiology](#)  
[Humans](#)  
[Male](#)  
[Perceptual Masking -- physiology](#)  
[Psycholinguistics](#)  
[Recognition \(Psychology\) -- physiology](#)  
[Reference Values](#)  
[Sex Factors](#)  
[Transfer \(Psychology\) -- physiology](#)  
[Verbal Learning -- physiology](#)

**Note(s):**

Grant Number: N20187; Agency: PHS

**Record Type:**

Index Medicus

**Article Type:**

Clinical Trial; Journal Article; Research Support, N.I.H., Extramural

**Citation:**

Status: MEDLINE Owner: NLM

**Date of Entry:**

20051212

**Date Completed:**

20060214

**Date of Update:**

20061115

**Accession No:**

PMID: 16337872

MEDLINE

**Database:**