Society of Applied Neuroscience

Proceedings of the Scientific Program

31st August – 2nd September 2005

Istanbul, Turkey

Welcome

On behalf of the Society of Applied Neuroscience I am pleased to welcome you to the Scientific Program.

We have put together a brief but comprehensive programme of keynote addresses, symposia and presentations from a range of experts in the field.

The programme begins on Wednesday with a keynote from Prof Roy John examining the subtypes of psychotic states.

Thursday begins with a keynote from Prof Basar looking at how face perception influences the EEG. This is followed by presentations from Prof Pfurtscheller and Prof Karakas. In the afternoon Dr Congedo chairs a symposium on new techniques and approaches.

Friday begins with a symposium headed by Dr Strehl examining childhood and adolescent disorders, which is continued in the afternoon by Prof Kropotov.

I'm sure you'll agree that this represents a full and varied programme reflecting advances in the field. We wish you an enjoyable and fruitful meeting!

Prof. John Gruzelier

Program Schedule

Wednesday, 31st August

18.00 – 18.50 **Keynote I.** Prof. Roy John
Subtyping of Psychotic States

18.50 – 19.20 **Individual Presentation** Dr. Adrian Burgess
Are EEG measures of functional connectivity useful for the objective diagnosis of schizophrenia?

Thursday, 1st September

9.00 – 9.50 **Keynote II.** Prof Erol Basar
Brain oscillations differentiate familiar from unfamiliar faces

Individual Presentations

9.50 - 10.20 Prof Gert Pfurtscheller
Motor-imagery induced sensorimotor rhythms

10.20 - 11.00 Prof Jordan Popjordanov
Quantum excitability of cortical dipoles and the mental arousal spectrum

11.00 - 11.30 Coffee

11.30 - 12.00 **Individual Presentation** Dr Christa Neuper
Reliability of EEG event-related de-(synchronization): long-term stability and consistency across different cognitive tasks

12.00 – 12.50 **Keynote III.** Prof Sirel Karakaþ
Cognitive processing in different states of consciousness represented by neuroelectric responses

12.50 -14.00 Lunch

Symposia I (Dr Marco Congedo)
New Techniques and Approaches

14.00 - 14.15 Dr Marco Congedo
Real Time Neuroscience: An independent field of research?

14.15 – 14.45 Prof Gert Pfurtscheller
Direct EEG-based Brain-Computer Communication

14.45 - 15.15 Dr Anatole Lecuyer
Virtual Reality and Real-Time Neurosciences

15.15 - 15.45 Coffee

15.45 -16.15 Dr Erwin Hartsuiker
Wireless recording technology

16.15 – 16.45 Prof Roy John
Dynamic Intervention in Coma

17.00 AGM

Program Schedule

Friday 2nd September

Symposia IIa (Dr Ute Strehl)
Childhood and Adolescent Disorders

9.00 - 9.30 Dr Tanju Surmeli
Left and right hemispheric EEG biofeedback training in Autistic spectrum disorder: 22 case studies

9.30 - 10.00 Prof Nada Popjordanova
Comparison of clinical results of EEG- and EDR-biofeedback for childhood and adolescent disorders

10.00 - 10.30 Dr Ute Strehl
A controlled comparison of slow cortical potentials and beta/theta training for children with ADHD

10.30 - 11.00 Coffee

11.00 - 11.30 Dr Harmut Heinrich
Training of slow cortical potentials in ADHD: Evidence for positive behavioural and electrophysiological effects.

11.30 - 12.00 Dr Martin Batty
A randomised control comparison of neurofeedback vs. attention training in ADHD: a progress report.

12.00-12.30 Dr Rien Breteler
Neurophysiological and neuropsychological characterisation of 175 unmedicated patients with ADHD: Implications for neurotherapy.

12.30 - 1.45 Lunch

Symposia IIb (Prof Juri Kropotov)
Childhood and Adolescent Disorders

1.45 - 14.15 Dr Numan Ermutlu
The effects of SMR training on ERPs in ADHD, bruxism, and nail biting

14.15 – 14.45 Drs Lynda and Michael Thompson
ADHD and Asperger's: A comparison of EEG and profiles and outcomes after neurofeedback

14.45 - 15.15 Prof Juri Kropotov
Applications of QEEG and ERPs in neurofeedback for ADHD in children

15.15 – 15.45 Coffee

15.45 - 16.15 Dr Beverley Steffert
Typologies of dyslexia: QEEG and psychometrics

16.15 – 16.45 Prof John Gruzelier
Alpha/theta training: New results with implications for adolescent disorders

16.45 – 17.45 Panel Discussion

Abstracts

Authors: Başar, E.[a,b], Özgören, M.[a,b] Öniz, A.[a,b], Güntekin, B.[d], & Eroğlu-Başar, C.[b,c]
Title: Brain oscillations differentiate familiar from unfamiliar faces.
Affiliation: [a]Dokuz Eylül University, Multidisciplinary Brain Dynamics Research Center & Faculty of Medicine, Department of Biophysics, 35340, Izmir, Turkey. [b] TUBITAK Brain Dynamics Research Unit, Ankara, Turkey. [c] Bremen, Institute of Psychology and Cognition Research & Center for Cognitive Sciences, University of Bremen, P.O. Box 330440, D-28334 Bremen, Germany. [d]TUBITAK BAYG, Ankara, Turkey

How does the brain electrically react to the presentation of the grandmother picture? In order to analyze this longstanding question of neuroscience we developed a strategy consisting of three types of stimulations was applied: A simple *light signal* (30 cd/m), 2) A stimulation signal showing the *face of an anonymous elderly lady* and 3) the picture *(face) of the own grandmother of the subject.* The subjects (N=26) were healthy, young people, in the age of 15-32 years. The pictures of the grandmother and of the anonymous face elicit varied degrees of enhancements and prolongations, in various frequency windows of cortical recording sites. Accordingly, the distributed alpha, delta, theta, beta and gamma systems *are selectively activated and manifest a differentiated ample distribution* during memory activation. There are around 30 significant peak to peak amplitude changes differentiating the activations of oscillations to both types of facial stimuli in a time period of 0-500 ms following picture presentation. Important differentiations are: The F_4 fast theta response (6-8 Hz) upon presentation of grandmother picture is 20 % higher than the picture to anonymous face ($p<0.05$). In C_z the amplitude of the face gamma response is significantly larger (22%) than grandmother response ($p<0.001$). In C_3 the amplitude of face gamma response is significantly larger (38%) than grandmother response ($p<0.05$). In the beta frequency window (15-30 Hz) anonymous face responses are significantly larger than the grandmother responses at F_3 (36%), F_4 (46%), C_z (47%) and P_3 (105%) ($P< 0.05$) locations. Occipital face and grandmother delta (0.5-3.5) responses are approx. 50% higher than the frontal ones. The delta posterior-anterior topological differentiations in delta band are not observed in responses to simple light, thus indicating that occipital theta response is sensitive only to face presentations. Face recognition problem incorporates also changes in facial expressions. We therefore extended our analysis on face recognition by using a new paradigm, which consisted to present to subjects (N=18) pictures of happy and angry faces, after necessary tests to define "happy", "neutral" and "angry" conditions. Such modulation of face expressions triggered prominent topologically changes in the oscillatory brain responses. Important examples are the great increases in the amplitude and the degree of phase locking of the occipital theta and gamma responses versus the neutral face stimulation of unknown subjects. The used paradigms are highly efficient for recognition of faces, accordingly for differentiating of semantic and episodic memory activations, further for differentiation of face expressions.

Authors: Batty, M. J., Frick, A., Hawken, M., Steffert, T., and Gruzelier, J.H.
Title: A randomised control comparison of neurofeedback vs. attention training in ADHD: a progress report.
Affiliation: Imperial College London, U.K.

Although studies utilising EEG biofeedback (neurofeedback) in Attention Deficit Hyperactivity Disorder (ADHD) have generated promising results, acceptance of neurofeedback in the wider scientific community remains limited. The present study redresses some of the criticisms directed at previous research, by the use of single blind random assignment and equivalent levels of therapist contact across each of two conditions. 21 children (19 male, mean age 9 years 4 months) with a DSM-IV diagnosis of ADHD were randomly assigned to either neurofeedback training or a programme of computer games (Captain's Log), designed to improve various facets of attention. In each group, subjects were stratified on the basis of their medication status, although all assessments were completed following a 48-hour medication wash out period. All subjects completed 30 sessions of either neurofeedback or computer training and were assessed pre and post-training on a battery of behavioural, cognitive and psychophysiological measures. Preliminary data suggest that while both interventions may reduce some of the core symptoms associated with ADHD, the performance of subjects receiving neurofeedback was superior to that of participants in the Captain's Log group. This improvement was evident in both the TOVA and Attention Network Task, in which flanker inhibition and RTs were reduced, while accuracy significantly increased following neurofeedback. Ongoing analysis aims to determine whether these improvements correlate with a reduction in the theta/beta ratio. In addition, regression analysis will determine the extent to which within session learning is associated with reduced ADHD symptoms. Although limited by low subject numbers, the preliminary data offer supportive evidence in favour of the efficacy of neurofeedback, which cannot be accounted for by increased expectancy and therapist contact.

Authors: Breteler, M [1,2], Arns, M [2] & Gordon, E [3]
Title: Neurophysiological and neuropsychological characterisation of 175 unmedicated patients with ADHD: Implications for neurotherapy.
Affiliation: [1] *Radboud University, Nijmegen, The Netherlands.* [2] *Brain Resource Company B.V., Nijmegen, The Netherlands.* [3] *The Brain Resource Company Plc., Sydney, Australia*

Disturbances of arousal regulation and hypo-arousal have been proposed as part of the core pathophysiology of ADHD. Dopamine and noradrenalin are associated with sympathetic arousal. Cholinergic activity is associated with parasympathetic arousal. Dysregulation in dopamine/noradrenalin and cholinergic function may therefore produce arousal disturbances. Skin conductance (sweat rate) and heart rate provide robust measures of arousal.
Markers were identified using 175 ADHD cases and 175 matched healthy peers from the International Brain Database. For healthy peers, normalization allows their performance to be quantified in the context of normal variation in age and sex. Normalization provides stringent control of the data. Markers were identified using measures which differed between ADHD and healthy controls at a highly significant level ($p < .0001$). 83% of ADHD cases was defined by a Brain Resource cognition marker (= cognition errors composite: CPT + errors due to impulsivity), vs 4% in healthy peers (96% identified as healthy). 90% of Cases was defined by combined Brain Resource cognition plus EEG and ERP Markers (i.e., Lack of sustained attention (reduced P150), poor working memory (reduced P450) and impaired response to novelty (reduced early P300) during CPT, enhanced frontal and reduced posterior P300 for target stimuli, and corresponding lack of inhibition for task irrelevant 'background'stimuli (enhanced N100 for non-targets).Corresponding delay and reduced motor response to 'Go'stimuli in the 'Go-NoGo' task was found for P300, as well as focal delay in N250 latency at temporal region for ANGER and corresponding deficit in recognizing anger. ERP Markers were localized in the brain using LORETA. Consistent with the models of ADHD, ERP deficits were localized to frontal and cingulate brain regions.
70% of Cases showed disturbances in autonomic arousal, consistent with 'hypoarousal' in ADHD, and with a dysregulation in noradrenalin/dopamine and cholinergic systems. 15% Showed signs of allied learning problems and 70% showed signs of allied reduced emotional intelligence, especially self-esteem. Implications for neurotherapy will be discussed, focussing on the relevance of individualized psychophysiological and neuropsychological assessments.

Author: Burgess, A.P.
Title: Are EEG measures of functional connectivity useful for the objective diagnosis of schizophrenia?
Affiliation: Imperial College London

Background

Despite evidence that abnormal functional connectivity is a critical feature in schizophrenia, reliable discrimination between patients and healthy controls is not possible on this basis. The aim of this study was to determine whether improved classification could be achieved by additionally considering the pattern of connections.

Methods

EEG was recorded during rest from two independent samples of patients and controls and measures of functional connectivity were obtained. The JCFO algorithm, trained on one sample and tested on the other, was used to classify each case and to identify the critical pattern of connections that discriminated between the groups.

Results

The JCFO algorithm showed good sensitivity and specificity on the training data and the efficiency of the classifier was confirmed on the test data. The critical distinguishing feature was a combination of abnormal connectivity that included the right frontal region.

Conclusions

Patients with schizophrenia can be distinguished from controls on the basis of an abnormal combination of functional connections focused on the right frontal region

Authors: Ermutlu, M.N. (1), Karamürsel, S. (2) and Döler, A. (3)
Title: The Effects of SMR Training on ERP in ADHD, Bruxism, and Nail Biting
Affiliation: 1 Kadir Has University Faculty of Medicine,
2 Istanbul University Istanbul Medical Faculty, 3 Etiler Güven Laboratory

A low P3 amplitude is present in various disinhibitory conditions such as attention-deficit hyperactivity disorder (ADHD), substance abuse, antisocial personality, conduct disorder, OCD with Tourette syndrome. The patients with low P3 manifested a significantly higher incidence of externalizing disorders and disinhibitory traits than the high P3 group. The P3 has been proposed to reflect attentional allocation and context updating processes of working memory and to involve the activation of inhibitory processes over widespread cortical areas. The amplitude of P3 is taken to reflect CNS inhibition (the larger the P3, the more the inhibition, while its time of occurrence (latency) reflects mental processing speed. In this study the effects of SMR/theta training was assessed by event related potentials (ERP) in patients with ADHD (N=16 M; 11,8± 2,8), in patients with bruxism (N=10: 8F, 2M; 35 ±13,6) and in patients with nail biting symptom (N=14; 4F, 10M; 13,3 ± 7,5).

RESULTS: In patients with ADHD, bruxism, and nail biting SMR/Theta training increased P3 significantly and caused a significant slow positive potential shift in the 200-500 ms range after stimulus. In ADHD patients theta/SMR and theta/beta1 ratios significantly decreased. In bruxisim patients alpha, SMR, and beta 1 bands increased significantly. In patients with nail biting symptom only SMR increased significantly. After training nail biting and bruxism symptoms resolved. In ADHD patients social relations and academic performance increased, approved by parents and teachers.

CONCLUSION: Robust change from slow negative potential shift to slow positive potential shift and significant increase in P3 amplitude suggest that SMR/theta training induces increase in inhibitory processes. Bruxism and nail biting symptoms can be related to disinhibition. SMR/theta training can be at least a complementary treatment modality in disorders and symptoms related to dysinhibition especially in ADHD and should be tried in its externalizing comorbid disorders.

Authors: Gruzelier, J. (1), Raymond, J. (1) and Parkinson, L. (2)
Title: Alpha/Theta training: New results with implications for adolescent disorders.
Affiliation: 1 Division of Neuroscience & Mental Health, Imperial College London. 2 Brain Health, London.

Operant control of the theta/alpha ratio has now been demonstrated in a number of reports (Egner, Strawson & Gruzelier, 2002; Egner and Gruzelier, 2003, 2004). In the course of these studies we confirmed the expectations of Green (1977) who pioneered this technique to enhance creativity, in view of the extensive cultural documentation of the hypnogogic state, which is produced through elevation of the theta/alpha ratio, as a state promoting creative insights. In conservatoire students, in two consecutive studies, artistry in performance was enhanced to a professionally significant degree through alpha/theta training, with notable enhancement of interpretative imagination in performance and musicality. At the same time students experienced enhanced feelings of well being (Edge and Lancaster, 2004). Here we report on two new studies. In the first we went on to extend the results to dance performance and found with five weeks of training professionally significant improvements in dance performance, and showed that these could also be achieved through training coherent changes in hear rate variability. The two approaches appeared to influence different aspects of dance performance (Raymond et al, 2005a). In the second study we extended the clinical implication of the influences on well being, by training medical students with high self-report ratings of social anxiety and withdrawal. Again 10, 20 minute sessions were found to be efficacious when compared with a mock feedback control group, with mood changes measured with the Profile of Mood States (Raymond et al, 2005b). As a development of this clinical work we are carrying out a pilot study on patients with borderline personality disorder.

Authors: Heinrich, H[1,2], Gevensleben, H[3], Moll, G.H.[1], Rothenberger, A.[3]
Title: Training of slow cortical potentials in ADHD: evidence for positive behavioural and electrophysiological effects
Affiliations: [1]Child & Adolescent Psychiatry, University of Erlangen, Erlangen, Germany. [2]Heckscher Klinik, München, Germany. [3]Child & Adolescent Psychiatry, University of Göttingen, Göttingen Germany

Objective: Learned self-control of slow cortical potentials (SCPs) may be clinically helpful in neuropsychiatric disorders characterized by deficient cortical self-regulation, e.g. attention deficit hyperactivity disorder (ADHD). In this study behavioral and neurophysiological effects of an extended SCP training were tested in ADHD children.
Methods: 13 ADHD children, aged 7 to 13 years, participated in a SCP neurofeedback training during summer holidays. They completed 25 sessions of 50 minutes each within three weeks. Before and after the training, parents completed the German ADHD rating scale (FBB-HKS) and event-related potentials were recorded in a cued continuous performance test (CPT-OX). For a waiting list group of 9 ADHD children, the same testing was applied also at an interval of three weeks.
Results: According to parent ratings, the FBB-HKS score was reduced by about 25% after training. SCP training did not affect the P300 but led to a pronounced CNV increase in cue trials of the CPT-OX test. ADHD children may be able to allocate more attentional resources expecting the succeeding relevant stimulus after SCP training. As a consequence, behaviourally, a decrease of impulsivity errors was observed.
Conclusion: Positive behavioral and specific neurophysiological effects of SCP training provide first evidence that this method may become a valuable treatment module for ADHD.

Author: John, E.R.
Title: Subtyping of Psychotic States
Affiliation: New York University School of Medicine and Nathan Kline Institute for Psychiatric Research of New York

This lecture will review the basic procedures of quantitative analysis of the EEG(QEEG), and demonstrate the differential sensitivity of the Neurometric method of QEEG analysis. Evidence will be presented in various developmental and psychiatric disorders that subtypes of patients exist which are homogeneous with respect to symptomatology and diagnosis but heterogeneous with respect to pathophysiology, evolution of illness and response to treatment. A very large cohort of psychotic patients from psychiatric hospitals in New York and Berlin, diagnosed as either alcoholic (A), depressive (D), or schizophrenic (S), has been subjected to cluster analysis based upon QEEG variables. Six clusters were found, replicating the results of an earlier study based only on a smaller group of patients all diagnosed as schizophrenic. Each cluster contains some patients diagnosed as A, D or S.. Three dimensional source localization images (VARETA) reveal certain common and certain disparate features implicating two different neuroanatomical systems in all six clusters. Implications for treatment will be discussed.

Author: John, E.R.
Title: Dynamic Intervention in Coma
Affiliation: New York University School of Medicine and Nathan Kline Institute for Psychiatric Research of New York

This lecture will review prevailing beliefs about the genesis of coma and provide a meta-analysis of a number of rather radical endeavours to treat patients in spite of the existing dogmas. The case history of a patient who suffered severe hypoxic encephalopathy in May 2004 after a surgical mishap will be presented in detail. A systematic attempt is still in progress to re-establish and regulate an appropriate neurochemical environment for the CNS, using novel QEEG methods to evaluate dose response curves. Brain electrical responses of this akinetic, mute patient diagnosed as PVS/MCS were used to demonstrate differential activation of brain regions during performance of imaginary tasks by the patient. The longitudinal evolution of this case will be described.

Author: Karakaþ, S.
Title: Cognitive processing in different states of consciousness represented by the neuroelectric responses of the brain
Affiliation: Hacettepe University Spec. Ar. Experimental Psychology, Ankara, Turkey

The electrophysiological responses of the brain in rapid eye movements sleep (REM) and the four stages of nonREM (NREM) sleep include the event-related potentials (ERPs) and the event-related oscillations (EROs). On the basis of ERPs and EROs, information processing operations in sleep were compared with those in wakefulness. Data on overnight sleep was acquired from 12 (age range: 20-33 yrs; mean age 24 yrs) right-handed, healthy volunteer males. Data on the awake stage was collected from 21 right-handed male volunteers that were matched for age. Electrophysiological responses were obtained in response to the passive oddball (OB-p) paradigm under sleep and under active OB (OB-a) and mismatch negativity paradigms (MMN) under wakefulness. Auditory stimulation consisted of 65 dB, 2000 Hz deviant (p= .20) and 1000 Hz standard (p= .80) stimuli with 10 ms r / f time and 50 ms duration. Overall, sleep ERPs consisted of a negative peak at 140 ms, a positive peak at 230 ms, another negative peak at 370 ms and positive peak at 450 ms followed by a large negativity at the 450-940 ms time window. These peaks varied in amplitude, latency and duration according to different stages of sleep. The configuration of the oscillatory responses showed three configurations: Large amplitude, differentiated delta and distinct theta response of long duration (in response to deviant stimuli under Stages 2-4 and under Ob-a paradigm); distinct theta response only with short duration (in response to deviant stimuli under REM and MMN). These findings showed that sleep stages can be differentiated on the basis of ERPs ad EROs. Highest responsivity was obtained in Stage 2 sleep. REM was similar to the wakefulness stage with respect to the early ERP and ERO components. Information processing aspects of these time-domain and frequency-domain responses, problem areas and prospects for sleep research will be discussed.

Author: Kropotov, J.
Title: Applications of QEEG and ERPs in neurofeedback for ADHD in children
Affiliation: Institute of the Human Brain of Russian Academy of Sciences, St. Petersburg, Russia. Norwegian University for Science and Technology, Trondheim, Norway

Introduction.
Knowledge about EEG organization in the patient's brain is necessary requirement for application of neurofeedback. This paper presents a methodological approach developed in my laboratory for 1) assessment electrophysiological indexes of executive functions in ADHD population and for 2) constructing individually tailored neurofeedback protocols for correction executive dysfunctions.

Method
250 normal children and 300 ADHD children (age from 7 to 16 years) participated in the study. Artifacts were corrected by means of ICA (independent component analysis) method. Absolute and relative spectra, spectral ratios, spectral asymmetries, coherence, phase, as well as event-related potentials (ERPs) and event-related desynchronization (ERDs) in four different tasks were used as parameters for electrophysiological assessment. The tasks included 1) GO/NOGO task for assessment executive functions, 2) mathematical task for assessment abstract reasoning, 3) reading task for assessment reading and speech understanding, 4) acoustic task for assessment auditory information processing. ICA was applied for separation ERPs components reflected different stages of information processing. Power spectra and ERPs components were mapped into Talairach space by LORETA.

Results
The paper will discuss the results of comparing spectral, ERPs and ERDs parameters between ADHD and healthy populations. In particular, our data reveal 4 sub-types of QEEG abnormalities and 3 subtypes of ERPs abnormalities in ADHD. Application of EEG spectrograms, ERPs and ERDs for constructing individual protocols of neurotherapy will be presented. In particular, the effect of beta EEG training on EEG parameters in a subgroup of ADHD children characterized by increased theta beta ratio in central areas will be presented.

Conclusion
This study is the first to show that three types of parameters (amplitude/coherence spectra, ERPs, and ERDs) can be effectively used for constructing individual protocols in ADHD sub-types.

Author: Lécuyer, A.
Title: Virtual Reality and Real-Time Neurosciences
Affiliation: SIAMES Project IRISA/INRIA, Campus de Beaulieu.
35042 Rennes, France

This presentation will focus on the relation between Virtual Reality Technologies and Real-Time Neurosciences. (We define a virtual reality system as an immersive system that provides the user with a sense of presence – the feeling of "being there" – by means of plausible interactions with a synthetic environment simulated in real-time).

We will first describe the recent advances in the field of Virtual Reality (VR). For this aim, we will emphasize the possibilities offered by the latest VR hardware and software components. We will also detail key applications of VR, such as medical simulators or re-education and assistance to disabled people.

Second, we will try to identify the potential relations between virtual reality and real-time neurosciences. For instance, the use of real-time neurosciences techniques could be profitable to design new interaction tools for virtual environments based on cerebral activity – the so-called "Brain-Computer Interfaces". We will also look for the best uses of virtual environments for real-time neurosciences. The new kinds of interaction and navigation provided by virtual environments could be used indeed to improve neurofeedback or real-time visualisation of cerebral data.

Last, we will describe a recent tool designed to link virtual reality technologies and real-time neurosciences: the Open-ViBE software platform (Open Platform for Virtual Brain Environments). Today, Open-ViBE is a general purpose platform for the development of 3D real-time virtual representation of brain physiological and anatomical data. Open-ViBE is a flexible and modular software platform which is planned to integrate future modules for brain physiological data acquisition and processing, multimodal display of cerebral data, and brain-computer interface for virtual environments.

Authors: Neuper, C., Grabner, R., Fink, A., & Neubauer, A.C.
Title: Reliability of EEG event-related de-(synchronization): long-term stability and consistency across different cognitive tasks.
Affiliation: Department of Psychology, University of Graz, Austria

The role of brain oscillations in cognitive task performance has been intensively studied and the significance of distributed theta, alpha and gamma oscillatory systems has become of great interest to the study of human information processing. An appropriate method to assess stimulus- or task-related changes of different EEG frequency bands is the event-related desynchronization (ERD) and synchronization (ERS) analysis of the EEG. It is well established that ERD/ERS in defined frequency bands is sensitive to various task-related aspects and also to temporary changes in the participant's cognitive state; less clear is the picture of results with respect to individual differences in cognitive ability.

In a recent study we examined whether task-related band power changes (event-related desynchronization/synchronization; ERD/ERS) that have been linked to individual differences in cognitive ability demonstrate satisfying temporal stability and cross-situational consistency.

Multi-channel EEG recordings from 29 adults, assessed at three different occasions over two years were examined. Between-session correlations and consistency coefficients (Cronbach's alpha) across the 3 experiments were evaluated for both, spectral power features of the resting EEG and ERD/ERS estimates while the participants performed some cognitive task (i.e. different elementary cognitive tasks that put comparable demands on the participants).

ERD/ERS values, while subjects performed a cognitive task, demonstrated satisfactory stability and consistency (i.e. > 0.7), whereby the degree of consistency varied as a function of frequency band and brain region. Highest consistency was found for the 8-10 Hz ERD in parieto-occipital recording sites (i.e. > 0.9). In resting EEG, mean alpha (gravity) frequency was the most stable EEG feature.

The present data suggest that ERD/ERS phenomena in different narrow frequency bands are rather stable over time and across different situations. The relatively high reproducibility of ERD/ERS promotes the usefulness of this measure in assessing individual differences of physiological activation patterns accompanying cognitive performance.

Author: Pfurtscheller, G.
Title: Motor imagery induced sensorimotor rhythms
Affiliation: Laboratory of Brain Computer Interfaces. Institute of Computer Graphics and Vision. University of Technology, Graz, Austria.

Motor imagery needs focused attention to a specific body-part and is therefore especially suitable to study the dynamics of sensorimotor rhythms in the alpha (mu) and beta band. This dynamics of oscillations can be studied by quantification of the event-related desynchronization (ERD) and event-related synchronization (ERS). Both, ERD and ERS display a somatotopic pattern. While the ERD can be seen as a correlate of an activated cortical area, with increased information processing, the enhancement of central mu rhythms can be interpreted as a correlate of a deactivated or inhibited cortical area with reduced information processing.
It is of interest to note that the ERD within the alpha (mu) band does not occur in isolation, but is accompanied very often in an ERS in neighbouring cortical areas. This phenomenon is called "focal ERD/surround ERS". Examples are e.g. the focal ERD in the hand representation area simultaneously with the midcentral ERS during hand motor imagery and the focal ERS close to the midcentral foot representation area simultaneously with the surrounded ERS in the hand areas during foot motor imagery. Especially impressive is the enhanced hand area mu rhythm when attention is focused to the foot area (or the face area) and withdrawn from the hand area. Of interest is also that the ERD is broad-banded between 8 – 14 Hz, while the ERS is narrow-banded between 10 – 14 Hz.

Author: Pfurtscheller, G.
Title: Direct EEG-based Brain-Computer Interface (BCI)
Affiliation: Laboratory of Brain Computer Interfaces. Institute of Computer Graphics and Vision. University of Technology, Graz, Austria.

An EEG-based BCI transforms thought-specific EEG changes into control signals. For this task it is necessary to analyse the EEG online, extract specific features and discriminate between different mental states. Important components defining a BCI are the mental strategy, the mode of operation and the type of features used for classification. Mental strategies are operant conditioning, focused attention and motor imagery. A BCI can be operated in a cue-based mode (synchronous or computer-driven BCI) or an uncued mode (asynchronous or user-driven BCI). In the former case the mental task is triggered by a cue-stimulus, that means the EEG has to be analyzed in predefined time windows only. In the latter case the user is free to intend prespecified mental task at will and therefore the EEG has to be continuously analyzed.

The control signal at the BCI output can be used e.g. to operate a spelling device for completely paralyzed patients, to control a neuroprosthesis in patients with spinal cord injury, to navigate in virtual environment or to indicate the brain state in biofeedback therapy.

Author: Pop-Jordanov, J.
Title: Quantum Excitability of Cortical Dipoles and the Mental Arousal Spectrum
Affiliation: Macedonian Academy of Sciences and Arts Skopje, Macedonia

The empirically established dependence of the mental arousal on EEG frequency is widely and successfully used for neurofeedback treatment based on frequency adjustment. However, the underlying relevant mechanism is still not clear enough. Namely, a theoretical explanation is missing – why the mental states are frequency dependent and why just in this form and intervals. These questions are considered here, using quantum theory and calculation at the microscopic level. The analytical and numerical investigations, starting with collective transitions in a system of cortical dipoles, led to the following conclusions:

- The probability of quantum transitions induced by cortical electric field can be interpreted as mental susceptibility and readiness to change at initial neuronal firing.
- The resulting frequency dependent transition probability curve correlates with mental arousal spectrum, including its empirically proven frequency dependence and characteristic intervals.
- The same quantum theoretical approach, combined with the concept of entropy, may provide explanation why the equilibrium, spontaneous, non-disturbed, "eyes closed" mental state is normally characterized by the alpha band.
- The general law of mental activation, derived by normalizing the quantum probability spectrum, represents the quantitative measure of consciousness, providing information on its level as function of electric neuronal frequencies.

Authors: Pop-Jordanova, N. Zorcec, T. Demerdzieva, A. Krstevska, I* and Simoska, S.*

Title: Comparison of clinical results of EDR and EEG biofeedback for childhood and adolescent disorders.

Affiliation: Dep. Psychophysiology, Pediatric Clinic, Faculty of Medicine. *ICEIM-Macedonian Academy of Science and Arts, Skopje, R. Macedonia.

Abstract:
An overview of the results obtained with EDR and EEG biofeedback in the assessment ant therapy of children and adolescents in the period of ten years is presented and discussed.

The influx of about 600 patients with stress related disorders per year was the cause of extensive mostly clinical use of biofeedback modalities.

Main disorders deled with, ranked by their incidence, are somatoform problems, headache, anxio-phobic problems, enuresis/encompresis, anorexia/bulimia, obesity, ADHD, ticks, PTSD, OCD, autism, child abuse etc.

It appeared that the EDR biofeedback is more preferable method by young children than EEG biofeedback, either as a unique treatment or as a first step preceding the NF therapy.

In addition, preliminary results of Peak Achievement Training in school setting are presented.

Finally, some problems and challenges related to the pioneering introduction of this new approach in the Southeast European region are discussed.

Authors: Strehl, U* and Leins, U. **
Title: A controlled comparison of slow cortical potentials and beta/theta training for children with ADHD
Affiliation: *Institute of Medical Psychology and Behavioral Neurobiology, University of Tübingen, Germany. ** University Hospital for Psychiatry and Psychotherapy of Tübingen, Germany

Introduction
While there is growing evidence of behavioral and cognitive improvement in children with ADHD after feedback of oscillatory activity of the brain, the regulation of slow cortical potentials has been used only recently. The rationale of this paradigm refers to insufficient regulation of excitation thresholds. Data of a study that compared both paradigms and followed children for six months after the end treatment are reported.
Method
Two groups with 19 children were either trained to regulate their slow cortical potentials or to control EEG spectral frequencies. The training consisted of three phases of 10 sessions each. Different from most other neurofeedback studies transfer tasks were introduced in order to facilitate the use of regulation strategies in everyday life. Participants were blind to group assignment and pre/post measurement evaluated regulation of EEG variables, behavior, attention and IQ.
Results
Follow-up evaluation six month after the end of training showed stable ability to regulate certain parameters of trained brain activity. While the SCP-group learned to regulate activation, the Theta-Beta-group showed self regulation skills in deactivation. Both groups improved in attention and intelligence test scores. Stable behavioral changes were reported by parents and teachers.
Conclusion
Theta-Beta-training as well as training of SCPs lead to control over brain activity. Stable changes of behavior, attention and IQ in both groups recommend both training paradigms as an option for the treatment of ADHD. Detailed data analysis is needed in order to elucidate whether the mechanisms of effect are similar, too.

Authors: Surmeli, T. & Ertem, A.
Title: Left and right hemispheric EEG biofeedback training in Autistic spectrum disorders: 22 case studies.
Affiliation: Living Health Center for Research and Education. Istanbul , Turkey.

Background: The efficacy of left and right hemispheric neurofeedback training was evaluated in 22 children in the autistic spectrum based on EEG results and established training protocols for other conditions with similar symptoms. The cases are evaluated uncontrolled.
Method: 22 cases ranging 3-10 years old were previously diagnosed with autism.7 cases were under the age of 6.Evaluation measures includes QEEG analysis, with Nxlink and NeuroGuide databank, ATEC (Autism Treatment Evaluation Checklist), parent assessments, clinical observations and videotaping. Responses to ATEC and parent assessments were analyzed to evaluate the effectiveness of neurofeedback training.
Results: 22 cases who received EEG biofeedback training showed significant improvement based on ATEC, parent assessment , QEEG analysis with Nxlink and NeuroGuide.
Discussion: The autistic children who underwent the EEG Biofeedback training showed significant improvement.

Authors: Thompson, MD., & Thompson, L.
Title: ADHD & Asperger's Syndrome EEG & QEEG Findings and Results with 165 ADHD and 126 Asperger's

Goal: To review initial findings and outcomes after neurofeedback training in clients seen in a clinical / educational setting.Hypothesis: Using QEEG & LORETA in Asperger's cases, one can observe an axis of disturbed functioning which includes the posterior cingulate (Brodmann area 31) and the anterior cingulate ((Brodmann area 24). In addition, we observe high amplitude slow waves (3-10 Hz) &/or very low amplitude beta (13-18 Hz) &/or high amplitude spindling beta (> 20 Hz) in the medial frontal, orbital and/or prefrontal cortex. These findings suggest dysfunction and may also be found in other disorders which may include: anxiety, panic, OCD, Tourette's. Some findings, such as anterior cingulate activity, may be seen in ADHD, too. What appears to be unique to Asperger's is having the above differences from a normal data base plus right temporal-parietal cortex inactivity, which may correspond to problems reading social cues and emotion (sensory aprosodia).Rationale for Training:Increasing sensorimotor rhythm (SMR) using neurofeedback has a stabilizing effect on a cortex that is unstable and easily kindled (Sterman 2000). Beta spindling is one indication of a cortex that may be easily kindled, irritable, even unstable, in other words, a cortex that is not functioning properly. Beta spindling is an EEG finding that may be observed in many of the above disorders so SMR training is appropriate.Method: Clients were trained to decrease their dominant slow wave activity (somewhere within 3 - 10 Hz range) and beta spindling (within 20-36 Hz range) at sites indicated by QEEG findings. Precise frequency ranges were chosen according to each individual's pattern. In addition, they were trained to increase SMR (low amplitude found between 12-15 Hz) over the central area C3, Cz, C4. Metacognitive strategies were taught when the feedback indicated that the client was focused. Pre and post testing (after 40 sessions) used the Wechsler Intelligence Scales, Wide Range Achievement Test, Test of Variables of Attention (TOVA), Intermediate Visual and Auditory continuous performance test (IVA), questionnaires for ADHD and for Asperger's and QEEG changes. A review of the charts of 126 clients diagnosed with Asperger's was carried out and compared to a previous review of 165 clients with a diagnosis of Attention Deficit Disorder (ADHD, Inattentive or Combined Type). Data was analyzed for clients with pre and post-testing results on one or more of the standardized tests. Results: Significant improvement ($P < .001$) was found on all measures (IQ, academic levels, continuous performance tests, questionnaires) with the exception of one IVA subtest in the Asperger's group. Discussion: Because this clinical work is not a controlled study, the efficacious treatment components cannot be determined. Nevertheless the positive outcomes do suggest that neurofeedback is a useful treatment for students with either ADHD or with Asperger's syndrome. This work also demonstrates that systematic data collection in a private educational setting produces information that can be used both to monitor student progress and improve intervention programs.

The Society of Applied Neuroscience (SAN)
seeks to advance neuroscientific knowledge and its innovative applications
empowering both scientists and practitioners
in serving the public by optimising self-regulatory brain function.

SAN Aims

- Advancing integrative neuroscience, including novel applications such as neurofeedback (electroencephalography - EEG, functional magnetic resonance imaging - fMRI, near-infrared spectroscopy – NIRS), autonomic nervous system biofeedback, neuro-rehabilitation, brain-computer interface (BCI), transcranial magnetic stimulation (rTMS), virtual reality feedback, vagus nerve stimulation, audio-visual stimulation, etc.
- Fostering education in applied neuroscientific techniques
- Enhancing integrative practice in clinical treatment, education and optimal performance
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Hardware and software for QEEG, ERP, ERD/ERS, LORETA analysis and neurofeedback

1. Mitsar

"Mitsar" is a device for ***recording*** (19) 21 channels EEG. It is available in a wireless version (BlueTooth technology).

2. WinEEG

"WinEEG" is a computer program for analyzing EEG including:
artifacting by means of several methods (PCA, ICA...)
remontaging to various montages,
automatic ***spike detection,***
dipole approximation of spikes,
calculating absolute and relative spectra, spectral ratios, spectral asymmetries, coherence, phase, event-related potentials, event-related de/synchronization, event-related wavelet transforms;
decomposing ERPs into independent components using normative spatial filters
mapping the above mentioned parameters into 2-D topograms and 3D Talairach atlas by LORETA;
comparing all computed parameters with the normative data base (250 children of 8-16 years old and 60 adults are now available) and ***displaying*** significance probability maps (SPM).

3. BrainTune

BrainTune is a 1(2)-channel device for ***performing various protocols of neurofeedback*** in video/audio and computer modes.

4. BrainTuner

"BrainTuner" is ***a computer program for neurofeedback***. The program enables the user to design an individual protocol according to QEEG, ERP, ERD/ERS assessment performed by the WinEEG program.

Mitsar Ltd., St.-Petersburg, RUSSIA, http://www.mitsar.spb.ru

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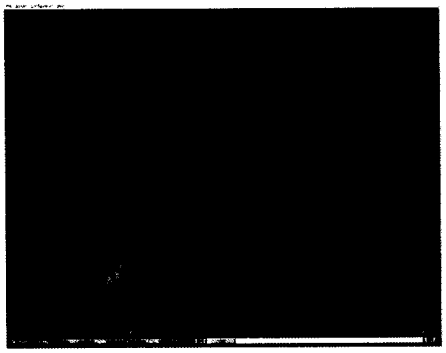
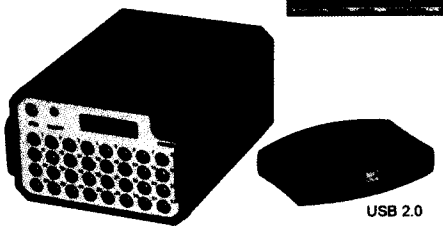
NeXus: Wireless EEG/QEEG

Are you a researcher or a clinician? Are you interested in the latest developments in physiological and wireless monitoring systems? If you are, we invite you to visit our (free) presentation about the new generation of the NeXus-10 and NeXus-32 and how to use them. The presentation will take place on August 31st at the S.A.N. meeting.

These 10 and 32 channels systems support polygraphic recording through BlueTooth and on Flash memory, up to 20 hours, of the following modalities:

DC-EEG, SCP, ECG,EMG
ECG, EOG, Respiration,
BVP/PPG, Oximetry,
Skin conductanc, Temperature
at 24 bit resolution and sample rates of up to 2048 /sec.





USB 2.0

For more information, please contact :

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Tel 0031-475-410123

COST ACTION B27
"ELECTRIC NEURONAL OSCILLATIONS AND COGNITION (ENOC)"
1st WG1, WG2 and WG3 meetings

3 September 2005

DETAILED TIMETABLE

8:30-9:00	Registration		
9:00-9:15	*Plenary session* Opening		
9:15-9:45	General information on COST mechanism and funding (Prof. M. Pascu)		
	Parallel sessions: Short presentations of current research and annual working plans		
	WG1	**WG2**	**WG3**
10:00-10:20	A. Schloegl (AT)	G.Pfurtsheller/G.R.Muller-Putz (AT)	C. Neuper / C. Brunner(AT)
10:20-10:40	D. Dimovski (MK)	S. Bo Andersen (DK)	J. Yordanova (BG)
10:40-11:00	J. Kurths (DE)	T. Zorcec / E. Cvetkovska (MK)	G. Stojanov (MK)
11:00-11:20	F.T. Arecchi / M. Frasca (IT)	H. Heinrich (DE)	C. Basar-Eroglu (DE)
11:20-11:40	Coffee		

11:40-12:00	W. Duch (PL)	W. Sannita / L .Narici (IT)	L. Maffei / D. Burr
12:00-12:20	A. Kalauzi (CS)	J. Trabka / M. Pakszys (PL)	W. Pakszys / A. Wrobel (PL)
12:20-12:40	E. Basar (TR)	D. Sokic (CS)	N.Nedeljkovic (CS)
12:40-13:00	T.Baldeweg / T. Steffert (UK)	E. Dursun / T. Surmeli (TR)	U. Isoglu-Alkac / A. Ademoglu (TR)
13:00-13:20		L. Parkinson / B. Steffert (UK)	D. Vernon / M. Batty (UK)
13:20-13:30	Electing of WG Chair and Vice-chair	Electing of WG Chair and Vice-chair	Electing of WG Chair and Vice-chair
13:30-15:00	Lunch		
	Plenary session: Summary of WG sessions		
15:00-15:20	Prof. W. Klonowski (WG1)		
15:20-15:40	Asst. Prof. Dr. N. Ermutlu (WG2)		
15:40-16:00	Dr. A. Burgess (WG3)		
16:00-17:00	Discussion and conclusion		
17:00-17:30	Coffee		
17:30-18:15	Keynote speech: Prof. E. Roy John		