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Alpha and theta oscillations: their meaning for short- and long-term memory. - W. Klimesch (University of Salzburg, Department of Physiological Psychology, Salzburg, Austria).

Alpha and theta show an interesting double dissociation between the type of EEG response and cognitive task. Whereas theta synchronizes in response to working memory (WM) demands, alpha (particularly the upper alpha band) desynchronizes in response to semantic, long-term memory demands. These findings suggest a functional specialization that also appears to be reflected by cristallized and fluid information processing capacities as more recent evidence suggests.

With respect to theta, the crucial question is, whether it reflects global WM processes in general, or more specific functions. The most consistently reported findings are that theta is related to the maintenance of information in WM and to the encoding and retrieval of episodic information. Furthermore, a long lasting increase in Fmθ is associated with sustained attention. There is, however, no clear evidence whether theta is involved in sensory and perceptual processes as was shown e.g., for gamma. Most interestingly, some studies indicate that gamma and theta become phase coupled during episodic processing. These findings suggest that theta may play an important role for the establishment of complex "multi-dimensional" episodic codes and that gamma oscillations – possibly reflecting perceptual codes – are nested within theta cycles.

EEG bandpowerchanges during the performance of an intelligence task. - M. Doppelmayr, W. Klimesch, P. Sauseng, K. Hödlmoser and D. Rachbauer (University of Salzburg, Salzburg, Austria).

Since Berger (1928) there were many attempts to link EEG to intelligence. Most studies were performed using ERPs or spectal estimates and yielded contradictory results.

Using ERD (Pfurtscheller and Aranibar 1977) Neubauer et al. (1995, 1999) found differences between high and less intelligent subjects with respect to the amount and topography of ERD. In the presented study we analyzed bandpowerchanges according to the ERD method during the performance of the Ravens intelligence test. Bandpower changes were calculated for the first three seconds after the appearance of the stimulus on a computer screen. According to Klimesch (1996) and Doppelmayr et al. (1998) we used individually defined frequency bands with individual bandwidths. The sample (n=22) was divided into a group of high vs a group of less intelligent subjects according to the Culture fair intelligence test (CFT3). The results revealed a differentiated picture of the functional specification of the different frequency bands, well in line with the findings of Klimesch (1999). With respect to topography and time interval significant interactions between intelligence and task difficulty were found preliminary in the theta and upper alpha range while the data for the lower alpha frequencies showed a stronger relation only to increasing task difficulty.

Error-related potentials and their functional significance. - M. Falkenstein, J. Hoormann, J. Hohnsbein

(Leibniz Research Center for Working Environment and Human Factors (IfADo), Dortmund, Germany).

After erroneous responses the event-related potential reveals two components, a fronto-central negativity (N_e) with a latency of about 60 ms, and a parietal positivity (P_e) with a latency of about 300 ms. A small N_e is also elicited after partial errors, while the P_e is restricted to full errors. We propose the N_e to reflect an error detection process in form of a mismatch between representations of the performed (incorrect) and the intended (correct) response. This hypothesis is supported by various results; e.g. the N_e is smaller and delayed when task difficulty is enhanced, i.e. the representation of the correct response impaired. The alternative conflict detection hypothesis of the N_e was not confirmed by our data. In particular, we could not find an N_e difference between conditions with different conflict. The functional significance of the P_e is not entirely clear. However, conscious error recognition is a prerequisite for the P_e. In elderly and Parkinson's disease the N_e is reduced suggesting that the dopaminergic system participates in the generation of the N_e.

Dimensions of semantic meaning of Chinese word and evoked brain topography. - W. Skrandies*, M.J. Chiu+, Y. Lin+ (* Institute of Physiology, University of Giessen, Giessen, Germany; + Department of Neurology, NTUH, Taipei, Taiwan).

The affective meaning of words can be quantified statistically by the "semantic differential technique" resulting in statistically defined, independent dimensions where every word is uniquely located on the three dimensions evaluation ("good - bad"), potency ("strong - weak"), and activity ("active - passive"). We studied a total of 55 Chinese adults in two experiments: 210 nouns were rated by 32 subjects, and factor analysis on the questionnaire data yielded three independent semantic dimensions. Semantically unique words were used in electrophysiological experiments in another group of 23 healthy right-handed adults.

Words of similar physical appearance belonging to different semantic classes were presented visually in random order, and the EEG was recorded in 32 channels. Evoked potentials were computed for each semantic class. Significant differences in electrical brain activation between semantic word classes were seen as early as 80 ms after stimulus onset confirming earlier reports on similar findings in German subjects. These results illustrate language- and culture independent activation patterns.

Supported by DAAD and NSC.

Habituation of endogenous event-related brain potentials. - H. Zimmer (Institute of Psychology, University of Mainz, Mainz, Germany).

This paper is concerned with the question of whether endogenous components of the event-related brain potential (ERP) qualify for showing habituation of the orienting response (OR). It has been tackled using an ordinary repetition/change paradigm as well as a variant thereof. Results indicate that at least two endogenous components of the ERP, the parietal slow positive wave and the frontocentral slow negative wave 2, meet the essential requirements to be demanded of habituation: both slow waves exhibited, like an exemplary OR component, the skin conductance response, the typical exponential decline with repeated stimulations and recovered in response to a change. In the same way the novelty P3 leveled off systematically with the stimulations, but without showing recovery. Thus, in so far as habituation of the OR is conceptualised as a selective inhibitory central nervous system process which can be assumed to have taken place only if an exponential response decrement is followed by a recovery, the generalised decrement of the novelty P3 cannot be equated with habituation.

Does the source of the neuromagnetic Mismatch Negativity (MMNm) shift within its latency range? - T. Rosburg*, J. Haueisen+ and I. Kreitschmann-Andermahr *^ (* Department of Psychiatry, University Jena, Jena, Germany; + Biomagnetic Center, University Jena, Jena, Germany; ^ Department of Neurosurgery, University of Technology Aachen, Germany).

The aim of the our study was to clarify whether the source of the neuromagnetic mismatch negativity (MMNm) exhibits a location shift within its latency range, comparable to that of the source of the auditory evoked field component N100m. For this purpose left-hemispheric data of 29 subjects were analysed and the sources of the MMNm and N100m were calculated in a 30 ms time window around the peak maximum. In the applied oddball paradigm frequency, duration and intensity deviants were presented within one block. Subjects were requested not to attend to the stimuli.

For the N100m dipoles a significant shift from superior to inferior and from posterior to anterior was observed within the analysed time window. Similarly, MMNm dipoles of duration and intensity deviants shifted significantly from posterior to anterior within their latency range. In contrast to N100m dipoles, a significant shift from superior to inferior was not detected for MMNm dipoles, independent of which kind of deviant was analysed. Concerning this direction, the analysis of variance revealed a significant component x time interaction between the N100m and the MMNm of duration and intensity deviants. This finding can be regarded as evidence that the time course of the N100m and MMNm (at least for duration and intensity deviants) is not the same.

New trends in EEG signal analysis. - H. Witte (Institute of Medical Statistic, Informatics and Documentation, Friedrich Schiller University, Jena, Germany).

Digital processing of EEG signals provides objective data, helps in data storage/retrieval and visualization, improves the classification as well as prediction of events and supports the monitoring of treatments. The first visible trend in EEG analysis is the increasing use of time-variant and multivariate approaches, e.g. time-variant coherence, phase, and bicoherence estimation. Furthermore, methods for the characterization of interactions between remote brain regions (functional and effective connectivity) and for the quantification of information transfer (e.g. time-variant Granger causality) have been applied in EEG analysis. All these methods lead to a mass of complex data and their interpretation is a challenging mission. Most of the interpretation problems can be solved by means of problem-tailored and/or model-related processing schemes. Subtle effects of phase synchronization (Gebber et al. Brain Research 1999, 818: 556-560) can be explained by means EEG simulations on the basis of relaxation oscillators (e.g. forced van-der-Pol or Rayleigh oscillators; Fitzhugh-Nagumo-Oscillator; (Witte et al., Theory Biosc. 1999, 118: 284-299).

Nonlinear EEG analysis and seizure prediction. - K. Lehnertz (Department of Epileptology, University of Bonn, Germany).

Anticipation of seizures is a challenge for both basic research and clinical epileptology. The framework of the theory of nonlinear dynamics provides new concepts and powerful algorithms to study complicated dynamics such as brain electrical activity. Converging evidence from various investigations now indicates that nonlinear EEG analysis provides a means to reliably characterize different states of normal and pathological brain function and thus, promises to be important for clinical practice. Apart from significant contributions improving the interictal topographic diagnosis of primary epileptogenic areas in different cerebral regions, nonlinear EEG analysis also reliably identifies a long-lasting pre-ictal phase in a high percentage of cases. Future real-time analysis devices may enable both investigations of basic mechanisms leading to seizure initiation in humans and the development of adequate seizure warning and prevention strategies.

Methods of time-frequency analysis for investigating phase-coupled oscillations in the EEG. - B. Schack (Institute for Medical Statistics, Computer Science and Documentation, University of Jena, Germany).

Several studies have shown that phase-coupled oscillations act as an functional integrative mechanism of different neural assemblies. Bivariate spectral analysis methods with high time resolution are used for the description of such integrating mechanisms based on transient phase-coupled oscillations.

Usually EEG coherence is used to describe synchronized oscillations for different sites of the cortex. Thereby, synchronization concerns correlation across trials of both amplitude and phase. In recent years different methods were developed measuring pure phase synchronization based on estimating instantaneous phase or cross phase between two oscillations. Such methods are phase coherence and different kinds of phase synchronization. Whilst phase coherence gathers linear transfer of information in particular, the phase synchronization index evaluates both linear and non-linear phase-coupling. A special method for detecting quadratic phase coupling is bispectral analysis. Latterly, time-variant estimation of bispectral parameters was realized (Schack, B. et al., Clinical Neurophysiology, 2001, 112: 1388-1399).

In the contribution different kinds of phase-coupling will be explained. The correspondent time-variant methods for their analysis will be presented and demonstrated in EEG studies.

Artificial neural networks as pattern recognition tool in EEG and EP analysis. - L. Leistritz (Institute of Medical Statistics, Computer Sciences and Documentation,University of Jena, Germany).

Artificial Neural Networks are information processing systems composed of a large number of simple processing cells, where the internal information transfer takes place by means of directional connections between these cells. An essential element of such networks is the ability to learn a task on the basis of given training samples. Manifold possible fields of applications in medicine, natural sciences and technology are due to the high adaptability and functionality of trainable systems.

Different kinds of Neural Network types as well as various conceptions for the solution of pattern recognition tasks in EEG and EP analysis are presented in this contribution. Starting with the classical pattern recognition procedure consisting of pre-processing, feature extraction and classification, the possibility for integrating the pre-processing into the training process of static Neural Networks are presented. Furthermore, an approach without any pre-processing steps is presented by means of dynamic recurrent Neural Networks.

Thereby, the main focus is set to the so called supervised learning, where the potentialities and limitations with respect to the generalisation capabilities of trained systems are particularly pointed out.

Investigation of time-variant causal interactions between two EEG signals by means of the adaptive

Granger causality. - W. Hesse, E. Möller, M. Arnold, H. Witte, B. Schack (Institute of Medical Statistics, Computer Science and Documentation, Jena, Germany).

Standard methods as e.g. correlation and coherence are employed for detecting interactions between pairs of EEG signals. But, these methods are unsuitable to investigate causal relations between signals. One approach in this context is the so-called Granger causality.

The general idea of causality may be expressed in terms of predictability. If a signal X causes a signal Y, the knowledge of the past of both X and Y should improve the prediction of the present of Y in comparison with the knowledge of the past of Y alone.

Bernasconi and König (1999) used the Granger causality successfully for the investigation of causal interactions within the visual cortex of cats, assuming the stationarity of the EEG.

For fast changing cognitive processes the stationarity of EEG signals may not be expected. Therefore, a time-variant estimation of the Granger causality was developed based on the adaptive fit of autoregressive models. Simulations show that the adaptive Granger detects temporary directed interactions in a few milliseconds. The adaptive Granger causality was applied to the EEG, recorded during the Stroop task. In distinction to the congruent situation, a widespread network comes into existence at the end of the conflict situation directed from posterior to frontal areas.

Segmentation of multivariate time series and application to ERP-data. - A. Hutt (Max Planck-Institut fuer Mathematik in den Naturwissenschaften, Leipzig, Germany).

Segmentation of multivariate time series represents a helpful tool in the analysis of electroencephalograms (EEG). Several methods have already been developed, which mainly differ in the classification criteria. The proposed method utilizes results from a well-known clustering method and interprets them in a new way. The presented work introduces a possible concept for the origin of segmental structures in EEGs, which is based on notions of physics of complex systems. A measure of segmentation quality is introduced, which behaves independent of the number of intrinsic segments. Applications to both subject-average and single-subject ERP-data from an auditory cognitive experiment illustrate the method in its several aspects. In case of subject-average data, ERP-components are identified with signal segments. Additionally, nine single-subject data sets are analyzed. The obtained results show the known latency shifts of components. Collecting the single segmentation results, distributions of segment borders are obtained, which represent probabilities for segment borders.

Changes of Omega complexity related to perceptual transitions during multistable visual perception. - T. Koenig*, J. Wackermann+, P. Kalus*, W. Strik* and T. Mueller* (* University Hospital of Clinical Psychiatry, Department of Psychiatric Neurophysiology, Bern, Switzerland; + Institute for Frontier Areas of Psychology, Dept. of Empirical and Analytical Psychophysics, Freiburg i.Br., Germany).

The subjective perception of series of ambiguous stimuli often shows a remarkable stability. This stability indicates the influence of internally driven, top-down processes that bias the interpretation of the ambiguity toward the current expectations of the subject. The current study aimed to explore brain electric correlates of changes in multistable perception. 21 channel EEG was recorded while 13 healthy subjects watched a stroboscopic alternative motion paradigm implying illusionary motion with ambiguous direction. The EEG was analyzed using Omega complexity, a lower-bound estimator of the number of independent activities in the brain. Omega complexity was computed within a running window of 250 ms duration, shifted over time from 2 sec before stimuli which were perceived as changed to 2 sec after those stimuli. The course of Omega complexity over time showed consistently decreased values in a period from about 660 to 310 ms before the presentation of those stimuli that the subject reported as change. This observation is compatible with the hypothesis that internally generated top-down processes maintaining the stability of the percept show short-lasting drops in intensity, allowing alternate modes of perception to take place.

Topographies of complexity differentials of brain electrical fields. - J. Wackermann (Dept. of Empirical and Analytical Psychophysics, Institute for Frontier Areas of Psychology, Freiburg i.Br., Germany).

Global descriptors of brain electrical activity, especially the global measure of spatial complexity (Omega), turned out to be a useful tool for quantitative assessments of brain functional states. A frequently raised objection against the global, single-valued complexity measure is that the topographic information is lost. This disadvantage can be overcome by evaluating "local complexity differentials" (LCD), i.e., virtual variations of Omega-complexity caused by exclusion of each single local source (scalp electrodes). Signs and magnitudes of LCD are determined by how much or little the local activity co-varies with the rest of the spatially distributed electrical field. Highly co-varying sources contribute little or zero; minimally co-varying sources usually contribute positively to the global complexity, unless they synchronise the entire field and thus reduce the global complexity. Topographical maps of complexity differentials (TCD) distinguish scalp loci and regions by their LCDs as "regulators" or "modera-

tors". This is demonstrated by changes of TCD patterns occurring with transitions between different functional states, e.g. with changes of vigilance. TCD appears a promising technique extending the global approach.

Importance of topographical ERP analysis in psychiatry. - A.J. Fallgatter (Department of Psychiatry and Psychotherapy, University of Würzburg).

After years of "shadowy existence" the importance of Event-Related-Potentials (ERP) in psychiatry augments again. This positive and also justified development from my point of view has two essential reasons: on the one side the methodological advantages of electrophysiological methods (direct recording of neuronal activity in real time, improved spatial solution by methods of source localization like LORETA) are increasingly perceived in psychiatry. On the other side it is realized that recent methods of neuroimaging like Positron Emission Tomography (PET) and functional Magnetic Resonance Tomography (fMRT) quite have methodological problems (measurement of secondary change of blood flow as reaction to neuronal activity, poorly standardized evaluation with manifold possibilities of influence on the result, restricted acceptance by psychiatric patients). Meanwhile, methods derived from ERP have also become a standard technique in fMRT, conducted in modern examinations as event-related fMRT. Thus, electrophysiology and fMRT have moved closer again. In this lecture the high stability and reliability obtainable in topographic ERP parameters is demonstrated by example of the NoGo-Anteriorisation (NGA). Furthermore, possibilities of clinical application in psychiatric problems are presented. This shall contribute to encourage us electrophysiologists to plead with self-conscience for the advantages of ERP methods in clinical neurosciences.

CPT in OCD: signs of reduced inhibitory processes. - M.J. Herrmann, C. Jacob, S. Unterecker and A.J. Fallgatter (Psychiatric Neurophysiology, University Hospital of Psychiatry and Psychotherapy, Würzburg, Germany).

Recent studies showed, that OCD can be described as a disturbance in fronto-striate circuits, characterized by a hyperactivity, in the orbitofrontal cortex and the nucleus caudate. Clinically these patients are obviously unable to inhibit obtrusive thoughts or actions, a function which was also discussed to be generated by the frontal cortex. The aim of this study was to investigate the brain electrical activity during inhibitory processes in OCD. 12 patients with OCD and 12 healthy controls conducted the Continuous Performance Test, a cued Go NoGo task, while the EEG was measured with 21 electrodes. We replicated previous reports that the positive brain electrical field for the NoGo condition was significantly further anterior than in the Go condition for a P300 time window for healthy controls (NGA, $t= 8.42$; $p<0.001$). The brain electrical field during the NoGo condition was significantly less anterior for OCD- patients compared to controls ($t=-2.60$; $p<0.05$). This difference in the NoGo condition was discussed as a clear sign of a reduced inhibitory ability in OCD.

Left temporal dysfunction during auditory hallucinations investigated with auditory evoked potentials (AEP). - D. Hubl, T. Koenig, A. Federspiel and T. Dierks (Department of Psychiatric Neurophysiology, University Hospital of Clinical Psychiatry, Bern, Switzerland).

Schizophrenia is one of the most common diseases in the world and hallucinations are one of its core symptoms. Even though hallucinations have been described since antiquity and their generation is attributed to the cerebral cortex, their exact cause and location remains unclear.

In this study we investigated patients with paranoid schizophrenia, suffering form hallucinations with AEP during they perceived verbal auditory hallucinations. The patients were asked to press a button while they heard voices. Periods with hallucinations could be distinguished from those without hallucinations. AEP was analyzed separately for both periods. Global field power (GFP) was calculated and brain electrical sources were estimated with low resolution electromagnetic tomography (LORETA). Both GFP and LORETA amplitude were lower during hallucinations than between hallucinations.

We hypothesize that the reduced AEP amplitudes during hallucinations are due to an internal pre-activation of the auditory cortex, competing for processing resources with the external stimuli. As the patients were right handed, these phenomena seem to affect the dominant left hemisphere stronger than the other hemisphere.

Syntax of EEG microstate concatenations is altered in acute, medication-naive, first-episode schizophrenics. - D. Lehmann*, P.L. Faber*, S. Galderisi+, W.M. Herrmann^, T. Kinoshita~, M. Koukkou#, A. Mucci+, N. Saito~, J. Wackermann*, G. Winterer^ and T. Koenig# (*The KEY Institute for Brain-Mind Research, U. Hosp. Psychiat., Zurich, Switzerland; +Dept. Psychiat., University Naples, Italy; ^Dept. Clin. Psychophysiol., U. Hosp. Psychiat., Freie Universität Berlin, Germany; ~Dept. Neuropsychiat., Kansai Med. U., Osaka, Japan; #Dept. Psychiatric Neurophysiol., U. Hosp. Clin. Psychiat., Bern, Switzerland.

Microstate analysis is hypothesized to identify the psychophysiological building blocks of mentation. In 27 young, first-episode, medication-naive schizophrenics and 27 matched controls, multichannel resting EEG (~37 sec/subject) was analyzed into microstates using a global analysis approach. All data were assigned to four

microstate classes (A, B, C, D), using kmeans clustering. Mean microstate duration was less than 100 msec. For each subject, the frequency with which the microstates of the four classes followed each other was determined (transition matrix) as percentage of all transitions. For the six possible pairings of transitions between the four classes, the preferred direction of each transition pairing was computed as percentage difference. The preferred directions were compared between patients and controls; ANOVA (4 classes × 2 subject groups) demonstrated a significant interaction between classes and groups. Transitions between A and C, and between A and D differed significantly between groups. In patients C to A and A to D were preferred versus D to A and A to C in controls. This means that patients showed a reversed sequence (CAD) compared to controls (DAC). The observed, altered syntax of brain electric microstates offers a novel perspective of the putative brain mechanisms that implement the symptomatology of schizophrenia. (Partly supported by IGPP grant #670806).

Quantitative electroencephalographic alterations in psychiatric disease. - J. Brinkmeyer and R. Ihl (Düsseldorf, Germany).

Alterations of qEEG due to aging and their usefulness for the differential diagnosis between patients with dementia of the Alzheimer type (DAT), patients with endogenous depression and schizophrenic patients were studied here. 99 aged controls, 363 patients with dementia of the Alzheimer type, 173 patients with endogenous depression and 134 schizophrenic patients were included in the study. EEG data with the frequency band between 1 and 24 Hz was digitally stored and analyzed by using common spectral power parameters. A reclassification function of the different diagnostic groups was carried out. We wanted to find out whether classification of psychiatric diseases is possible and which variables are discriminative.

For the patients with DAT we found an average correct reclassification of 79%, for patients with endogenous depression of 64%, for the schizophrenic patients of 69%, for healthy aged controls of 81% and for the healthy young controls of 87%.

Thus, a high discriminative power in the differential diagnosis of depression, dementia, schizophrenia and normal healthy controls could be observed, when spectral power parameters were used. The high accuracy of the classification could be a useful tool in the diagnostic process.

EEG and the test for the early detection of dementia with discrimination from depression (TE4D); a validation study. - J. Brinkmeyer, B. Grass-Kapanke, R. Ihl (Düsseldorf, Germany).

The Test for the Early Detection of Dementia with Discrimination from Depression (TE4D) was developed as a screening instrument for mild dementia. In patients suffering from dementia and depression, convergent validity of the TE4D to EEG and other psychometric tests will be investigated here. In 48 patients suffering from Alzheimer disease (ICD-10 F.00) and 16 patients with affective disorders (F30-F39) the tests TE4D, ADAS-cog, SKT, BCRS, MMSE were assessed and an EEG recorded. Group differences were compared with t-tests. A regression analysis was calculated. The inter-test-correlations ranged between r_s=0.77 and r_s=0.91. Significant differences between the groups were found for all tests and the frequency bands **α** and β. For the qEEG, a significant positive correlations were found between TE4D (Dementia subscore) and the mean frequency (r=0.47), the peak frequency (r=0.42), the frequency bands **α** (r=0.59) and β (r=0.56) as well as negative correlations in the frequency bands δ (r=-0.23) and ϑ (r=-0.42). The mean frequency and the activity in the frequency bands **α**, β_2, δ and ϑ contributed to the regression equation. The correlation between regression equation and the TE4D was r_s=0.87. The other tests also correlated with the TE4D: ADAS r_s=-0.75, MMST r_s=0.82, SKT r_s=-0.74, BCRS r_s=-0.83. Compared to the other psychometric tests, the TE4D showed the highest convergent validity with the EEG parameters. The TE4D-score and the EEG-alterations correlated significantly with the degree of severity of Alzheimer's disease. The result underlines the validity of the TE4D in diagnosing dementia.

EEG correlates of facial affect recognition in schizophrenic patients and healthy volunteers. - J. Brinkmeyer, W. Wölwer, W. Gaebel, M. Streit (Düsseldorf, Germany).

16 partly remitted schizophrenic patients and 16 healthy controls participated in the study. To study facial emotion recognition thirty digitized black and white photographs from Ekman and Friesens set of "pictures of facial affect" served as stimuli. The EEG was recorded from 29 scalp locations with a time constant of 10 sec. According to previous data analyses we defined three latency windows (LW). According to the topographical information from the CSD maps for these analyses CSD values were grouped into measurements from frontal (FCSD), temporal (TCSD) and central (CCSD) electrode sites and used as within subject factors. The statistical comparisons of the CSD components showed significant group differences in response to emotional faces both in LW1 and LW2. The amplitude ANOVAs corresponding to LW1 and LW2 showed stronger CSD values for all three components in healthy controls. Within LW1 FCSD (r = 0,40, p = 0,02) and within LW2 CCSD (r = -,37, p = 0,04) and TCSD (r = -0,49, p = 0,005) were associated with task performance in facial emotion recognition. Furthermore, within LW2 latency of FCSD was associated with task performance (r = -,39, p = 0,03). According to our previous studies we were able to provide evidence for an association between brain activity and affect recogni-

tion performance, and, additionally, between brain activity and facial affect recognition deficits in schizophrenic patients by means of EEG/CSD analyses. However, the CSD analyses revealed more specific information about the related electrophysiology than ERP analyses and, furthermore, are in good agreement with neuromagnetic data.

Maturation of somatosensory pathways after early craniectomy in a case of pansynostosis of neurocranium (M. Crouzon). - P. Christophis*, Th. Jünger+, D. Reiter*, H.-P. Howaldt+ and D.-K. Boeker* (*Department of Neurosurgery; +Department of Maxillo-facial and Facial Plastic Surgery, Justus-Liebig University, Giessen, Germany).

In healthy humans evoked potentials (EP) show typical changes during maturation of somatosensory pathways in the first years of life. Therefore it is possible to recognise a maldevelopment of the brain maturation in childhood on hand of deviations from typical EP-shape. In a case of premature pansynostosis of neurocranium (M.Crouzon) complicated with additional hydrocephalus internus and with cerebellar malformation (Arnold-Chiari II) was treated operatively. An extensive craniectomy, a resection of the cerebellar tonsils, a shunting of the Hydrocephalus, and a fronto-orbital advancement were performed successively during the first year of life. During this time and in the follow-up four years the acoustic (BAEP), the somatosensory (MSEP), and the visual (VEP) evoked potentials were derived repeatedly. The maturation of the somatosensory pathways of the treated child monitored via EP was found to be normal at every time. These findings demonstrate the competence of EP to monitor the maturation of the brain in diseases of the nervous system and also show the positive therapeutic influence of the early operative treatment in present case.

Working memory load and EEG coherence. - T. Dörfler*, A. Simmel*, F.-M. Schleif*+ and E. Sommerfeld* (* Institute of General Psychology, University of Leipzig, Germany; + Institute of Computer Science, University of Leipzig, Germany).

For the accomplishment of a work memory task different areas of the human brain are of essential importance. Investigations in this field show that both frontal and parietal regions in their interaction enable the performance of the working memory. In this article coherence analysis is used as an internal indicator for the construct of mental effort. Therefore, a working memory task was given as an external request. Test subjects had to memorize an amount of simple geometrical figures. To obtain a complexity variation we only modified the number of figures in three conditions (two, four and six figures). Results show that coherence between functionally coupled brain subsystems reflect partial processes in course of complexity-dependent memorization of figures. EEG analysis of coherence in frequency bands beta1 (13-20 Hz) and theta (4-7.5 Hz) shows different aspects of human information processing represented by different band characteristics. It can be shown that a significant relationship exists between rising work memory load and frequency band-specific rises of the absolute coherence duration.

Electrophysiological correlates of response control in schizophrenia and cycloid psychoses. - A.-C. Ehlis, M.J. Herrmann, T. Ringel, C. Jacob, A. Heidrich, M. Schnizlein, A. Wagener and A.J. Fallgatter (Department of Psychiatry and Psychotherapy, University of Würzburg, Germany).

The anterior cingulate cortex (ACC) is involved in the execution of appropriate and the inhibition of inappropriate responses. Performance of the CPT (a Go-Nogo-task) requires both of these processes and leads to a specific electrophysiological pattern consisting of a shift of the positive brain electrical field from posterior to anterior during the Nogo-condition (Nogo-anteriorisation, NGA). An electrophysiological source localization (LORETA) revealed a close relationship between the NGA and a Nogo-hyperactivity in prefrontal areas (particularly the ACC) in healthy subjects. In contrast, schizophrenic patients were found to have a markedly reduced NGA and do not show a significant activation of the ACC during the CPT-Nogo-condition.

The present study employed the CPT to compare the electrophysiology of 15 controls, 15 schizophrenic and 11 patients suffering from cycloid psychoses. As expected, we observed a significant shift of the brain electrical field during the Nogo-condition for the control group and the group of cycloid psychoses, but not for the schizophrenic subgroup. Comparing both groups of patients to the healthy controls, we found a significantly reduced NGA in the schizophrenic subgroup only.

The results indicate neurophysiological differences between both groups of endogenous psychoses, which would further justify a clear differentiation between the two diagnostic subgroups.

Differences and consistencies for valence distinction in ERP microstates when reading emotionally positive and negative words. - L.R.R. Gianotti, P.L. Faber and D. Lehmann (The KEY Institute for Brain-Mind Research, University Hospital of Psychiatry, Zurich, Switzerland).

ERP's were recorded (33 channels, 250 samples/sec/channel) from 21 normals reading 432 words with positive or negative emotional valence (450 msec presentations; 2 sec intervals; attenting for recall, no instruction about valence). Global microstate analysis (Pascual-Marqui et al. 1995) separated the 113 ERP maps

during presentation into 13 information processing steps (microstates); three showed significant topographical differences between positive and negative words: #4(106-122 ms), #6(140-166 ms), #7(166-198 ms). Using LORETA, the difference "positive minus negative word-evoked current density" was computed for each voxel. 860 of the 2394 voxels showed consistent valence differences in the three microstates: positive words showed stronger activity than negative words (from 1=inferior to 4=superior): 1) left anterior temporal, 2) left-to-midline prefrontal, 3) bilateral prefrontal, and 4) right-to-midline prefrontal & left posterior; negative words stronger than positive: 1) right anterior temporal, 2) right central temporal, 3) bilateral posterior, and 4) frontal & occipital midline. However, the global 3-D pattern of valence differences was dissimilar between microstate #6 compared to #4 and to #7, but correlated significantly between #4 and #7. - Thus, brain activity incorporated the automatically perceived valence in three information processing steps, in various brain regions (partially consistent in the three steps), while not reflecting simple hemispheric asymmetry; the difference pattern was similar in two microstates (IGPP grant #670806).

EEG oscillations and binding: a perspicuous Gestalt percept fails to enhance gamma activity. - S.P. Heinrich*, A. Aertsen+ and M. Bach* (*Elektrophysiologisches Labor, Univ.-Augenklinik Freiburg, Freiburg, Germany; +Neurobiologie und Biophysik, Albert-Ludwigs-Universität Freiburg, Germany).

The binding of stimulus features into a coherent percept is a fundamental task of the visual system. According to the Dynamic Binding Hypothesis, this might be coded by neural synchronization. Animal studies suggest gamma-range neural oscillations to be involved, reports on binding-related oscillations in the human EEG are contradictory.

Most previous experiments were based on a stimulus-onset paradigm. Thus, the EEG always contained responses to trivial local stimulus changes in addition to binding-related components. We used a new approach with a Gestalt emerging from a continuous movement of stimulus elements without any discontinuances. The EEG was recorded from 18 subjects. 3 different stimuli were presented repeatedly in random order within each experimental block: two line grids, and a stimulus without Gestalt. Before each block, subjects were instructed to attend to one of the 3 stimuli and indicate its occurrence by pressing a button.

The stimuli produced a striking Gestalt percept and elicited strong event-related potentials with a weak task dependence. Alpha and beta activity was clearly modulated. The gamma range showed a weak, but significant, reduction. Perceptually relevant time intervals were differentially affected by the actual stimulus/task combination. No increase in gamma activity according to the Binding Hypothesis was found.

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Effects of ocular correction on topographical EEG analysis. - M.J. Herrmann and A.J. Fallgatter (Psychiatric Neurophysiology, University Hospital of Psychiatry and Psychotherapy, Würzburg, Germany).

The investigation of psychiatric patients by means of event-related potentials reveals the problem of an increased number of artefacts by eye blinks. As we need a certain number of good EEG epochs to increase the signal-to-noise ratio adequately, the high number of ocular artefacts leads to high, and therefore undesirable exclusion rate of patients of the investigated population. Alternatively ocular artefact correction algorithms were developed, to estimate and to remove the effect of eye movements on the EEG. Unfortunately, it was described that these correction algorithms did not remove the effects sufficiently, especially for frontal electrode positions. In this study we investigated the effect of the correction algorithm of Gratton and Coles on the topographical description of the brain electrical fields during the Continuous Performance Test in 24 patients with OCD. The results indicate, that the ocular correction of Gratton and Coles corrects the frontal EEG only insufficiently. The consequence is a displacement of the positive brain electrical field to anterior, which correlates positively with the number of corrected eye blinks. Therefore, we can not recommend the algorithm of Gratton and Coles for topographical ERP analysis.

The use of filter for topographical segmentation exemplified by the event-related face potential. - M.J. Herrmann and A.J. Fallgatter (Psychiatric Neurophysiology, University Hospital of Psychiatry and Psychotherapy, Würzburg).

A face specific brain potential for the processing of faces has been described over vertex (Cz) as a positive and over temporal electrode positions (T5, T6) as a negative component at 170 ms after face presentation. We replicated this face peak in our study in 18 healthy controls, but only for the single electrode positions described before, and not for the global field power (GFP). The topographical segmentation (dissimilarity, KEYSEG) did not reveal any segmentation at this time point. After filtering the event-related potentials with a bandpass of 2 -20 Hz the results were clearly different. We found a non-ambiguous segment at the time point of the face peak with a significantly higher GFP for faces compared to the control stimuli. As a kind of validation we calculated a source localization of the face peak with LORETA. LORETA localized the face

peak in the right gyrus fusiformis, a region which was described to be responsible for the face peak before. The results indicate that a bandpass filter of 2 -20 Hz might be not only a valid tool for ERP analyses, but also a necessary one.

A mission for the EEG coherence analysis: is the task complex or difficult? - M. Köhler*, K. Buchta*, F.-M. Schleif+ and E. Sommerfeld* (*Institut für Allgemeine Psychologie Universität Leipzig, Germany; + Institut für Informatik, Universität Leipzig, Germany).

The cognitive effort is an important parameter in maintenance and processing of cognitive structures. We investigated the influence of variation of complexity and difficulty on working memory processes for the acquisition of maintenance and processing components. For this purpose, we had a particular look at the synchronous activity between selective brain areas. Complexity is defined by the number of elements and relations. In the experiment, the variation of complexity was based on the variation of the number of elements in four linear ordering problems. Difficulty is defined by the number of operations necessary for getting a solution. It was varied by the distance in ordinal units of elements within the linear order. As a measure for synchronization, we used EEG coherence analysis (beta1 band, 13-20 Hz) between fronto and parietal electrodes (Schack et al. 1999). The response time increased with complexity and difficulty, whereas the coherence reacted only to the variation of complexity. The results suggest, that increased cognitive maintenance effort is reflected in increased synchronization between frontal and parietal regions. In contrast to this results, coherence does not increase during longer information processing over the same cognitive structure. Thus, we obtained a specification for the definition of complexity and difficulty.

Subsecond EEG microstates with different topographies differ in EEG temporal wave frequency. - D. Lehmann*, P.L. Faber*, V. Strelets+, L.R.R. Gianotti*, V. Novototsky-Vlasov^, J.H. Gruzelier~ and T. Koenig% (*The KEY Institute for Brain-Mind Research, U. Hosp. Psychiat., Zurich, Switzerland; + Inst. Higher Nerv. Activity and Neurophysiol., Russ. Acad. Sci., Moscow, Russia; ^Serbsky Inst. Soc. and Forens. Psychiat., Moscow, Russia; ~ Dept. Cogn. Neurosci. and Behav., Imperial College of Sci., Tech. and Med., London, UK; % U. Hosp. Clin. Psychiat., Bern, Switzerland).

Multichannel resting EEG (>40 seconds, 2-20 Hz) from two normal, adult cohorts (Moscow, N=13, Bern N=11, mean age 35 and 25 years, respectively) independently were parsed into microstates of quasi-stable scalp map landscape, analyzing the maps at all times of maximal strength (peaks) of global field power (software EMMA, freely available at http://www.puk.unibe.ch/tk2/tk.htm). Based on their map landscapes, the microstates were clustered into four classes. Global EEG wave frequency for each microstate class was assessed as frequency of global field power peaks/second. In both data sets, oneway ANOVA's (4 classes as repeated measures) showed significant differences between classes. Also in both data sets, in the two faster compared to the two slower microstate classes, the electric gravity centers of the microstate maps were significantly more anterior and more left; however, there was no linear relation between gravity center location and wave frequency. - Microstate segmentation of multichannel EEG time series parses the EEG map sequences into epochs of quasi-stable potential landscapes, in a time range around 100 msec. The present results suggest that these spatially defined, subsecond EEG epochs are associated with distinctly different EEG wave frequencies. (Partly supported by IGPP grant #670806).

Prognostic ability of somatosensory and early auditory brainstem evoked potentials for long-term outcome in patients with aneurysmal subarachnoid haemorrhage. - A. Massah, D. Reiter, P. Christophis, D.-K. Boeker (Department of Neurosurgery, Justus-Liebig University, Giessen, Germany).

In a prospective study of 98 patients with subarachnoid haemorrhage (SAH) initial findings of SEP and BAEP as well as the clinical grading according to Hunt and Hess were correlated with long-term outcome according to Glasgow Outcome Scale. We confirmed that SEP and BAEP were feasible for an early and reliable estimation of prognosis of patients with SAH, furthermore we could prove that evaluation of evoked potentials in particular SEP also with comatose or sedated patients, where neurological judgment is impossible, facilitate an exact prognostic value (CPOS = 0,880; P< 0.0001). Statistic analysis of our results showed that combined use of SEP and BAEP provides an increase of prognostic accuracy (CPO (SA) = 0.9416; P< 0.00001). Considering few numbers of false optimistic predictions, SEP represents a clearly stronger prognostic indicator than BAEP and clinical evaluation. The relative risk for patients to suffer a poor long-term outcome was 130, 88 and 43 for abnormal findings in SEP, BAEP and initial clinical state, respectively. Evoked potentials correlate significantly with outcome. The use of combined evoked potentials modalities (SEP and BAEP) permits the most significant prognostic ability.

Electrophysiological correlates of complex mental processes: an EEG - coherence study. - B.Ch. Mayr-Schwank, P. Rappelsberger (Cognitive Neuroscience Group, Brain Research Institute, University of Vienna, Austria).

The experimental material consists of a test de-

signed to evoke "complexity of thinking" during the performance of five tasks, which demand cognitive abilities, namely verbal, spatial, formal-logical and creative thinking. It is assumed that they have to be integrated in a complex manner for successful performance. Participants have to understand the written instructions whilst mentally preparing (imagining) the solution and subsequently have to build a correct construction.

The experiment was split into two conditions, "imagination" and "building", condition of control was "eyes open". During these conditions EEG was recorded with 19 electrodes (international 10/20 system) in 18 students. Coherence was calculated for 1 second artefact-free epochs.

The results show a common pattern for each "imagination"-task as well as for each "building"-task, which seems to be "typical" for the TEKODE. There were also differences between "imagination" and "building" concerning increase and decrease of coherence between certain electrode positions, which may be an experimental implication for looking at these paradigms differently. Also, individual characteristics of activation were seen and discussed.

Evoked potential correlates of arithmetic size effects. - D. Szücs, V. Csépe (Hungarian Academy of Sciences, Department of Psychophysiology, Hungary).

The mathematical size of numbers and the distance between operands used in arithmetic tasks have well known correlates in reaction times and error rates. In two experiments in simple arithmetic tasks we analyzed whether the numerical size and distance effects are related to grand mean ERPs or to the power spectra of individual EEG epochs (FFT and wavelet methods). Normal subjects carried out an arithmetical comparison (N=16) and an addition (N=12) task. In one part of the comparison task the alphabetic positional values of letters were also compared. EEG was recorded in 18 channels (0.15-30Hz, sampling rate: 250 Hz). Arithmetic size correlated mildly with grand mean ERPs in more time windows, especially in parietal sites. Size effects were detected in the N1, P3 and LPC components. The spectra of EEG proved to be sensitive to arithmetic effects in the 2-8 Hz band. Comparing the positional values of letters and digits gave rise to different patterns of EEG size effects giving further details to the interpretation of the effects.

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Visual object identification and visual memory functioning are linked in the hippocampus proper: evidence from intracranial event-related potentials. - M. Vannucci*+, T. Grunwald*, T. Dietl*, N. Pezer*, M.P. Viggiano+, C. Helmstaedter* and C.E. Elger* (*Department of Epileptology, Bonn University Medical Center, Germany; + Department of Psychology, University of Florence, Italy).

The medial temporal lobe (MTL) plays a crucial role in episodic memory, and recent studies indicate that it also participates in visual object processing. However, the relationship between memory and visual processing is still unclear, as is the role of specific MTL subregions. We asked whether the hippocampus proper participates in visual object identification and whether this function is related to memory performance. We recorded intracranial event-related potentials from within the hippocampus proper in 19 temporal lobe epilepsy patients (9 left, 10 right; 9 with, 10 without visual memory deficits) during a visual object identification task in which pictures of real objects were to be discriminated from nonsense figures. Only in patients without visual memory deficits the hippocampus proper differentiated between both kinds of stimuli: while real objects elicited a high-amplitude positive component around 700 ms, nonsense figures elicited a slow negative potential in the same time-window. By contrast, in patients with visual memory deficits, similar and less pronounced responses were elicited by both kinds of stimuli. Our data show that the hippocampus proper participates in the semantic processing of visual stimuli. Moreover, they indicate that this hippocampal function is directly related to visual memory functioning.

TGM: a cross-platform software package for topographic mapping of brain electric data. - J. Wackermann (Dept. of Empirical and Analytical Psychophysics, Institute for Frontier Areas of Psychology, Freiburg i.Br., Germany).

The tgm software package is a collection of utilities for topographic mapping of 2-D spatially distributed data. Tgm relies on the UNIX-based "pipelines" philosophy. Each step of data processing is implemented as a stand-alone utility: conversion of linear data records to topographic arrays (tgmtopo), interpolation of topographic arrays (tgmintp), scaling and morphing (optional) of interpolated data arrays into map images in a generic graphic format PGM (tgmimag). Tools generating point-to-point morphing tables are also available (tgmmorf). A series of map images is rendered into PostScript files (tgmps) or final pictures as colored bit-mapped graphics (tgmppm). Output files can be printed, viewed on the screen, converted into usual word processor or Web browser compliant graphic formats, and thus are easily included into professionally designed text documents or Web-based presentations. Due to its devotion to platform-independent, truly portable data formats and open source code policy, the package provides a viable alternative to proprietary, usually single

system-bound applications. The package is freely available as C source code for LINUX, DOS, and Win9x.

ACC - two methods, one result? - LORETA- versus fMRI-data under a NoGo-condition. - A. Wagener, A.J. Bartsch, M.J. Herrmann, , B. Hamelbeck, A.-C. Ehlis and A.J. Fallgatter (Department of Psychiatry and Psychotherapy, University of Würzburg, Germany).

Studies using fMRI found activation in widespread brain areas under a NoGo-condition in contrast to a Go-condition (eg. Garavan et al. 1999). However, LORETA (Low Resolution Electromagnetic Tomography, Pascual-Marqui et al. 1994)), a source localisation method for averaged event-related potentials, points to a significant activation in the anterior cingulate cortex (ACC, Brodmann Area 24) during a NoGo-Task. The use of different paradigms complicates a comparison. Therefore, the visual Continuous Performance Test (CPT, Rosvold et al. 1956) was carried out by the same twelve healthy persons (23-38 years old) once during an EEG-leakage and once within a Siemens Magnetom Vision scanner (BOLD-fMRI). The fMRI-data were evaluated by the SPM99 software. The results of the two methods are equivocal. Both methods show a significantly higher activation in the ACC during the NoGo-Task instead of the Go-Task, although this result for the fMRI-data is only true after a small volume correction. Furthermore, the fMRI-data indicate a significantly higher activation of the right dorsolateral cortex during a NoGo-Task, pointing to a comlementary function of both methods.

Cue reactivity in cannabis addicts and controls. - K. Woelfling, S.M.Gruesser (Department of Clinical Psychology, Humboldt-University Berlin, Germany).

Due to learning processes, originally neutral internal and external stimuli become drug- associated, can elicit stimulus-induced psychophysiological reactivity (e.g. craving, activation of specific brain structures) and are responsible for relapse even in long-term abstinents. The objective of the present study is to compare the cue reactivity in cannabis addicts and healthy controls in a psychophysiological exploration. Standardized addiction-associated stimuli (cannabis) and drug stimuli (alcohol) – which are not associated with the addiction - as well as negative, positive and neutral stimuli (Gruesser et al. 2000; Lang et al. 1994) were used in a cue exposure paradigm to assess stimuli-induced physiological (event-related potentials, ERPs) and psychological (craving, mood, disorders) parameters. Analyses of ERPs (late positive complex, LPC) show that addicts processed cannabis stimuli in contrast with neutral and alcohol stimuli similarly as strongly arousing as positive and negative stimuli. LPC appears to be influenced by the addiction state. Controls processed all drug-associated stimuli comparably to neutral stimuli. Schupp et al. (2000) assume that positive/negative stimuli initiate stronger motivational and emotional processes. Our results indicate that cannabis-associated stimuli were perceived more arousing which we interpret as evidence of this concept in drug craving.

Mapping development and risks for dyslexia in kindergarten. - D. Brandeis, S. Brem, K. Bucher and U. Maurer (Department of Child and Adolescent Psychiatry, University of Zurich, Switzerland).

Familial and phonological risks are important predictors for developing dyslexia. In auditory test, early neurophysiological markers of this risk are already present at an age of 6 months. Less clear is how visual or basal processing deficits contribute to the development of dyslexia, and how neurophysiological markers and the corresponding processing steps change during development.

Children with (N=25) and without (N=22) a familial risk for dyslexia (mean age 6.6 years) were examined with 42 channel ERP mapping during auditory and visual tests, and compared with adults (N=19).

The comparison between control children and adults indicated that both auditory and visual development involves major topographic and temporal reorganisation of brain activity. Differences between risk and control children mainly affected visual processing during the first 150 ms, and included both enlarged and reduced P100 microstates.

The results reflect early visual deficits in the risk group which are pathway specific. Whether these visual markers of risk for dyslexia in Kindergarten improve early detection of dyslexia can only be decided after establishing the diagnosis during the planned follow up in school. Since effective prevention of dyslexia through phonological training in Kindergarten has been demonstrated, improved prediction with biological markers is considerable clinical relevance.

SNSF grant 32-59276/99 and "NCCR on Neural Plasticity and Repair".

Mapping development and risk for dyslexia during visual form and motion processing. - S. Brem, U. Maurer, K. Bucher and D. Brandeis (Department of Child and Adolescent Psychiatry, University of Zürich, Switzerland).

We examined whether familial risk for dyslexia affects early visual processing of print, shape and motion before learning to read. Visual processing was measured by mapping the occipital positive P100 microstate found for all visual presentations.

Kindergarten children with (N=25) and without (N=23) familial risk for dyslexia were examined during

42-channel-ERP recordings. Separate tests were run to examine processing of patterns (words, pseudowords, symbol strings, pictures) and motion detection (20%, 40%, 80% coherence).

Group differences in GFP of the P100 microstate (patterns 55-171 ms, motion 63-141 ms) varied with tests and condition ($p<0.05$, $F(3,44) = 3.8$). Children at risk had lower P100 GFP for word and pattern processing than controls, but higher GFP for motion processing. Post-hoc t-tests indicated that children at risk had reduced P100 to words and pictures, but enlarged P100 for 80% coherence.

These results indicate that already before learning to read, children at risk for dyslexia process certain visual stimuli with enlarged or reduced P100 microstates, and suggest pathway specific visual deficits.

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Neuronal plasticity and visual perceptual learning. - W. Skrandies (Institute of Physiology, University of Giessen, Giessen, Germany).

Sensory training induced by visual stimuli is followed by lowered perceptual thresholds. Most human subjects are able to perceive 3-D information contained in dynamic random dot stimuli only after some practice. In a similar way, there is perceptual learning with visual hyperacuity targets (vernier stimuli) resulting in higher discrimination performance.

The psychophysical data illustrate that passive (inattentive) viewing of visual targets results in about 75% of subjects in an increase of discrimination performance. Learning is stimulus specific: the exact physical stimulus parameters of the learned targets are important. In addition, the retinal location of training targets is critical. Perceptual learning is rapid and occurs after about 30 minutes of training.

These changes in perceptual performance are accompanied by changes of stimulus-evoked EEG activity. Major effects in the electrophysiological data were not seen with simple amplitude measurements but with the topographical pattern of activation suggesting that neural assemblies in the visual cortex are affected by sensory training. The electrical brain activity of subjects who did not improve in perception, displayed no such changes of electrophysiological parameters.

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Auditory plasticity and the mismatch negativity. - J.M. Gottselig*, D. Brandeis+, G. Hofer-Tinguely*, U. Maurer+, A.A. Borbély* and P. Achermann* (* Institute of Pharmacology and Toxicology, University of Zurich, Switzerland; + Institute of Child and Adolescent Psychiatry, University of Zurich, Switzerland).

The mismatch negativity (MMN) tracks the brain's response to auditory stimulus change, and its amplitude correlates with discrimination ability. We investigated whether increases in the MMN associated with discrimination practice are limited to the practiced stimulus difference, or whether they extend to an unpracticed difference. Subjects (n=16) underwent two 40-min. electrophysiological recordings (R1, R2). We presented deviant eight-segment tone patterns (high, HD, and low, LD; probabilities = 0.075) that differed from a standard pattern (probability = 0.85) by an equal frequency change in the sixth segment. During R1 and R2, subjects watched silent films. Between R1 and R2, subjects practiced discriminating one deviant from the standard. The MMN was calculated as the difference in the evoked potentials to deviants and standards. Performance increased significantly during practice. Better performance in the LD practice group suggested that LD was easier to discriminate than HD. In both groups, significant MMN amplitude increases were observed from R1 to R2 for the practiced discrimination. A significant increase in MMN amplitude was also observed for the unpracticed discrimination in the HD but not in the LD group. Thus, practice-related increases in MMN amplitude may transfer from practiced to unpracticed stimuli, depending on relative difficulty of discriminations.

EEG microstates, global synchronisation and child development. - T. Koenig*+^, L. Prichep+, P. Valdes Sosa^, E. Braeker^, D. Lehmann~, R. Isenhart+ and E.R. John+ (* University Hospital of Clinical Psychiatry, Department of Psychiatric Neurophysiology, Bern, Switzerland; + Brain Research Laboratories, NYU School of Medicine, New York, USA; ^ Cuban Neuroscience Center Ave. 25 esq. 158, Playa, Havana, Cuba; ~ The KEY Institute for Brain-Mind Research, PUK, Zurich, Switzerland).

Human cognition requires temporal synchronization of widespread neuro-cognitive networks. Since the cognitive development of humans continues over the first two decades of life, a long lasting development should also be observed in the functional organization of these networks. Based on the EEGs of 496 healthy subjects between 6 and 80 years, this development was described using microstate analysis and a synchronization measure called Global Field Synchronization (GFS). The analysis divides EEGs into subsecond epochs with stable brain-electrical field distribution, assumingly corresponding to basic steps in human information processing. GFS measures, at a given frequency, how much of all active processes occur with a common phase lag. It turns out that the development of microstates is discontinuous and the transition latencies correspond well with the latencies that developmental psychologists have postulated. On the other hand, one can observe an increase of

symmetric and a decrease of asymmetric microstate with increasing age, which is paralleled by an increase of GFS. We assume that these changes correspond to an increase of bilateral synchronous brain activity and thus assumingly to an improved inter-hemispheric integration. This hypothesis is also supported by the development of the Corpus Callosum, which terminates only in late youth.

Neuromonitoring via derivation of somatosensory evoked potentials during neurosurgical spinal operations. - P. Christophis, D. Reiter, A. Massah (Department of Neurosurgery, Justus-Liebig University, Giessen, Germany).

Intraoperative monitoring during neurosurgical operative treatment gives the possibility to prevent lesions of neural tissue. In present study 56 patients with diseases of the spine and of the spinal cord was monitored intraoperatively via somatosensory evoked potentials (SEP) for detection of potential alterations with significant warning character. The detected SEP-changes were also correlated with the corresponding postoperative clinical outcome. In two cases a monitoring was not achievable, because the SEP-signal was not detectable. In nine cases preoperative SEP-changes were improved during surgery. In these cases a clinical improvement was also found postoperatively. In 13 other patients SEP-changes or worsening of initial SEP-changes were recorded during surgical manipulations. In four of these cases these findings was only transient, and the clinical state of these patients remained unchanged after the operation. In the remaining nine cases a significant correlation was found between postoperative clinical outcome and intraoperative SEP-changes. In the last 32 cases the SEP remained unchanged during the operation. Except one case with postoperative neurological worsening the clinical postoperative state remained unchanged in all these cases. This false-negative-monitoring show that during spinal surgery it is necessary to monitor not only the somatosensory function but also the function of the motor pathways.

Visually evoked potentials (VEP) in children with generalized seizures. - A. Portisch, D. Dralle (Department of Neuropediatrics, Justus-Liebig-University. Giessen, Germany).

Earlier we demonstrated neuronal hyperexcitability in one of the temporal lobes as a reaction to light stimulation in children with focal epilepsy. In the present report we describe VEP in 23 children and young adults with generalized seizures. 15 children without neurological problems served as a control group.

Recordings of flash-evoked VEPs were obtained in 19 channels (10-20 system) with a common average reference. 100 samples were averaged over 400 ms after the stimulus.

At the occipital leads latencies and amplitudes of the N70 and P100 were normal in all children. 15 (=65%) of the 23 patients with generalized epilepsy showed 150-200 ms after the stimulus a neuronal hyperexcitability of the temporal lobes, 47% of them bilateral. In contrast, only 2 (=13%) of the 15 normal children displayed an additional reaction of the temporal lobes.

This hyperexcitability seems to depend on the time interval between the last seizure and the VEP recordings. Children with seizures within the last week showed in 86% an additional temporal negativity, whereas children being seizure free for more than one year displayed this in only 55%.

Impaired cognitive processing in patients with different multisystemic myotonic muscle diseases is reflected by distinct disturbances of global field power (GFP) in continuous performance task (CPT). - M. Schneider*, C. Schneider+, M.J. Herrmann* and A. Fallgatter* (* Department of Psychiatry and Psychotherapy, University of Würzburg, Germany; + Department of Neurology, University of Würzburg, Germany).

Introduction: Myotonic Dystrophy (MD) and Proximal Myotonic Myopathy (PROMM) are multisystemic muscle diseases with similar clinical features, but, little is known about affection of the central nervous system.

Methods: 15 PROMM-patients (55.9 ± 8.6 years) and 9 MD-patients (39.1 ± 14.6 years) were tested for attention performance (d2-test), non-verbal intelligence (Raven-test) and visual memory (Benton-test). All of them performed a Continuous Performance Task (CPT) with a 21-channel-EEG-recording.

Results: PROMM-patients and MD-patients showed impairment of visual memory and were slow in attention performance.

The average GFP-amplitude from PROMM-patients was significantly lower for the Go-condition (PROMM: 4.0 ± 2.1µV; control: 5.7 ± 1.9µV; $p<0.05$) as well as for the NoGo-condition (PROMM: 4.8 ± 2.1µV; control: 6.9 ± 0.8µV; $p<0.001$). The topography of the centroids was not significantly different.

MD-patients showed a significant shifting of positive field centres to the anterior direction for both the Go- and the NoGo-condition compared to controls ($p<0.005$) without significant differences in amplitudes or latencies of GFP.

Conclusions: Both PROMM-patients and MD-patients show impairments of cognitive processing that are reflected by neuropsychological and neurophysiological testing results.

In the latter group, neurophysiological data might hint to premature functional ageing processes.