

particular demands of a situation. Prior studies have shown that patients with frontal lobe lesions have particular difficulty with this task. Assessment of reactive flexibility requires motor execution and inhibition to evaluate the correctness of the criterion shift. Therefore, event-related potentials (ERPs) recorded simultaneously to a flexibility test are similar to those recorded in a GO/NO-GO task. We developed a flexibility test isolating the stage of shifting the response criterion from motor response. The demand could be either to withhold or execute a motor response to a specific nonverbal visual stimulus appearing later in the sequence of stimuli. ERPs were recorded over six medially fixed electrodes: Starting at Fz, electrodes were fixed equidistantly (3.5 cm) towards posterior regions. Parallel to the electrophysiological data, overt responses of the subjects ($n = 16$) were recorded.

ERPs elicited by stimuli requiring a criterion shift as well as the stimuli indicating a motor execution or inhibition were characterized by a prominent P3. The three conditions could be distinguished clearly on the basis of P3 topography: ERPs associated with a criterion shift showed significantly higher amplitudes at fronto-central electrode positions in contrast to those associated with a motor response. Furthermore, P3 latencies were significantly increased when the motor response was withheld. Demanding motor inhibition to a specific visual stimulus leads to a decrease in P3 amplitude and an increase in P3 latency for all three conditions: criterion shift, motor execution and inhibition.

Implications of this paradigm for basic research and clinical application are discussed.

Individual differences in spatial cognition: Evidence from slow event-related brain potentials

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Slow event-related brain potentials were measured in a mental rotation and mental size scaling task. The data were analyzed separately for two groups of subjects who scored either above or below the median of the spatial subtest mirror images of the Wilde intelligence test. In both groups the transformation of mental images was accompanied by a very pronounced negative slow wave over the posterior part of the scalp. The maximum of this negativity which can be interpreted

as a sign of activation of the underlying cortical areas appeared at parietal and occipital electrodes. The amplitude at parietal electrodes varied in both groups with difficulty of the transformation operation, e.g., it increased with larger rotational angle. Independent of these general effects, the two groups differed in their slow wave pattern: Good performers revealed less cortical activation (a smaller negative slow wave) over the left posterior part of the cortex than poor performers. Over the right hemisphere, both groups had the same amplitude level at all electrodes. The result is interpreted on the basis of Kosslyn's theory of high level vision suggesting that particular modules located in the left hemisphere are more highly loaded when subjects are less efficient in transforming mental images.

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The olfactory event related potential (OERP): Special features of methods and results

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Various studies from our laboratory employing classical paradigms from ERP research have shown that the structure of the OERP is very similar to that of auditory or visually event-related potentials. However, the latencies within the OERP are prolonged due to complex processes of signal transduction in the receptor cell.

Methodological problems arise from the perceptual and processing characteristics of odors, e.g., habituation, interaction of concentration and valence. Possibilities for counteracting these problems in studying OERPs are discussed.

The majority of studies in the field of OERP research have been focused on determining the influence of exogenous factors on the parameters of the olfactory evoked potential. We have also tried to integrate endogenous determinants like the meaning, hedonic evaluation, and informational value of an olfactory stimulus into the design and interpretation of our experimental work. Effects of these factors, especially on the late positive component of the OERP, will be presented. It is summarized that the psychological relevance of odors is an important factor in olfactory perception.

The processing of stimulus features, however, seems to differ from the acoustic or visual modality: while there is a lack of evidence for a strong concentration effect on the OERP, the biological

relevance of odors causes specific changes in the OERP.

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Dealing with DC drift artifacts in ERP recordings

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DC drift artifacts can pose severe problems in the analysis of event-related potentials (ERPs). Especially for slow wave components, extending over periods of several seconds, drifts and experimental effects will be superimposed as the drifts cannot be expected to average out. Drifts normally vary at random among electrodes, so they will distort topographic information, which is expressed by inter-channel differences.

Hennighausen et al. (1993) developed an offline method to correct for DC drifts that estimates the global trend in base potential over the whole experimental session. The calculation is based on prestimulus baseline values, which are adjusted for amplifier reset offsets. The slope of the drifts, however, frequently varies at random within a few minutes. The drifts thus cannot always be fitted adequately by a global linear trend, and non-linear polynomial fits seem to be arbitrary.

A modified approach is proposed here. The method operates on the continuously recorded raw data, which is divided into consecutive epochs of medium size (10–100s). The size should be chosen such that each epoch extends over several trials. The epoch boundaries are aligned with the beginning of the event-related evaluation interval and, naturally, also to the amplifier reset points. For each epoch a linear regression is computed to estimate the trend component that is subtracted subsequently. The method integrates all available data points and thus achieves an estimate as accurately as possible. Robust statistical estimation is used instead of least squares minimization. This assures less sensitivity to outlier points. Additionally, obvious artifacts such as blinks, etc. are excluded from the regression.

The method has been validated using multi-channel ERP-data from a study on visual memory for spatial positions and object properties. Genuine DC potentials were recorded to be able to investigate slow wave activity during rehearsal with a duration of 6s. The detrending procedure

causes a clear reduction of the error term in the analysis of variance, in particular related to between-channel comparisons, while leaving the experimental effects unaffected.

Memory for food in anorexic patients during starvation and after food-intake

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It is a well known phenomenon that anorexic patients are cognitively attracted to food and nutrition, and this may aggravate their disease. The present experiment served to investigate this cognitive attraction during starvation and after food intake. Immediate recall of acoustically presented words was taken as an indicator of cognitive fixation.

Twelve female anorexic in-patients and 12 control subjects matched for gender, age, and education were investigated on three occasions: (1) fasted; (2) thirsty; (3) satiated and not thirsty. In each testing session four lists of 15 words each were presented which had to be recalled immediately. The words belonged to 4 categories: (a) neutral objects; (b) food; (c) drinks; (d) emotional words. Recall of words from each category was assessed as the dependent variable.

Generally, the anorexic patients recalled more words than the control subjects ($P < 0.01$). While the control subjects recalled more food words when hungry, recall of food words in the anorexic patients did not differ when hungry or satiated ($P < 0.05$). However, the improving effect of thirst on recall of drinks was comparable in anorexic patients and controls. Recall of neutral and emotional words did not differ across the three occasions.

The results suggest that memory for food is not modulated by hunger and satiety in anorexic patients.

This phenomenon is specifically related to food stimuli and does not pertain to other motivational cues like thirst-related stimuli.

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