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The scrabble paradigm allows the investigation of the electrical cortex activity associated with processes involving short and long term memory simultaneously. The task consisted of forming words from a set of letters presented in random order. Task difficulty was manipulated by varying the number of letters (3, 4 and 5) presented to the subject. Behavioral results reveal that the subjects performed the task serially, as denoted by a linear reaction time increment as the number of random letters in the set increased. The brain potentials elicited during the scrabble paradigm were the P200, N200, and P300 components followed by a negative slow wave (NSW) and a positive slow wave (PSW). The N200 amplitude increased with task complexity, while the P300, NSW and PSW amplitude decreased with task difficulty.

371 BRAIN POTENTIALS OF SPATIAL LOCATION AND MOTION DIRECTION ENCODING INTO WORKING MEMORY

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Neurophysiological evidence of two different working memory subsystems for visual information has been found very recently. These subsystems correspond to the two main visual pathways: the dorsal stream for motion-spatial information and the ventral stream for object information. This study aimed to further dissociate different working memory subsystems within one of the streams, namely within the dorsal stream. For these purposes, event-related brain potentials (ERP) were recorded while subjects memorized either the spatial location or the motion direction of stimuli. These ERP were compared to ERP recorded while subjects looked at the same stimuli but performed other control, non-memory tasks. Working memory activity for spatial location was accompanied by a late negative slow wave maximal over parieto-occipital leads. Working memory activity for motion direction failed to show significant effects, although a trend was found corresponding to a late negative slow wave maximal over frontal leads. These results reveal an important difference in ERP modulation between a working memory subsystem for spatial location and other subsystem for motion direction information, providing evidence of different working memory subsystems within the dorsal stream.

372 MAGNETIC FIELD DETERMINES FORMING OF MOTIVATION

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This study aimed to find out how weak disturbances of the natural magnetic field (NW) influences the process of self-organisation in adult male Wistar rats.

METHOD: Animals had to solve a problem and to form a cyclic food operant behaviour in a multiple alternative maze (Plexiglas, 90 x 60 x 40cm). The algorithm of the task consisted in a sequence of 4 logic elements: if after getting a food in two feeders (1,2) the animal leaves the maze (3) and enters it again (4) there will be always food available in feeders. A free-choice method was used for learning, so the absence of any conditioned stimuli made possible to study the process of self-organisation. Each session lasted 13 min, with a food deprivation period of 22 hours. Two series of experiments were carried out. In Expt.1 (control, n = 40) learning was studied against the background of a natural and homogeneous MF ($B = 38 \pm 2$ microTesla). In Expt.2 (n = 30) an inhomogeneous MF was modulated by three magnets placed under the maze. The magnitude of MF induction varied from 55 microTesla up to 300 microTesla on the surface of the maze floor.

RESULTS: Weak disturbance of natural MF, comparable with one produced by numerous man-made metal constructions or technical devices, broke the spontaneous transition of orienting activity in a new situation into exploratory behaviour. Unlike the controls, after a short period of orientation (1-3 min) deep and prolonged locomotor depression (up to 12 min until the end of the session) was developed in all MF-exposed rats in the first session. The absence of any signs of motivation and "initiative" was observed in all MF-exposed rats for the next sessions. The periods of locomotor activation became shorter and typical behaviour consisted in entering the maze, approaching the feeder and taking a food. But all these actions did not activate MF-exposed rats at all as it was observed in control. So, MF-exposed rats were unable to organise the operant habit by themselves, but learning was possible after an additional external stimulation (sound, light, hand-pushing etc.). Moreover, the information processing was twice quicker than in control rats. The hypersensitivity to any kind of external and internal stimuli (sound, light, social isolation, food ration, etc.) was observed in MF-exposed rats. The very unexpected side-effect of learning against the background of inhomogeneous MF has been obtained. Psychophysiological depression provoked significant increase of alcohol intake in all initially alcohol averse rats from 0,01 g/kg/day (2% of 10% ethanol solution in total daily liquid) up to 5,4 g/kg/day (81%).

CONCLUSIONS: The data obtained in this study give an evidence that MF factor is involved in forming of motivation state. The absence of spontaneous transition of orienting activity into exploratory and searching behaviour demonstrated that the conditions of forming a stable "excitation hearth" in the brain (I.P. Pavlov's term meaning co-ordinated brain structures excitation for dominant state) have been

broken by changing MF background. It resulted in inability of cognitive processes display and its motor realisation as forming of a goal-directed behaviour. Taking into account the high sensitivity of the nervous system to MF and existing ideas about the important role of the MF component of CNS in intracellular and intrastructural interactions in the brain, we hypothesise that the MF can be considered as a system-organising factor in motivation - the crucial psychophysiological state for cognitive activity.

373 POST-TASK P3 LATENCY CHANGE AS A CORRELATE OF IQ

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The standard psychometric scores show a variable relationship with event-related evoked potential latencies and amplitude. In the present study, we have compared the psychometric scores obtained through WAIS-PR with evoked potential latencies and amplitude recorded at 2 sessions, one before, and the other immediately after a brief period of rigorous mental task. Two types of tasks were employed: auditory, in which the subjects had to repeat a string of digits in reverse order, and visual, in which the subjects had to read laterally inverted text. The latency of P300 as well as the auditory reaction time changed significantly following both types of tasks. The increase in latency following visual task showed significant negative correlation ($r = -0.545$) with IQ scores. Neither the pre-task, nor the post-task latencies taken individually correlated significantly with the IQ scores. Comparisons made between subjects with lower IQ (< 110) and higher IQ (> 120) also showed significant differences in post-(visual) task latencies. The ERP amplitudes did not show significant changes following task. The increase in latency could be a reflection of activation of longer, multisynaptic parallel processing pathways, and subjects with higher IQ could be endowed with more such processing power. Following activation by a mental task, subjects with higher IQ possibly draws upon this reserve resulting in more efficient though not necessarily speedier information processing.

374 APPEARANCE OF FRONTAL MIDLINE THETA ACTIVITY RELATED TO LEARNING

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Appearance of frontal midline theta activity (4-7 Hz) was studied in a simulated traffic situation in which the subject had to find a correct way to drive a car through a set of roads

in a computer game. At the first cross-roads the subject had to follow the instruction contained in a traffic sign (1st sign, duration of presentation 2.8 s) indicating choice from one of three roads. At the second cross-roads a choice had to be made between one of four roads on the basis of the second traffic sign (2nd sign, duration of presentation 2.1 s). The second sign was an arrow pointing either to the right or to the left. The indication of the sign was dependent on the road used at the first cross-roads. Thus, for each three roads there was one correct pair of the second roads corresponding to the right-left traffic signs. The traffic signs were presented in random order. Immediate feedback was given after each trial. Each trial lasted about 10 s with a pause of 2 s between trials. The driving performance was analysed on the basis of correct/incorrect road selections and driving errors.

Two learning-control sessions were used. In the *first session*, subject had to learn the meaning of the traffic signs by trial and error. The subject drove on one of the three roads until he reported he had found the correct way. The number of trials depended on the subject's learning ability. After this, the subject practised on the same road (60 trials). Thereafter, the rest of the three roads were similarly learned and practised (*learning condition*). Finally, a block of 180 trials was run, in which the traffic signs were randomly chosen for presentation (*control condition*).

In the *second session* two blocks of 180 trials were carried out. In the first block of trials subject was given the correct alternatives by instruction (*learning condition*). After a pause of 15 min the second block of trials were carried out (*control conditions*). In both conditions the traffic signs were presented in random order.

The EEG was recorded from Fz. A trial was divided into seven 1610 ms observation sections: a section from the beginning of the driving, three consecutive sections starting from the appearance of the first traffic sign, two consecutive sections from the appearance of the second traffic sign, and one section at the end of the trial. The length of the whole analysis period was 11.3 s. In the first session significantly more theta was found during the correct than during incorrect road selection in the learning condition. There was no significant differences between the road selections in the control condition. On the other hand, in the second session, there was no differences between the road selections in the learning condition. In the control condition significantly more theta was found during correct road selection than during incorrect one.

Disappearance of the difference between the road selections in the first session was due to the significant increase of theta in the control condition during correct, and especially during incorrect road selection on the sections following the presentation of the traffic signs. Correspondingly, the appearance of the difference between the road selections in the second session was due to the significant increase of theta in the control condition during correct road selection on the section following the presentation of the first traffic sign. During incorrect road selection theta decreased on the section following the presentation of the second traffic sign.