AGE-RELATED DIFFERENCES IN EEG GAMMA POWER DURING RECOGNITION OF FACIAL EXPRESSIONS

There are several studies underlined emotional aging but it’s not clearly explained yet how event-related oscillations are affected by emotional aging. Facial expressions recognitions is a major marker of emotional abilities. In the literature, facial expression recognition was reported to be related to gamma oscillations. In this study, we aimed to investigate gamma response pattern during facial expressions recognition task using event-related spectral perturbation (ERSP) analysis.

15 healthy young subjects and 15 healthy elderly subjects were included in the study. EEG was recorded with BrainAmp 32-Channel DC System. Nine photographs from Ekman and Friesen (1976) series were selected with three different facial expressions (angry, happy, and neutral) of three different faces. After each EEG recording session, subjects were asked to identify each facial expression that was presented. Gamma (28-48 Hz) frequency ERSP were analyzed with EEGLAB toolbox. Repeated measures of ANOVA was used for statistical analysis.

There were statistically significant result for faceXgroupXlocation (F = 6.168, p = .033) comparisons. Post-hoc comparisons showed that elderly subjects had greatest gamma ERSP value at the frontal location while minimal at the occipital location. Unlike the elderly, healthy young subjects had greatest gamma ERSP at Parieto-occipital (P3, P4, O1, O2) locations while minimal at the frontal location during “happy” face expression perception. Also, healthy young subjects had greater gamma ERSP value than elderly subjects at parietal locations during “angry” face expression perception.

In the present study, elderly adults showed a different pattern from the young group. Elderly subjects showed increased gamma ERSP at more anterior locations while young group showed increased gamma ERSP at more posterior areas. This results could be interpreted as the compensatory pattern that coming with aging.

Spatial frequency modulations of basic features in object categorization

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Introduction. Local information integration is crucial for visual images identification. Grouping mechanisms include second-order filters (SOFs) (Graham, 2011). They find spatial modulations of contrast, orientation and spatial frequency and take part in texture segmentation. But the possible role of these mechanisms in image categorization is still an unanswered question. Our study is aimed to find whether the information extracted by SOFs is useful in object categorization. Basic SOF model supposes that these filters are not selective to modulation dimension (Wilson, 1999). But recent studies revealed their specificity (Kingdom et al., 2003; Babenko, Ermakov, 2015). We changed inhibitory flanks of the model to make it selective to modulated basic feature (Babenko et al., 2011). Besides first-order filters simulate striate neurons with their frequency and orientation tunings and SOFs integrate outputs of these filters with different localizations by universal algorithm.

Methods. Test images were created with this model. We extracted areas with the greatest amplitude of contrast, orientation and spatial frequency modulation from the photographs of natural objects (295 items) in 6 carrier frequency bands according to the number of visual pathways in the human visual system (Wilson, Gelb, 1984). These areas were combined in test images that were presented to observers. General number of stimuli sets was 3 (1 for each modulation dimension). Each set included all possible combinations of areas extracted from different bands of carrier. The observer task was to categorize presented image with maximum accuracy.

Results. The integration of all information extracted by the model in the test image provided 97% basic-level categorization for orientation modulations, 87% for contrast modulations, 9% for spatial frequency modulations. Combination of orientation modulations with two peak carrier frequencies (16 and 32 cpi) allowed to categorize objects with 86% accuracy. The results of basic-level object categorization for images combined from orientation modulations of different bands of carrier are shown in the Figure. I.e., we take into account the information transferred through two of six human visual pathways. Adding another peak carrier frequency (64 cpi) did not increase the percent of right basic-level categorization but improved the performance on subordinate level up to 74%.

Conclusions. The information extracted by the model is sufficient for natural object categorization. Orientation and contrast
modulations are the most informative ones. The information extracted in 3-octave band of carrier from medium spatial frequencies is sufficient to provide 85% and more accurate basic-level categorization.

Picture 1: https://www.eventure-online.com/parthen-uploads/175/18001/add_1_437259_f5c7581f-7472-47ec-8cde-150cf2a44c6.png
Caption 1: X-axis - combination of peak carrier frequencies in image (cpi), Y-axis - categorization performance in percents. Confidence limits are for p<0.05.

03

Three-month Transcendental Meditation reductions in perceived stress are associated with DMN increased connectivity at rest

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Introduction: Meditation practices have been reported to favor psychological well-being and to affect brain functional and structural architecture. Here we combined psychometric assessment and resting state (RS-)fMRI to investigate whether and to what extent behavioral and brain changes may occur after the first 3-months of Transcendental Meditation (TM) practice in naive subjects.

Methods: After signing an informed consent, thirty-four healthy adults participated in the study: 19 subjects voluntarily chose to be part of the ‘meditation group’ (29±9y, 10F), while 15 subjects were included in the ‘control group’ (32±11y, 7F). The meditation group was instructed to complete two daily 20-min TM sessions, one in the morning and one in the evening. At recruitment (T0) and after 3 months (T1), all participants completed six questionnaires assessing anxiety, stress, depression, resilience and empathy, and underwent two MRI scans (1.5T), including ~730° RS-fMRI and high-resolution anatomical images. A Principal Component Analysis was applied to psychometric scores, and the first component (C1, 25% of total variance) was selected. Relative T1-T0 variations in C1 were assessed in each group using paired t-tests, while a Fisher’s exact test was applied to investigate between group differences. Analyses of fMRI data were performed using AFNI and FSL. In particular, potential T1-T0 changes in the Default Mode Network (DMN) were investigated using a seed-based functional connectivity analysis (NeuroSynth peak coordinates [0,-50,24]) and a linear-mixed effect model.

Results: At T0 demographic variables and C1 score, which reflected an aggregate measure of anxiety, stress and depression, did not differ between groups. Meditation time was 30.6±12.8 hours (M±SD) in the 3-months period. At T1, the proportion of individuals showing a C1 (anxiety/stress) reduction was significantly different between the TM and control groups (79% vs. 40%, respectively, p=0.03; Fisher’s exact test). Indeed, a significant reduction in C1 score was observed in meditators (p=0.02) but not in controls (p=0.85). While no significant difference in DMN-connectivity between T0 and T1 was found in either group, meditators showed a significant negative correlation between C1 score variation and DMN-connectivity in precuneus and right parietal cortex (p<0.05, cluster-corrected, Fig.1).

Conclusions: A relatively brief TM practice period was accompanied by a reduction in subjective anxiety, which in turn was significantly associated with a connectivity increase in the posterior portion of the DMN. These findings support the beneficial effect of TM on psychological well-being, and suggest a role for brain functional networks that comprise areas crucial for reappraisal and subjective relief.

Picture 1: https://www.eventure-online.com/parthen-uploads/175/18001/add_1_444629_eb10e407-befb-41cd-a4cf-764c59d7d7e4.png
Caption 1: Figure 1. Correlation between BOLD signal strength (precuneus and right parietal cortex) and C1 score [T1-T0] in the Meditation Group.

04

The complexity of heart rate during behaviour formed in different stages of ontogeny

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The autonomic neural system is the main way for the brain-body coordination; at the same time, many studies have demonstrated the coupling of visceral responses to cortical regions activity (cingulate, insular, visual and somatosensory regions). It means that not only the nucleus of the solitary tract, ventrolateral medulla, parabrachial nucleus and
hypothalamus but also many cortical regions take part in the brain-body cooperation. Heart rate variability (HRV) is the variation over time of heartbeat intervals. The way by which HRV reflects the activity of ANS is clear enough but the heart rate regulation by cortical structures is still an unanswered question (Thayer et al., 2009). It has been shown that HRV associated with a diverse range of affective and cognitive processes (Acharya et al., 2006), which can be considered as characteristics of behaviour formed at different stages of ontogenesis. Behavioural acts formed in different stages of ontogenesis are subserved by co-activation of different specialized neuronal groups distributed in the cortex and had emerged in learning (Shvyrkov, 1995). Therefore we investigated HRV in the early-formed behaviour differed from HRV in the later-formed behaviour and in what case it would be higher.

We have recorded ECG in 35 participants (28 men, age from 21 to 35), who were mathematicians. Participants had to take two tests. The first test included sentences with mathematical terms (later-formed behaviour). The second test included sentences with words were in common current use (early-formed behaviour). The task was to add one missing word in each sentence.

To evaluate the complexity of HRV we estimated the sample entropy (SampEn). SampEn is a measure quantifying the regularity of time series (Richman and Randall, 2000). We have compared SampEn in performing tasks. SampEn was significantly higher at the mathematical test performance (median=1.04; quartiles: 0.93-1.14) than at the performance of the commonly used words test (median=1.01; quartiles: 0.88-1.04) (Z=2.81, p=0.004, Wilcoxon test). The complexity of HRV was higher when participants were performing the later-formed behaviour. It means brain-body coordination was more complicated in that case.

The main output of the study is that the system subserving of behaviour is reflected not only in the brain activity but also in the body’s activity. Functional systems, which subserve behaviour, are not only neuronal systems but include different parts of the body, which change their activity to cooperate with the brain for an optimal achievement of results. Supported by grant RFBR N16-36-60044 mol_a_dk.

**05**

**MEG spectro-temporal patterns underlying semantic processing**

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<u>Introduction:</u> Our brain takes advantage of a distributed network of cortical regions that extract semantic information from perceptual representations conveyed by different sensory modalities. The particular temporal dynamic by which this categorial representation is produced remain however partially unclear. Using machine learning classifiers on MEG-evoked fields, here we attempted to identify the MEG spectro-temporal patterns underlying semantic category discrimination, supposing that true conceptual knowledge should rely on temporally coinciding dynamics across different presentation modalities.

<u>Methods:</u> A set of forty items from four categories were repeatedly presented to 16 healthy volunteers (5F 27±2.5) using different presentation modalities, namely pictorial, auditory and written word, in distinct experimental sessions. Data were acquired with a 306-channel Neuromag MEG system (1000 Hz sampling frequency). Data-epochs centered on the stimulus onset (-250ms to +500 ms) were extracted, band-pass filtered (1-80Hz) and resampled (400 Hz). Visually identified bad trial and channels were respectively discarded and interpolated from spatial neighbors. Finally, starting from signal time–frequency decomposition (500ms 90% overlapping time bin, 2 Hz frequency bin), multivariate analysis was performed with CoSMoMVPA, using Linear Discriminant Analysis to classify stimulus category within a time-frequency-channel searchlight. Results maps obtained independently for the three modalities were tested against the fixed chance level and corrected with TFCE, binarized and summed. Commonalities between modalities were defined by a score of 3, indicating complete overlap between thresholded single-modality accuracy maps.

<u>Results:</u> Temporal sensors, mainly in the left hemisphere, showed across-modality overlap in the theta and alpha frequency bands in the 100-400 ms interval peaking around 250 ms, while a cluster of right occipital sensors reached an early (100 ms) overlap peak in the 12-15 Hz band. Gamma activity retained the ability to discriminate between semantic categories in occipital sensors for the visual modality only.

<u>Conclusions:</u> Our results show that our brain can produce modality-independent conceptual representations of specific sensory inputs within a few milliseconds, actively integrating sensory information through a widespread cortical network within the occipital and temporal regions, areas that have already been associated with conceptual knowledge. Moreover, MEG oscillatory activity in the theta and alpha band provides the main discriminant features allowing for an accurate classification of category-based information, confirming the role of these rhythms in lexical retrieval and semantic processing. According to our hypothesis, the described spatio-temporal integration process could underlie the generation of modality-independent concepts.

**06**

**Face processing in congenitally deaf signers as revealed by fast periodic visual stimulation**

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Introduction: As a result of permanent sensory deprivation, neural systems that are deprived of their typical input, as well as spared sensory modalities, often reorganize (cross-modal and intramodal plasticity, respectively). In congenitally deaf signers the study of face processing has revealed both cross-modal and intramodal adaptations: the activation of auditory cortices (e.g., superior temporal sulcus) was observed in response to face stimuli (e.g. Benetti et al., 2017); hemispheric dominance shifts in ventral visual areas (e.g. fusiform gyrus) were found in response to the presentation of emotional facial expression (e.g. McCullough et al., 2005). However, a systematic assessment of different stages of face processing in congenitally deaf signers is lacking.

Methods: To address this issue, we combined fast periodic visual stimulation with electroencephalography (EEG), an approach providing sensitive and objective measures of face-processing in hearing individuals (e.g., Rossion, 2014). A series of three EEG experiments designed to hierarchically test different levels of face-related discrimination were run in a group of congenitally deaf signers (N=14) and a group of matched controls (N=14). We investigated the following face processing functions: (1) generic face categorization (faces appearing at a fixed frequency of 1.2 Hz in a train of visual images of objects appearing at 6 Hz); and in two orthogonally implemented experiments, (2) individual face discrimination (different vs. identical unfamiliar faces, across emotional facial expressions) and (3) facial emotional-expression discrimination (emotional face expressions vs. neutral faces, across identities).

Results: In all three experiments, both groups showed bilateral occipito-temporal responses over the scalp. For both generic face categorization and facial expression discrimination, matched controls displayed, as expected, a right lateralized topography (on average). On the contrary, congenitally deaf individuals showed a left hemispheric dominance. No group difference in hemispheric lateralization emerged instead for individual face discrimination. However, in this latter experiment, congenitally deaf signers exhibited a greater response as compared to matched controls, over the midline, at frontal and central electrode sites. Such a topography pattern is compatible with a cross-modal activation of auditory cortices in congenitally deaf signers.

Conclusion: Altogether, our results suggest compensatory changes at distinctive levels of the face-processing system in congenitally deaf signers. The left hemispheric dominance in congenitally deaf signers has often been linked to the relevant role of faces in sign language (e.g. McCullough et al., 2005; Neville et al., 1987).

Oculomotor activity differences of experts and novices in solving chemistry test problems

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Introduction. In this study we tried to locate oculomotor parameter differences in people with different chemistry competences when reading texts and analyzing schemes, describing chemical processes. We suggested that eye movement patterns differ between the two groups (experts and novices), across a range of eye movement measures: average fixation duration, average fixation duration on AOI, AOI revisits, fixation count, blinks.

Methods. Participants in the study were 35 chemists (age range 18-55) with two different levels of expertise: 18 chemistry experts, 17 novices. There were 4 trials for each subject. Each trial included 1) reading a text describing a chemical process; 2) solving tasks in the form of graphs, using information from the text: filling empty cells in circuits; indicating errors; swapping elements to maintain the correct structure of the chemical process. Time was unlimited both at the stage of reading the text, and at the problem solving stage. Stimuli were presented on a 23-inch screen with a 1920x1080 pixel resolution, using the software Experiment Center from SMI. The search rate and eye movement data were recorded with an SMI iViewX Hi-Speed 1250 tracker (sampling rate 500Hz) with head support and the corresponding SMI software iViewX.

Main results. It is found that experts are significantly faster in all types of tasks (F(1,139)=69.88, p<0.01). Also experts have more correct answers (F(1,139)=10.79, p<0.01). Novices have longer blinks duration when they read texts and solve problems (F(1,139)=28.87, p<0.01). It shows that the problems present greater complexity for novices and thus require greater effort. There are no differences in eye movements between groups of experts and novices in reading texts. Analysis of eye movement in graphical tasks showed that experts are characterized by longer fixations, which concentrate on significant areas of graphical representations of tasks (F(1,139)=8.77, p<0.01). Novices generally have shorter fixations, which are evenly distributed in relation to the location of separate elements of the problem. It is also found that experts make less transitions between AOI than novices (F(1,139)=88.01, p<0.01).

Conclusions. Experts spend less time solving problems and solve problems more correctly due to less effort. The obtained data can be interpreted as evidence of the existence of two different strategies in task performance. Novices use perceptual strategy, which is aimed at extracting as much information as possible from the presented graph. Experts use more effective cognitive strategy, which is based on previous knowledge and mental representations, sustained in working memory.

Picture 1: https://www.eventure-online.com/parten-uploads/175/18001/add_1_445649_d39ca50a-1cf6-43f8-8e88-173eea1b653c.png
Oscillatory correlates of perception of emotional faces depending on depression scores
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Depression is one of the most common mental disorders that goes together with changes in the emotional sphere. Studies have been shown that patient with the major depressive disorder had increased brain activity in regions participated in emotional identification and production (Stuhrmann, Suslow, Dannowski, 2011). However, there are still a few studies about changes in emotional perception depending on depression scores in healthy subjects without clinical relevance of depression. The aim of this work was to determine whether depression scores measured in healthy subjects affects oscillatory dynamics of perception of emotional information. 46 volunteers (31 women and 15 men aged 18 to 28 years) completed the Beck depression scale (BDI II). As a stimulation, we used an ensemble of the photographs presented by Ekman and Friesen (1976). In the face gender discrimination task subjects were instructed to press “1” or “2” upon presentation of, respectively, a male, or a female face. Median split was applied to divide the sample into low and high depression groups. To assess face-evoked changes in spectral power, event-related spectral perturbations were calculated using EEGLAB toolbox (Delorme and Makeig, 2004). FDR correction for multiple comparisons was used to reveal significant effects. There were no significant differences between low and high depression groups concerning mean number of errors and reaction time. Angry faces evoked the increase theta spectral power during the first 200 ms after the presentation in high depression group but the decrease – in low depression group. In contrast, happy faces evoked the increase of theta spectral power during the first 200 ms after the presentation in low depression group but the decrease – in high depression group. Thus, the presence of depression scores predisposed to higher sensitivity to negative emotional information and lower sensitivity to positive emotional information.

Some Relationships between Postural Measures and Cognitive Functions
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Some Relationships between Postural Measures and Cognitive Functions
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Introduction
Balance is a process determined by an integration of multiple afferent stimuli from visual, vestibular, stomatognathic and somatosensory systems. These afferences produce a continuous response of the tonic postural system in order to control body stability during the spontaneous sway in standing position. The body’s posture is also related with the plantar pressure and surface. Moreover, there are evidences of a link between body’s posture and cognition. The aim of the study was to explore the correlation between baropodometric and stabilometric measures and performance in cognitive tests.

Methods
A sample of 42 healthy subjects (male: n=19; mean age: 25±3 years) took part in the study and were assigned in two groups according to their practice with sports: sedentary (SD, ≥3 consecutive years without sport activity) and sporty (SP, ≥3 consecutive years of sport activity). Subjects underwent to baropodometric and stabilometric assessments, with both Open Eyes (OE) and Closed Eyes (CE) conditions, as well as to a battery of cognitive tasks, including Corsi span, Digit span, Symbol Digit Modalities Test, Modified Five Point Test, phonemic and semantic fluency tests, Stroop test.

In SP subjects, mean sway Y (i.e. the mean distance between the extreme swings of the center of pressure in the sagittal plane; the lower its value, the more accurate the process of postural control) was negatively correlated with phonemic fluency test: r = -0.55. In SD subjects, mean sway Y was negatively correlated with spatial span: r = -0.62. On the other hand, significant positive correlations between plantar surface and performance in verbal working memory tasks were selectively found in SP subjects: both right and left forefoot surfaces were significantly correlated with scores at digit span task (r=0.57; and r=0.60 respectively).

Conclusions
These findings suggest that the more accurate the postural control is the greater the performance in cognitive tasks measuring executive functions and verbal and spatial working memory. This suggests that executive functions contribute to postural control, with the two functions sharing partially overlapping neurofunctional networks centered in frontal cortices.
Electrophysiological insights into the interaction of feature- and object-based processing in selective visual attention
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Objects represent a fundamental selection unit of visual attention. The integrated object account implies mandatory spreading of attention across all features bounded into one object. In line with some recent studies, however, we have failed to find this effect in our first experiment. Here, we employed a novel experimental design, allowing simultaneous electrophysiological measurements of the allocation of attention to two distinct features within one object, by driving two distinct steady state visual evoked potentials (SSVEPs). Results (n=30) obtained through Fast Fourier Transform (FFT) based on rhythmic entrainment source separation (RESS) indicate that facilitation across features within one object is not mandatory but depends on their task-relevance. In a second experiment, we adjusted the design only slightly by changing it into a shifting paradigm to allow for the examination of the time courses of feature- and object-based processing. Surprisingly, results (n=28) obtained through FFT deviated dramatically from the first experiment in that we found complete object integration. A follow-up experiment is essential to further illuminate possible criteria influencing the interaction between feature- and object-based processing. The subsequent time frequency analysis of the data of the second experiment suggests a two-stage facilitation of the task-relevant feature first, followed by a facilitation of the task-irrelevant feature representing object integration.

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Cortical representation of visual and kinesthetic mental images as a function of hypnotizability and gender
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Introduction. The subjects with high hypnotizability (highs) exhibit greater ability of kinaesthetic imagery with respect to low hypnotizable individuals (lows) and stronger functional equivalence between imagery and perception. The aim of the present study was to investigate the cortical representation of the visual and kinesthetic mental image of a rotated position of the head in highs and lows of both genders.

Methods. Twenty-one highs and 20 lows were invited to imagine to maintain their head rotated toward one side by seeing their chin in axis with their right shoulder (V, visual imagery), and in a different condition, by feeling tension in their neck muscles (K, kinaesthetic imagery). EEG was recorded through 32 electrodes in basal, V and K conditions lasting 1 minute each. For each EEG band log transformed absolute powers were averaged across frontal, medio-anterior, medioposterior, occipital sites. For each region, left and right sites were averaged as imagery is bilaterally represented. Analysis of the absolute power of all frequency bands was conducted according to a 2 Hypnotizability (highs, lows) x 2 Gender (females, males) x 2 Imagery Modality (kinaesthetic, visual) x 2 Condition (basal, task) design. Imagery-induced changes (Δv, Δk: task-basal) were also compared between each other for the regions exhibiting significant changes during both imagery tasks with respect to basal conditions. Pearson correlation coefficients between vividness of imagery, hypnotizability scores and imagery-induced power changes were computed. The level of significance was set at p<.05.

Results. Highs reported significantly higher vividness than lows only for the kinaesthetic modality of imagery and only for the kinaesthetic mental images hypnotizability showed a positive correlation with the reported vividness of imagery(R=.432 p<.005) and a negative correlation with the reported cognitive effort (R=-.352, p<.024). Only the highs among females and the lows among males (HF and LM) exhibited significant power changes during the kinaesthetic task, whereas visual imagery was associated with cortical activations in the females of both hypnotizability groups (LF, HF).

Conclusions. The study supports earlier findings of an advantage of highs in kinaesthetic imagery and indicates an intriguing interaction of hypnotizability and gender in this respect, as already observed the visual identification of haptically explored unmeaningful objects and blindfolded reproduction of haptically explored angles.

12
THE ROLE OF n-3 POLYUNSATURATED FATTY ACIDS IN THE FORMATION OF THE PSYCHOPHYSIOLOGICAL STATUS OF SKI RACERS
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The psychophysiological status of the athlete is an important aspect of the formation of his adaptive responses in answer to a high load. It is provided by a complex mechanism of neuroendocrine regulation, in particular, n-3 polyunsaturated fatty acids [1,2,3]. The purpose of the study is to examine the role of n-3 PUFA in maintaining the normal functional state of the nervous
system of athletes and the to justify the prospect for the further practical application of the data obtained.

20 high-trained skiers aged 17 to 29 y.o. (master of sports, candidates for masters of sports) from regional team were recruited to participate in the study. Evaluation of the overall functional state of the nervous system was performed in a simple visual-motor reaction according to 3 indicators: functional level of the system (FLS), stability of the reaction (SR), and level of functional possibilities (LFC) [4]. The level of essentional alpha-linolenic acid (ALA), eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) were determined by gas chromatography.

The level of the tested PUFAs was below the normative values - ALA in the average for the group of 0.4% (norm 0.6%), EPA 0.8% (norm 1.4%) and DHA 1.6% (norm 1.4%) respectively. It indicates, first of all, the insufficient intake of PUFAs by athletes, and also may be associated with their intensive expenditure. It was shown that a lower level of n-3 PUFAs in blood plasma is significantly associated with low indicators of the overall functional state of the nervous system of the subjects. Thus, the level of ALA correlates with all three integrative parameters of FLS (rs = 0.601, p <0.01), SR (rs = 0.606, p <0.01) and LFS (rs = 0.631, p <0.01). The interrelation between the level of EPA and FLS (rs = 0.527, p <0.01), and DHA with SR (rs = 0.448, p <0.01) and LFS (rs = 0.472, p <0.01) was noted. The obtained data allow to make the assumption that n-3 PUFAs positively influence the general functional state of the nervous system, increasing the adaptive capacity of the organism, which makes it advisable to use n-3 PUFAs supplements in sports of high achievements.

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fMRI resting state network between the thalamus and other brain regions in Major Depressive Disorder

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Recently, functional magnetic resonance imaging (fMRI) studies of Major depressive disorder (MDD) have examined connectivities within specific resting-state neural networks among the prefrontal, anterior cingulate and other brain regions. The goal of this study was to investigate the resting-state functional connectivity patterns between the thalamus and other brain regions in patients with major depressive disorder (MDD).

The imaging data were obtained from MDD patients (BDI score 23.38 ± 5.63) and healthy control subjects (HC, BDI score 2.25 ± 3.01). All patients had been on medication, and had no history of neurological or systemic illness, head injury or any other relevant medical or additional psychiatric disease. Subjects underwent 5-min resting-state scan with eyes open and they were instructed to stay quiet and fixate the white crossbar on the black screen. Brain functional data were analyzed with using the Matlab and Conn v.16 software.

The functional connectivity patterns of the right thalamus and other brain areas were evaluated according to the correlation coefficients between the thalamus and other brain regions at a voxel level. Then the altered functional connectivity in MDD group was identified by comparing the correlation coefficients of functional connectivity to those of the HC group using a two-sample, two-tailed t-test.

MDD patients, compared to HC subjects, showed significantly stronger functional connectivity between the right thalamus and other brain regions including the bilateral frontopolar prefrontal cortex (BA10), right orbitofrontal cortex, right inferior frontal gyrus, right insula, right supplementary motor area, right temporal pole, right superior temporal gyrus.

We conclude that MDD patients would have impaired or altered thalamus connectivities with other brain regions. These results support the hypothesis of altered or impaired network connection in MDD, which could be a neurobiological indicator of MDD.

(Supported by the Korea Basic Science Institute, T37800; Correspondence : Jin-Hun Sohn, jhsohn@cnu.ac.kr)

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A Comparison of Cognitive Load and Emotional Arousal on Liar’s Pupil Diameter Changes

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A Comparison of Cognitive Load and Emotional Arousal on Liar’s Pupil Diameter Changes

Ara Cho, B.A.</p>
The visuospatial attention network recruitment is mediated by alpha and alpha-beta phase synchronization through the Superior Longitudinal Fasciculus

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Introduction

It is well known that attentional selection of relevant information, while inhibiting distracting inputs, relies on local synchronisation of alpha band neuronal oscillations in visual cortices. Additionally, evidence for long-range coupling of neuronal oscillations between visual cortices and regions engaged in the anticipation of upcoming stimuli has been more recently provided in the alpha but also in the beta frequency ranges. Nevertheless, to date several questions in this regard still need to be addressed. On the one hand, the relation between long-range functional coupling and anatomical connections is still to be assessed, and, on the other hand, the specific role of the alpha and beta frequency bands in the different processes underlying visuo-spatial attention still needs further clarification.

Method

Magnetoencephalographic data in a cohort of 28 healthy subjects, performing a visuospatial attention task, were acquired. For the same subjects, diffusion MRI data were used to dissect the three branches of the Superior Longitudinal Fasciculus (SLF) as anatomical connection.

Using novel measures of linear (frequency-specific) phase synchronization, i.e. Multivariate Interaction Measure (MIM) and Phase Slope Index (PSI), we quantify functional connectivity between neuronal oscillations of brain activity in the alpha and beta frequency bands. Additionally, by using a novel measure of nonlinear (cross-frequency) phase-coupling, i.e., Antisymmetric Cross-Bicoherence (ACB) we assess cross-frequency interactions between alpha and beta bands to account for higher order functional mechanisms. Finally, the relationship of frequency-specific functional connectivity to individual differences in anatomical characteristics of SLF and to performance is assessed.

Results

We show that in both hemispheres alpha band phase synchronization is modulated by the orienting of attention according to a parieto-occipital top-down mechanism reflecting behavior, and its hemispheric asymmetry is predicted by volume’s asymmetry of specific tracts of the Superior Longitudinal Fasciculus (Fig.1). This occipito-parietal functional network is specific to the orienting of attention.

Our findings also show that a network comprising parietal regions and frontal regions, namely the right putative Frontal Eye Field but not the left, is recruited through an alpha-beta cross-frequency coupling (Fig.2). This network is involved in the deployment of spatial attention but not in the orienting, and the alpha-beta cross-frequency coupling through which it is recruited represents the broadcast mechanism by which the fronto-parietal circuit operates.

Conclusions

Overall, our study demonstrates that the visuospatial attention network features subsystems indexed by characteristic spectral fingerprints, playing different functional roles in the anticipation of upcoming stimuli and with diverse relation to fiber tracts.

Picture 1: https://www.eventure-online.com/parten-uploads/175/18001/add_1_443942_34d17ee8-3192-4d25-a0fa-b9d5e6777fff.png
The influence of language density on eye movements in silent reading: an Eye Tracking study in Russian vs. English
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Introduction
The neuroscientific study of the density effect in Russian and English has important implications for development of cross-linguistic models of reading. The present research conceptually replicates Liversedge et al. (2016). Russian and English are alphabetic languages with consonants and vowels, therefore their visual density can be compared. Words are longer in Russian than in English, thus the informational density of words in English is greater than in Russian. In line with previous research, we predict that this will result in increased number of shorter fixations spaced more sparsely in Russian reading as compared to English.

Methods
Twenty-seven Russian students participated in the study. To prescreen the level of Russian language proficiency, a C-test was constructed with 40 partially deleted words. The score was counted by the correct use of the lexical unit and its form (max 3 points per answer). The participants demonstrated an equally high level of Russian (M = 118.04, SD = 2.36). SMI Hi-Speed 1250 was used with sampling rate=500 Hz. After passing a 9-point calibration, participants read eight texts and answered comprehension questions. The texts were a Russian-translated version of the stimuli in Liversedge et al 2016. The stimuli were presented in Courier New font and one character subtended 46 visual angle.

Results
The sentence was taken as a unit of analysis, and four eye movement measures were computed: total sentence reading times, average number of fixations, average forward saccade size, and average saccade duration. Data more than 2.5 standard deviation from the mean for each participant and fixations shorter than 60 ms or longer than 800 ms were removed from the analysis.

As compared to the results obtained for English (Liversedge et al., 2016) in Russian we observed longer sentence reading times (Mrus=4302 ms, SDrus=1865 ms; Meng=3093 ms, SDeng=777 ms), less number of fixations (Mrus=8.6, SDrus=2.38; Meng=14.81, SDLeng=2.93), shorter saccade size rightwards in characters (Mrus=7.78, SDrus=1.79; Meng=8.53, SDLeng=1.55) with shorter fixation duration (Mrus=195 ms, SDrus=23 ms; Meng=207 ms, SDLeng=32 ms). There is a significant effect of text number, e.g. on total sentence reading times (F(6, 3701)=27.5, p<0.001).

Conclusion
The results confirm the prediction concerning fixation duration in Russian, but contradict it concerning shorter saccades and more fixation count suggesting that eye movements in silent reading are affected by specific linguistic features of Russian (besides density). Future research might focus on selecting such features and evaluating their impact on silent reading.

Effects of auditory presentations on visual memory processing: A study of Event-Related Potentials
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Introduction:
Event-related potentials (P3) time-locked to stimulus onset reflects attentional allocation to that stimuli. In our previous study, participants memorized figures presented with a sound (high-frequency sounds: HS / low-frequency sounds: LS) and subsequently recognized them in a old-new recognition memory test. Results indicated that when the P3 amplitude time-locked to figures presented with LS (LS-figures) increased in the memorizing session, their recognition rate in the recognizing session also improved. These results suggest that LS increased attentional allocation and improved memory consolidation, which corresponded to the results of previous studies (Mather & Sutherland, 2011). The current study investigated whether the recognition rate of LS-figures improved by presenting LS in the recognizing session.

Method:
Undergraduate and graduate students (N = 26, 16 women and 10 men, Mean age 20.6 ± 0.9 years) participated in this study. They memorized 30 geometric figures [25 with 1259Hz (1000Hz) and 5 with 1000Hz (1259Hz); pitch of sounds was counterbalanced between participants], and subsequently recognized them among 60 figures included new 30 figures. All figures were presented for 1000 ms with HS (25 figures) or LS (5 figures) in the memorizing session and were also presented for 2500 ms with LS in the recognizing session. All sounds were presented for 100 ms in synchronization with the figures. Electroencephalographic was recorded from 20 scalp sites, referenced to the linked earlobes.

Result:
The recognition rate of figures memorized with LS (LS-figures) improved more than figures memorized with HS (HS-figures) (LS-figures: 66.1 ± 23.8 %, HS-figures: 58.1 ± 12.6 %, <i>p</i>/i/ < .05). The P3 amplitude for LS-figures was larger than HS-
Introduction: The social conformity is one of the factors affecting behavior. It is considered as one of the possible motivation of alcohol abuse in human. The objective of the current study is to investigate the influence of conformity on the forming alcohol preference in rats as negative social factor. How does the desire to be like everybody around affect on the ethanol consumption?

Methods: We create a model of social conformity when rats drink alternative liquid in contrast with their cage mates. Experiments were carried out on the 51 Wistar male rats that lived in groups of three. We use four different social condition: 1) All together living rats had 10% ethanol (drinking ethanol together rats), 2) All rats drunk water, 3) Only one selected rat from cage had water, other rats had 10% ethanol, 4) Only one selected rat from cage had 10% ethanol, other rats had water (drinking alone rats). Two-bottle test was used in order to identify a development of ethanol preference in rats. Results: The presence in the group ethanol drinking cage mates promotes more distinct alcohol consumption. Among rats drinking ethanol which lived with water drinking cage mates the alcohol consumption tended to be lower as compared with the control. Among rats drinking water which lived with ethanol drinking cage mates the level of alcohol preference tended to be higher compared with the control.

Conclusions: The conformity affects the ethanol consumption depending on the social conditions – increasing in the ethanol environment and decreasing in the water environment.

Additional Information: This research was supported by Russian Foundation for Basic Research (RFBR-18-013-00390).
The effect of affect primes' visibility on effort-related cardiovascular response is moderated by gender
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Based on the resource conservation principle (Gibson, 1900), motivational intensity theory posits that effort increases with subjective demand as long as success is possible and justified (Brehm & Self, 1989). Recently, based on this theory, the Implicit-Affect-Primes-Effort (IAPE) model (Gendolla, 2012, 2015) posited that people use all available information about task demand in order to conserve resources. The IAPE model posits that information about performance ease and difficulty are features of our mental representations of emotional states, because people learn that performance is easier in some affective states than in others. Affect primes, like implicitly processed facial expressions of emotions that are processed during task performance, can make these ease and difficulty concepts accessible and influence subjective demand and thus effort. Several studies have supported the IAPE model. Implicitly processing sadness or fear primes during a moderate cognitive task difficulty lead participants to mobilize more effort than processing happiness or anger primes (e.g., Chatelain & Gendolla, 2015; Gendolla & Silvestrini, 2011; Silvestrini & Gendolla, 2011). By contrast, these simple affect prime effects are inverted in objectively difficult tasks (e.g., Chatelain, Silvestrini & Gendolla, 2016; Freydefont, Gendolla, & Silvestrini, 2012; Silvestrini & Gendolla, 2011). However, recent studies suggest that primes only have these effects if they are processed implicitly (e.g., Challou, Giersch, Bonnefond, Custers, & Cepa, 2015; Lasauskaite Schüppbach, Gendolla & Silvestrini, 2014). If affect primes were clearly visible, they produced zero or contrast effects on effort.

In order to better understand the effect of prime awareness on effort-related cardiovascular response, we ran a new experiment in which participants worked on a challenging arithmetic task with integrated briefly flashed pictures of happy vs. sad faces. Half of the participants were warned about the occurrence of the primes whereas the other half was not. Additionally, we controlled for the possible role of gender by recruiting equal numbers of women and men. Cardiac pre-ejection period, systolic and diastolic blood pressure, and heart rate were recorded to assess effort-related cardiovascular response. Pre-ejection period reaction was significantly stronger in the happiness-than in the sadness-prime condition—but only when participants were not warned. This expected prime x visibility effect was further moderated by gender—the effect was only significant among men. Our results suggest that, particularly for men, prime warning is a moderator of implicit affects’ effect on effort mobilization.

Men superiority on risk tolerance during a generalized trust game: An event-related potential study
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Introduction Trust between strangers is among the most important factors in human life, as it pervades almost all domains of society. The question of why and when people trust each other has important implications for social functioning and economic behavior. Previous behavioral research utilizing the Trust Game has revealed that, compared to males, females are more concerned about being exploited and thus less trusting others. However, the extant research has failed to clearly reveal the neurophysiological mechanisms of gender differences in the generalized trust.

Methods The current study experimentally investigated the time courses of gender differences in generalized trust behavior. We recorded the electroencephalographic (EEG) data of 43 healthy participants (22 males, 21 females) while they played the role of trustor in the one-shot Trust Game. We analyzed their behavioral data and event-related potential (ERP) components during the decision-making and outcome evaluation phase.

Results Behavioral results found no significant gender differences in generalized trust, but the effect of prior feedback on trusting choices did have significant gender differences. After a gain or neutral feedback, females subsequently made more trusting choices compared to males, while after a loss feedback, males subsequently made more trusting decisions than females. At the decision-making phase, males exhibited a larger N2 following distrusting decisions than trusting decisions, but females did not show this differences. At the feedback phase, females exhibited a larger differentiated-FRN responses to the gain and loss discrepancy. Moreover, males exhibited a more positive P300 following gains than losses, whereas females exhibited no P300 difference between two outcomes.

Conclusions Our study provided some new insights into the psychophysiological processes underlying gender differences in generalized trust behavior. Specifically, when making a decision to trust or distrust the counterpart, males shown a more negative N2 component following the distrusting choice compared to the trusting choice, while females did not have this differences, which may reflect greater cognitive control to inhibit trusting behavior for males. On the other hand, a more negative going dFRN responses for females than males may suggest that females respond more strongly to fear incentives and potential exploitation. Moreover, the differences P300 between gains and losses were more larger for males relative to females, indicating that males allocate more attentional resources to positive feedback.

Keywords generalized trust; gender differences; N2; dFRN; P300

Cardiac responses to emotional film clips in males with high vs low trait primary psychopathy
The present research investigated the relationship between emotional detachment as an expression of trait primary psychopathy and heart rate dynamics in response to emotional stimuli in a healthy community sample. The study was carried out on 57 male students with high (N = 27) and low scores (N = 30) on the first factor (Primary Psychopathy) of the Levenson Self-Report Psychopathy Scale. The participants viewed fifteen 2-minute-long movie clips of different emotional content (Erotic, Scenery, Neutral, Compassion and Fear) while their ECG was recorded. Each clip was then divided into five 22-second intervals and mean heart rate (HR) and heart rate variability (standard deviation of HR, SDHR) were analyzed after baseline correction. Statistical analyses were performed using linear mixed-effects models, and adopting a model selection strategy based on AIC. For each physiological measure we identified the model that best fit the data and then performed an F-test to assess the significance of each predictor. Concerning HR analysis, the Category by Group interaction (F(4,1343) = 4.44, p < .001) revealed that subjects in the High Psychopathy group did not differentiate among emotional movie clips, whereas subjects in the Low Psychopathy group manifested cardiac deceleration to Fear and Scenery clips. A main Group effect (F(1,56) =4.31, p < .001) was found regarding SDHR analysis, and showed that High Psychopathy subjects exhibited lower heart rate variability than Low Psychopathy subjects, irrespective of the film categories. Results are consistent with current theories regarding the construct of psychopathy as a complex condition in which emotional dysfunction, particularly in the form of detachment, plays a pivotal role. Furthermore, Fear clips induced a complex cardiac response, characterized by heart rate acceleration in the first interval (0-22 seconds) and a marked deceleration in the second (22-44 s), followed by a final HR increase. This pattern seems to reflect a defensive response (initial acceleration) followed by a strong orienting of attention (i.e. stimulus intake) towards biologically relevant threatening stimuli. A different, slower pattern of cardiac deceleration in the third interval (44-66 s) was found for Compassion clips, which tend to stimulate parasympathetic bradycardia possibly associated with a prosocial approach to another’s suffering. In conclusion, our findings emphasize the complex interconnection between personality traits and psychophysiological responses to emotion and also highlight the importance of using more ecological stimuli, such as movie clips, when investigating such subtle interactions.

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EEG effects of Type-1 Diabetes Mellitus on visuospatial working memory performance.
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Research on the effects of Type 1 Diabetes Mellitus (T1DM) suggests that diabetes has a negative effect on cognition. Recent evidence indicates that T1DM patients develop different neuronal activation patterns in relation to healthy controls during the performance of working memory tasks. These patterns have been explained as an expression of a neural compensatory strategy devoted to endure cognitive efficiency despite the deteriorating effects of the disease. The sample was formed by 36 right-handed, normal IQ, young individuals divided into 18 T1DM patients with no significant medical history of diabetic complications nor inadequate glycemic control, and 18 healthy controls matched by age, gender and educational level, while performing a visuospatial working memory task with simultaneous EEG recording. Stimuli consisting of neutral and happy facial expressions that were pseudo-randomly presented in different screen locations and the participants had to remember the sequential order of presentation including the corresponding spatial location. After a short delay, a second sequence was presented and subjects were instructed to determine if it corresponded, or not, to the inverse spatial order of the precedent sequence. The experiment consisted of trials with different working memory load (4 or 5 stimuli sequences: 1:1). Behavioral results showed significant differences in the accuracy rates between groups. The EEG analysis focused on epochs of performing with correct responses, and showed different activation patterns between patients and controls, highlighting an increase in the absolute power of delta and theta bands, with significant decrease of alpha in T1DM patients as compared with controls. The present results depict the behavioral and electrophysiological impact of T1DM development on visuospatial working memory performance. In this regard, quantitative EEG represents a useful tool to evaluate T1DM development in the aim to detect early signs of cognitive decline.

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Age difference in brain regions functional connectivity during reading Russian and English texts in boys and girls 12-17 y.o.
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Introduction: The adolescence is an important critical period both for physiological maturation and cognitive development, in particular, the formation of the reading skill and reading comprehension. The organization of the interaction between many spatially distributed brain structures plays the key role in the mechanisms of the cognitive activity. The aim of the study was to investigate the functional integration of different cortical areas during reading of Russian (native) and English (foreign) texts in adolescents.

Methods: Two groups of adolescents: younger of 12-13 (N=48, 20 male) and elder of 15-17 (N=37, 15 male) years old have read Russian and English texts (392 - 424 words) during EEG recording. Using the cross-correlation analysis of EEG matrix, the contribution of each cortical area in the spatial synchronization of biopotentials (SSBP) was assessed. To study the influence of factors Age (12-13 vs 15-17), Sex (male vs female), Task (rest wakefulness with the gaze fixation on the point, reading Russian/English texts) on the EEG parameters, the two-way analysis of variance (ANOVA) was used.

Results: Significant effect of the ‘Age’, ‘Sex’ and the ‘Task’ factors on the total SSBP level were revealed. The levels of SSBP for the left hemisphere of the brain significantly change during reading compared with the wakefulness with the eyes open state. Age and sex differences of SSBP in adolescents were revealed during reading Russian and English texts compared to the rest. Sex differences became more pronounced in elder group compared to younger and more pronounced in female then in male (Fig. 1). The topography of differences in SSBP levels in boys and girls groups are alike in all studied states: rest wakefulness and reading. In boys, the level of SSBP in adolescents 12-13 years old is higher than that of 15-17 years old in frontal and occipital areas bilaterally. In elder boys, the level of SSBP is higher in right frontal (F8), temporal, parietal and posterior parietal areas. In girls, the level of SSBP in younger adolescents is higher in frontal areas bilaterally and right posterior temporal region, while in elder adolescents - in central, parietal regions and zones overlapping the temporal, parietal and occipital areas bilaterally, left posteriorfrontal region. Conclusions: Sex and age differences were revealed in EEG spatial synchronization in adolescents during texts reading. Sex differences became more pronounced in elder group compared to younger and in female then in male.

Supported by RFBR Grant N 18-313-00169, FASO AAAA-A18-118012290373-7.

Picture 1: https://www.eventure-online.com/pashtun-uploads/175/18001/add_1_458067_f4a090b9-99dd-470d-b0ad-22e18aca28a6.gif

Caption 1: Age differences in the distribution of topical spatial synchronization of biopotentials in boys and girls during the rest and reading texts.

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Sympathetic involvement in the attentional modulation of the cardiac defense response
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Introduction
Previous research has shown that the long latency acceleration of the cardiac defense response (CDR), elicited by an intense acoustic stimulus, is augmented when participants perform simultaneously a visual attentional task. This effect has been interpreted, in line with a naturalistic view of defense, as suggesting that the CDR involves increased external attention in order to better detect and analyse the potential danger. However, no study has examined the autonomic (sympathetic-parasympathetic) mechanisms underlying this attentional effect. The aim of the present study was to examine the sympathetic mediation of this type of modulation.

Methods
Participants were 45 university students (30 women and 15 men) randomly split in three groups. The psychophysiological test consisted in two presentations of an acoustic stimulus capable of eliciting the CDR: white noise of 105 dB, 500 ms duration and instantaneous rise time. The inter-trial interval between both stimuli was 12.5 min. Groups 1 and 2 performed during 80 seconds an external attention task (Sternberg’s visual attention task) immediately after the noise presentation, Group 1 using neutral pictures and Group 2 using letters. Group 3 performed no task (control group). Impedance cardiology was used for continuous measurement of a direct index of sympathetic mediation: pre-ejection period (PEP). Cardiac period (CP) was also measured continuously from the electrocardiogram in order to obtain the CDR. The dependent variable was the simultaneous beat-by-beat pattern of CP and PEP.

Results
Results showed a potentiation of the long latency acceleration of CDR in both attentional groups in comparison with the control group. However, the group having neutral pictures showed higher potentiation than the group using letters. The index of sympathetic activity was reduced (inhibited) during the short latency acceleration/deceleration and then strongly activated during the long latency acceleration/deceleration. The main difference with the control group was in the duration of the sympathetic inhibition, larger for the two attentional groups. Thus, the sympathetic activity alone cannot explain the potentiation of the CDR by external attention.

Conclusions
Potentiation of the long latency acceleration of CDR by external attention is confirmed. This potentiation is larger when performing the attentional task using pictures than when using letters. The results of the pre-ejection period suggest the involvement of both branches of the autonomic nervous system in the attentional modulation of the CDR.
Alpha-tACS EFFECTS IN WORKING MEMORY PERFORMANCE DEPEND ON BOTH THE NUMBER OF RELEVANT AND NON RELEVANT ITEMS.
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Introduction: Electroencephalographic studies have demonstrated that oscillatory activity in the alpha frequency range is involved in the inhibition of the processing of not relevant items during cognitive tasks. For instance, when distracters are presented in one hemifield, an alpha enhancement can be found in the controlateral hemisphere, while presenting relevant items in one hemifield, leads to a controlateral alpha suppression, probably indexing the active processing of the stimuli. In a first set of experiments, we investigated the modulation of alpha activity during a working memory task including both relevant and irrelevant items, presented at different sample sizes, respectively in the left and right visual hemifields. In a second set of experiments, we investigated the effects of intrahemispheric alpha modulation by means of transcranial alternating current stimulation (tACS) in memory performance and in distracters inhibition. Finally, in a third set of experiments, we investigated the specificity of the effects for alpha frequency compared with a different non-harmonic frequency band.

Methods: 40 right handed healthy subjects participated to this randomized, placebo and frequency controlled, cross-over design study. 10 subjects performed the first experiment undergoing to a single EEG session while performing the task. 15 subjects took part to the second experiment including three sessions with online-tACS at alpha frequency and sham stimulation applied respectively in the left and in the right parietal cortex. Finally a group of 15 subjects constituted the control group, undergoing to three different sessions receiving 23 Hz and sham stimulation respectively in the left and right parietal cortex. In all the experimental conditions volunteers performed the working memory task with four or six relevant items in one visual hemifield and four or six distracters in the other one.

Results: In the first experiment, the time frequency analysis have shown a modulation of alpha oscillations depending on the number of both relevant items and distracters. Additionally, modulation of the activity in the alpha frequency band, conducted using tACS, improves working memory performance depending on both the number of relevant items and distracters. The effect is specific for 10 Hz stimulation, indeed no significant effects were found for tACS applied at 23 Hz.

Conclusions: Alpha frequency plays a role in working memory and changes in the alpha power can be found during task execution. To modulate alpha power with tACS enhances working memory performances when the highest number of distracters and the highest number of relevant items are presented together.

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Prisms and Posture: Baropodometric and Stabilometric changes after Arismatic Adaptation
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Prisms and Posture: Baropodometric and Stabilometric changes after Arismatic Adaptation
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Introduction
Prismatic Adaptation (PA) is a visuomotor procedure that by inducing lateral shifts of the visual fields modulates spatial attention and motor cortical excitability. Specifically, an increase of motor cortical activation is observed in the hemisphere ipsilateral to prisms deviation, i.e. contralateral to the aftereffect deviation of spatial attention observed after prisms removal. Yoked prisms have been also used to modulate posture, although evidence to support this practice is not consistent. The aim of the present study was to investigate any changes in postural measures after PA.

Methods
A sample of 42 healthy subjects (male: n=19; mean age: 25±3 years) took part in the study and were assigned in two groups according to their practice with sports: sedentary (SD, ≥3 consecutive years without sport activity) and sporty (SP, ≥3 consecutive years of sport activity).

Each subject underwent to two baropodometric and stabilometric evaluations conducted on a force platform, performed before and after PA.

Results
Left-oriented PA induced a significant decrease of the right plantar surface in both subjects’ groups (\(\langle i \rangle p < \langle i \rangle = .05\)). On the other hand, right-oriented PA induced a significant increase of the left plantar surface (\(\langle i \rangle p < \langle i \rangle = .04\)).

We have also found significant increase on the pressure load of the left feet in SD with left-oriented PA (\(\langle i \rangle p < \langle i \rangle = .03\)), meanwhile an increase on the right forefoot in SP with right-oriented PA (\(\langle i \rangle p < \langle i \rangle = .04\)).

Conclusions
Our results suggest that PA can indeed be a useful tool to modulate postural parameters, as tested with baropodometric measures and body oscillations. The effects induced seem to be directional specific, i.e. they impact on the body side contralateral to the prismatic deviation.
Study of the exposure repetition over word recognition in children with different reading level
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Introduction: The orthographic transparency depends on grapheme-phoneme correspondence thus influencing the learning process of reading. During early stages of reading learning, Spanish-speaking children use decoding as the preferred strategy. As they gain experience from text exposure, a lexical route is facilitated, and it allows them a faster and more fluid reading through the automatic recognition of words previously stored in an orthographic lexicon. However, not all children seem to benefit from text exposure, so it has been reported that children with dyslexia continue using sublexical decoding for longer than their peers, which results in slower reading. In this research, we explored the effect of the word repetition over reading recognition in children with different reading abilities to examine potential differences in their capacity to benefit from word exposure. Methods: Fifty-eight elementary school children attending the third grade participated. They were divided into three groups according to their reading speed performance (High: 20, Average: 18, and Low: 20 participants, respectively). Children were exposed to a text-reading task, which simulates the impact of repeated exposure on the natural development of reading. They were asked to read aloud three different texts, in which frequent and infrequent target-words were repeatedly inserted (four times) with simultaneous recording of eye-movements. Later on, they write down the target words by dictation. Results: We found that the three groups benefited from the repeated exposure and word frequency of the selected words, showing a significant decrease in gaze-duration during the fourth presentation of a word, suggesting more automatic recognition. Although the group with low reading skills showed a reduction in gaze-duration in the fourth presentation of a word, they also showed a significantly higher number of homophonic errors while writing those words. Conclusion: The results suggest that children with lower reading performances do benefit immediately from word exposure, but they probably have problems to store stable and accurate grapheme-phonemes representations in memory.

Psychophysiological mechanisms features of events sequences predicting in schizophrenia depending on neuroleptics different types
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The ability of brain to forecast a future events is one of the important cognitive ability. According by Karl Friston (Friston K., 2003) it plays the basic role in learning and adaptation to environmental changes. The ability to adapt is known to be reduced in patients with schizophrenia. The reason for this may be the inability of schizophrenic patients to learn effectively and, thus, the inability to forecast environmental changes. In studies of the brain’s predictive ability by registration the MMN and P300 response to the standard and deviant (unexpected) stimuli differences were found in responses by schizophrenic and healthy subjects (Umbricht et al.2003). In schizophrenia, these studies demonstrated deficits in MMN and P300 generation, but some studies failed to confirm it (Michie 2001).
We investigated the neurophysiological mechanisms of cognitive functions associated with parameters of various cognitive styles. As subjects, we invited schizophrenic patients with paranoid seizures and healthy people with different cognitive styles. Schizophrenic patients were also divided into groups, depending on what neuroleptics they were taking. We used psychological methods to measure cognitive styles and method of assessing negative symptoms at schizophrenia (SANS). To assess the functioning of neurophysiological mechanisms of cognitive functions, the evoked potentials for various standard and deviant stimuli arrange in sequences were used. In the instruction we asked to count the number of stimuli that regularly change according to a certain rule (for example increase in the sound frequency). We considered differences in brain responses to deviant and standard stimuli in terms of the parameter given in the instructions, as well as differences between the responses to deviant and standard stimuli according to a parameter not specified in the instruction. For schizophrenic patients, changes in the work of neurophysiological mechanisms of cognitive functions, reflected in the EP and in the visualization of the work of the hippocampal structures were found. This effect can be associated with mechanisms of translation from short-term to long-term memory, through changes of synapses potency of neurons during training to predict changes in sequences. These mechanisms depend on cognitive styles and reception different types of neuroleptics
Nonlinear dynamics of heart rate variability during mental stress: Recurrence plot analysis approach

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Introduction. Several nonlinear indexes of heart rate variability (HRV) have been developed for investigation of RR fluctuations in healthy subjects and in different pathologies. Recurrence (the repeated occurrence of a given state of the system) is a basic feature of many physiological systems. The purpose of this study is to investigate the effect of mental stress on recurrence-plot-based complexity measures of heart rate variability (HRV).

Methods. Young healthy subjects (162), aged 18–23 years, underwent mental arithmetic stress (mental arithmetic test [MAT]). We obtained two ECG recordings for each of the healthy participants: during the rest and performing MAT. The RR interval was extracted and the ectopic beats were removed. Nonlinear HRV analysis was performed with the program Kubios HRV Premium. The following measures were derived from the recurrence plot: recurrence rate (REC), the lengths of the diagonal lines (Lmean, Lmax), the determinism of the time series (DET), and Shannon information entropy of the line length distribution (ShanEn). The Wilcoxon match pair test was used to analyze the effect of MAT.

Results. Recurrence quantification analysis of RR revealed a significant increase in the values of the longest diagonal line (Lmax) during the MAT in contrast to rest (MAT 187.00 ± 11.99 beats, rest 123.51 ± 7.67 beats, P < 0.001). The significantly higher proportion of points forming diagonal lines (DET) were found during MAT (MAT 97.36 ± 0.1%, rest 96.94 ± 0.1 %, P < 0.001). No significant change was found in the average length of diagonal lines (Lmean): MAT 9.42 ± 0.15 beats, rest 9.34 ± 0.18 beats (P > 0.05). MAT induces a significant increase of the ratio of ones and zeros in the RP matrix (REC) (MAT 28.06 ± 0.5%, rest 26.41 ± 0.59, P < 0.01). ShanEn has changed insignificantly during MAT (rest 2.99 ± 0.02, MAT 3.02 ± 0.02, P > 0.05).

Conclusions. The complexity of the RR signal, estimated by recurrence quantification analysis of HRV, is sensitive to mental arithmetic test and might, therefore, be suited to assess nonlinear changes in autonomic neural outflow to the cardiovascular system during mental stress.


FRONTAL THETA RESPONSE IN PARKINSON’S DISEASE DURING AUDITORY AND VISUAL COGNITIVE PARADIGMS

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Introduction: Cognitive Impairment in Parkinson’s disease could occur by the progression of the disease. Event-related theta responses in the frontal region is strongly connected with cognitive processes. Increase of theta response during increased cognitive load is a robust finding. The decrease theta phase-locking and theta power was found in the patient groups which had cognitive decline. The aim of the present study is to investigate the event-related theta responses in Parkinson Patients with and without cognitive deficits during auditory and visual cognitive paradigms.

Methods: Three different group of Parkinson’s disease patients were included in the study. 15 PD patients without cognitive deficits, 23 PD patients with mild cognitive impairment (MCI), 11 PD patients with dementia, and 18 aged-matched healthy controls (HC) were included in the study. The mean of Mini Mental State Examination (MMSE) scores was 28.00±1.25 for the HC group, 26.80±1.90 for the PD group, 22.56±5.32 for the PD-MCI group, and 18.82±3.74 for the PD-Dementia group.

EEG was recorded at 8 different frontal locations (F3-F4, F7-F8, FC3-FC4, and FT7-FT8). Auditory and visual oddball paradigms were applied during EEG recordings. Phase-locking analysis (Inter-trial coherence) and event related power spectrum were analyzed for theta (4-7 Hz) frequency band for all subject groups for both “target” and non-target” stimulations.

Results: In accordance with the previous studies target stimulation elicited higher theta phase-locking and theta power than the non-target stimulation (p<0.05 for both comparisons). Group difference were significant, HC group had higher theta phase-locking and theta power than the PD-MCI group and PD-Dementia group. Furthermore, PD group had higher theta phase locking and theta power than the PD-Dementia group. There were no difference, between HC group and PD group and between PD-MCI group and PD-Dementia group.

Discussion: The present study once more showed the essential role of frontal theta response during cognitive processes. Frontal theta responses were increased during “target” stimulation both in auditory and visual oddball paradigms. PD patients with cognitive deficits (both PD-MCI and PD-Dementia) had reduced frontal theta response in comparison to healthy controls. Furthermore, PD patients with dementia had reduced frontal theta response in comparison to PD patients without cognitive deficits.
Lambda response reflects the color and luminance information processing
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Introduction Following saccades, positive brain potentials, called the lambda response, appear at the occipital site. The lambda response is assumed to correspond to visual potential after eye-movement fixation and is composed of single (P1) or bimodal (P1, P2) peaks. We previously suggested that P1 and P2 reflect the visual perception of the central mainly constituted cone cells (color process), and peripheral mainly constituted rod cells (luminance process) visual fields, respectively. In this study, we investigated the mechanism of occurrence of P1 and P2 by manipulating the color and luminance of the visual stimuli.

Methods Twenty university students (10 female, aged 21.6 ± 0.8 years) with normal vision and color perception participated in this study. They participated in color and then monochrome conditions. They moved their eyes horizontally between two visual fixations (one degree in size, 19 degrees apart) in the darkroom. In the color condition, the fixations and background were colored in yellowish green (162 cd/m²) and light blue (152 cd/m²). In the monochrome condition, the fixation and background were colored in black (0.57 cd/m²) and gray (1.30 cd/m²). After the color condition, we inserted 35 minutes of dark adaptation, then confirmed the presence of a central scotoma in participants in the monochrome condition, which suggests the quiescence of cone cells. The electroencephalogram (EEG) was recorded at 39 scalp sites, referenced to an average of C3-C4. To obtain lambda response, EEG signal (occipital site) re-referenced to linked earlobes were averaged by time-locking to the offset of saccades.

Results The results indicated that in the color condition (N = 3860, grand average across the subjects), the P1 amplitude was significantly larger than that of P2 (<i>p</i> < .01). By contrast, in the monochrome condition (N = 3696), the P2 amplitude was significantly larger than that of P1 (<i>p</i> < .001). The independent component analysis revealed maximum activities 100 ms later of saccade offset (corresponded with P1) in the color condition, and 194 ms later (corresponded with P2) in the monochrome condition.

Discussion These results suggest that the cone cells, which constitute the retinal cells, were activated more by the color and high luminance stimuli than by the monochrome and low luminance stimuli, and therefore the P1 amplitude increased in the color condition. Meanwhile, the rod cells were activated more by low luminance stimuli, and therefore the P2 amplitude increased in the monochrome condition.

Openness to Experience and cardiovascular stress responsivity: A novel examination of hemodynamic trajectories during acute stress exposure
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Openness to Experience and cardiovascular stress responsivity: A novel examination of hemodynamic trajectories during acute stress exposure
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Introduction. The personality trait of Openness to Experience has often been linked to cardiovascular well-being. However, underlying mechanisms that may account for an association remain unclear. One reason for this is the use of relatively low-powered research designs in studies that examine psychological predictors of cardiovascular stress responding. Research examining cardiovascular stress responsivity has typically examined stress responses by reducing them to simple measurements representing mean differences between phase-averaged baseline and stress-exposure periods. Such designs reflect a legacy of earlier technologies, where individual cardiovascular measurements could be harvested only every few minutes. Newer technologies facilitate continuous (i.e., beat-to-beat) measures, and so enable detailed scrutiny of the within-phase progress of stress responding contemporaneous to stress exposure. Method. The present study sought to examine whether Openness to Experience is associated to cardiovascular response profiles as assessed during acute psychological stress. In a laboratory setting, blood pressure, heart rate, and hemodynamic response data were collected continuously from 62 young female adults before and during exposure to acute stress (comprising cognitive performance challenge). Cardiovascular data were scrutinized in terms of bespoke phase averages, with phase durations determined based on the identification of statistically significant changes in cardiovascular function over consecutive 10-second epochs. Results. Analyses revealed significant linear interactions between time and Openness throughout stress exposure, for both systolic blood pressure and cardiac output. Further, a significant between-subjects effect for hemodynamic responding also emerged. Participants higher in Openness exhibited increasingly myocardial hemodynamic response profiles throughout
stress exposure, with participants lower in Openness displaying an attenuated myocardial trajectory. Comparisons of response curves suggested that Openness is positively associated with adaptive stress-response trajectories, with participants higher in Openness exhibiting cardiovascular activation and those lower in Openness exhibiting blunted cardiovascular stress-responding. **Conclusions.** This study is among the first to examine psychological predictors of cardiovascular stress responding using a high-granularity approach in order to profile responses during stress exposure. The data provide evidence that an attenuation of myocardial responsivity during stress exposure may underpin blunted blood pressure responding, in a way that further implicates Openness to Experience in processes underlying psychosomatic aspects of disease onset and/or progression.

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**Effects of Observer's Mental State on Mirror Neuron System Activity**

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The mirror neuron system (MNS) is a human brain function that is activated not only while executing motor action but also while observing the action of other people. It is known to be the neural basis of imitation and action understanding. EEG mu rhythm has been considered to reflect MNS activity. Past studies showed that mu suppression was deferred by another person's intention or the observer's intention to imitate. Those studies suggested that MNS activity is modulated by the observer's mental state. However, it is still not known that what kind of mental state has a strong effect on MNS activity. In this study, we aimed to determine which mental state enhances mirror system activity. Twenty-two university students participated in the experiment. They were asked to watch videos of hand movements with three instructions: understand the actor's intention (AU), imagining imitate the movement (IM), and simply watch the movement (CT). A 64ch electroencephalogram was recorded during the video presentation. Electromyography of the forearms was also performed for EEG artifact rejection. Each movement was started with 4-sec static picture of the hand and objects, and it was followed by 2-sec of movement and 2-sec of a static final frame. Videos consisted of repetition of the 8-sec sequence. An EEG 8-13Hz suppression index was calculated as the ratio of the power of the movement relative to the power of the 2 sec prior to the movement. Suppression was calculated at central sites which alpha rhythm is observed at.

Three conditions were analyzed with repeated measures ANOVA. There was a marginally significant main effect on conditions [ F(2, 18) = 2.95, <p(_adj.) = 0.065] at central site. Post-hoc contrasts revealed that the AU condition showed marginally stronger suppression than did the IM condition [F(2, 18) = 2.30, <p(_adj.) < 0.1]. On the other hand, no significant difference between the conditions was found at occipital site. This confirms that the mu suppression was little affected by the occipital alpha changes. The results suggested that MNS activity is modified by the observer's mental state.

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**The effort of meditation: Cardiac pre-ejection period during first session of focused-attention and open-monitoring meditation**


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Focused-attention (FA) and open-monitoring (OM) meditation techniques differ with respect to top-down control of attention. In FA states, where attention is focused on target stimuli, increased top-down control narrows attention aperture. In contrast, OM states associated with monitoring awareness weaken top-down control to broaden attention. Despite support for this perspective, cognitive effort involved in FA and OM is not well understood and previous work has only assessed self-reported meditation effort. In the present experiment, cognitive effort was indexed with cardiac pre-ejection period (PEP), a measure of beta-adrenergic sympathetic activation. Based on evidence that one session of FA or OM establishes distinct top-down control states and to distinguish instantaneous influences from training effects, we measured PEP in 46 naïve meditators’ first meditation session. At baseline, no significant differences in resting heart rate (HR) and PEP were observed. Linear mixed-modelling revealed distinct PEP and HR dynamics across the 17 minutes of FA and OM. Meditation techniques elicited similar PEP durations in the initial minute involving preparatory instructions. Then, in the subsequent minutes, where instructions become distinct to the meditation technique, PEP duration shortened under FAM but lengthened under OM. Towards the midpoint of both FA and OM, PEP returned to commencing levels. In the latter half of both meditation sessions, PEP increased from commencing levels but FA exhibited a larger rate of increase than OM. HR during OM was lower than FA and HR remained relatively stable under OM. In contrast, increasing HR was observed across the first 10 minutes of FA followed by a gradual decrease. Self-reported meditation effort was significantly higher following FA than OM but meditation likeability and success scores were not significantly different between meditation types. FA and OM states differ with respect to cardiac activity and self-report measures of cognitive effort. The present results suggest that increased top-down control under FA relies on increased effort whereas effort is decreased under OM to weaken top-down control. However, meditation novices may be limited in the extent that they can maintain increased effort...
The relationship between nonverbal intelligence and spatial working memory in the adolescence
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The spatial cognition has been repeatedly discussed as an important part of the general cognitive ability. The similar neural basis of the spatial working memory and intelligence that include the frontoparietal regions, as well as the hippocampus, is a confirmation of close links between spatial working memory and intelligence. In the present study we investigated whether there are any differences in the association between spatial working memory and nonverbal intelligence at different age during adolescents development. We administered Spatial Recognition Memory subtest of the Cambridge Neuropsychological Test Automated Battery (CANTAB) and Raven’s Progressive Matrices. The study involved 236 adolescents aged 10 to 17 (mean age = 13.06, SD= 2.042, 130 girls) from Russia. The Raven’s total score and the SRM number and the latency of the correct answers were used for the analysis. The sample was split into 3 age groups: 10–11, 12-14 and 15-17 age. We used Pearson’s correlation coefficient to measure the relationship between the variables. We found that there were no significant correlations between SRM measures and nonverbal intelligence for 10–11 and 12-14 age groups. The significant correlation was found only for the 15-17 age group. The SRM number of correct answers was correlated with Raven’s total score (r=.357;p<.002). The SRM latency of the answers wasn’t associated with nonverbal intelligence. The results are discussed in the context of the development of specific and general cognitive ability.

Evoked physiological tremor dynamics on deception related stimuli in concealed information test
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The main idea of this investigation is the robust deception-related emotional dynamics assessment based on evoked finger tremor analysis. The general task of investigation is automatic acquisition and processing of deception-related physiological tremor dynamics. The point of special interest is transient tremor amplitude differences in 8-12 and 17-23 Hz frequency subbands under irrelevant and deception related stimuli presentation.

Physiological tremor acquisition was implemented by bilaterally attached 3-axial digital accelerometers, fixed on external side of index fingers. Subjects were preliminary asked to keep their hands unsupported and horizontally aligned. Accessory biofeedback signal based on accelerometer tilt sensing capability was exploited to equalize initial conditions. Experimental model was realized as conventional simulation of well-known concealed information test (CIT). Experimental protocol includes randomized visual presentation of eight numbers (from 0 to 7), one from which subject has secretly marked on material carrier before the testing. Individual 3-axial realizations of physiological tremor dynamics were reduced to one dimension by Euclidean normalization and then band-pass filtered by recursive procedure based on singular spectrum analysis (SSA). Obtained evoked amplitude dynamics was enveloped using discrete Hilbert transform and arranged in accordance with affected stimuli. Individual realizations from similar classes were averaged into evoked tremor amplitude responses. Mean values were assessed using median estimation. Figure 1 shows patterns of evoked tremor amplitude dynamics in 17-23 Hz band obtained from the leading hand under various types of stimuli aggregation.

Figure 1. Averaged, normalized and centered evoked tremor amplitude dynamics in 17 – 23 Hz band obtained from leading hand. Y – axis: amplitude in arbitrary units; X – axis: time in milliseconds.

Typical evoked response consists of two subsequent phases with opposed polarity in short-term interval 250-700 ms after stimuli application. Extremal amplitudes are strongly affected by stimuli relevance. Evoked tremor amplitude dynamics in 8-12 Hz band displayed the same tendencies and exactly the same extremal amplitude ranks. Bootstrap based statistical analysis confirmed significant character of physiological tremor amplitude differences evoked by deception related visual stimuli perception comparing to irrelevant ones. Maximal extremal amplitudes of evoked transient tremor responses on deception related stimuli significantly exceeded analogous responses on all irrelevant signals in both explored frequency bands.

Special attention to transient evoked tremor dynamics was inspired by the interest to noninvasive deception detection techniques eminently suitable for use in forensic and law-enforcement practice and pre-employment polygraph screening.

Picture 1: https://www.eventure-online.com/parten-uploads/175/18001/add_1_439296_799488f7-bf38-436b-b39d-bdef3a40784.1.png

Functional predictors of psychological well-being
In prevalent approaches psychological well-being is understood as a derivative of emotion, purpose in life and achievement of meaningful goals, self-esteem of subjective quality of life. The variety of well-being's perceptions confirms its heterogeneity. Based on well-being affecting to workability and efficiency, questions concerning its mechanisms and contributing factors remain open. Available data on environmental predictors of well-being are highly controversial showing as a close co-relation (negative or positive) as a lack of co-relation between well-being and measurable indicators of worklife quality. Vertically organized model of well-being integrating such equivalent components and hierarchized vector from values to possibility of their achievement is becoming an increasingly important matter. Available evidence tends to possibility of achievement has a direct relationship to functional status, health state, as attested to by the studies incorporating psychosomatic component in a well-being.

**Methods:** The Ryff Scales of Psychological Well-Being; BMSII-B by Plath, Richter; Schwartz Value Survey; professional efficiency expert estimation; Maslach Burnout Inventory; Derogatis Questionnaire SCL-90-R; health assessment (medical commission examination). Participants: 285 rescuers, 415 train drivers, 115 pilots.

**Results:** Surveyed participants have no differences from civilian personnel by level of well-being as no direct relationship of professional efficiency both to health or functional status (job stress, fatigue, burnout).

**Conclusions:** The issue of review of well-being could be raised to consider at least the direct affect of functional status to well-being, if not its incorporation to well-being construct. Many phenomena viewed as purely psychologically are in fact having a psychophysiological basis and could be measured also with physiological indicators.

**Remote Detection of Human Emotional States by Facial Areas**

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Background. The noncontact diagnostics of an emotional arousal (EA) of a person is an important task of practical psychophysiology. We present the data concerning the distant identification of human EA by registration the dynamics of face (‘face regions of interest’, FRI). Methods. 17 volunteers, aged from 19 up to 55 years, participated in the experiments. The experimental setup included two IRCs: FLIR SC7700 with a frame rate up to 115 Hz and a spatial resolution of 640x512 pixels working in a spectral band 3.7-4.8 µ and COX CX640 DRIED with a frame rate up to 50 Hz and a spatial resolution of 640x480 pixels working in a spectral band 8-14 µ. The analysis of thermal images was carried out using the Python programming language and Open CV, Dlib and Open Face libraries, which allow, using the Viola-Johns method, to localize FRIs of a person (eyes, lips, a nose, etc.). The orientation of all FRIs, position of the head and the IRC, the compensation of head movement relative to the IRC, the selection of a specific point on an IR-image under different values of temperature were carried out using method CLNF. For the control of EA, the classical skin-galvanic response was registered by a contact method. EAs were provoked by physical (threat of electric shock) or mental (solving of a hard task) stressors.

**Results and Discussion.** 1) The FRIs around nostrils (mouth) and nose tip turned out to be the most effective areas for EA detection. 2) The FRIs' temperature varied within each respiratory cycle: the inhalation of cold air from the environment is followed by the exhalation of warm air from the lungs. 3) Time-series of temperature variations within the selected FRI, processed using the Fast Fourier Transform algorithm, allowed to quantify the breathing rate at rest and in a state of EA. 4) The high-frequency IR recordings can be used for remote controlling of breathing dynamics and obtaining the exhaled airflow velocity fields. 5) The results of remote IR diagnostics correlated well with the data of SGR registration.

**Frequency-selective generators of oscillatory brain activity (EEG) are predicting the earlier stage of Parkinson's disease**

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We focused our attention on the mechanism of semantic categorization and the anticipation as a special type of the memory. The experiment included the identification of semantic categories during the visual presentation of words belonging to two group stimulus: ‘animals’ and ‘objects’. Our method of “Microstructural analysis of oscillatory brain activity” (Danilova, 2002) based on the pacemaker hypothesis of the rhythmogenesis was used to study the cognitive disturbances in patients with Parkinson’s disease. The method calculated mobile current dipoles for narrow-band frequency-selective generators extracted from the in the range of 1-80 Hz with a pitch of 2.5 msec and determined their localization in the brain structures by the coordinates of the “Stereotactic Atlas of the human brain” (Talairach, Tournoux, 1988). The mechanism of the categorizations, which is normally groups quite easily formed for the “animals” category, has been destroyed in the patients with Parkinson’s disease. This is confirmed by the increase in the number of errors and the lengthening of the latent period of motor reactions during the identification of the category “animals” in relation to the category “objects”. We compared each group of patients (Yakhno N. N. and Levin O. S.) with norm group. The greatest convergence of the latent period of motor reactions during the identification of two categories of stimuli (“animals” and “objects”) were identified in the group of the patients - Levin O. S. (36,8061). A lesser similarity of lateral periods was found in the patients of the group - Yakhno N. N (48,1786). The greatest difference between lateral periods was revealed in the group of age norm (85,6879). In the patients the anticipation is preserved and it occurs before the category - “animal”. Thus, in patients with BP, two new markers were identified: categorization mechanism and linking the anticipation reaction to another category of stimuli that distinguish them from the norm. This conclusion is confirmed by an increase in the depression of the alpha rhythm, which, like the theta rhythm, appears in patients before the category “animals”, and not before the category “objects”. Thus, in patients with BP, two new markers were identified: the categorization mechanism and linking the anticipation reaction to another category of stimuli that distinguish them from the norm. 

The current study investigated the influence of full and divided attention and the relative contribution of valence and arousal on the early frontal (300 - 500 ms) and late parietal (500 - 800 ms) ERP old/new effect underlying recent and remote recognition memory of neutral and emotional images. Participants either passively viewed the affective images or they performed a concurrent affective task-irrelevant task during image presentation. Incidental recognition memory was assessed either 15 minutes (recent memory group) or one week (remote memory group) after the encoding task. The early frontal ERP old/new effect did not differ between the full and divided attention condition, it was unaffected by the valence and arousal value of the images and time delay (recent memory vs. remote memory). Memory performance and the late parietal old/new effect were reduced in the remote memory group relative to the recent memory group, but the emotional influence on memory performance and parietal old/new effects did not differ between groups. Divided attention at encoding did not further modulate the influence of affective content on recognition memory performance, but electrophysiological results suggest that this is due to different underlying mechanisms. The parietal old/new differences associated with full attention were modulated by the valence value, while the valence and arousal value of affective stimuli influenced the late parietal ERP old/new effects associated with limited attention at encoding. Electrophysiological results suggest that visual attentional processes play a role in the recollection based recognition of positive/high-arousal images, but not of negative images.

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Neurophysiological Correlates Underlying the Influence of Divided Attention on the Emotional Memory Enhancement Effect

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Neurophysiological Correlates Underlying the Influence of Divided Attention on the Emotional Memory Enhancement Effect
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The current study investigated the influence of full and divided attention and the relative contribution of valence and arousal on the early frontal (300 - 500 ms) and late parietal (500 - 800 ms) ERP old/new effect underlying recent and remote recognition memory of neutral and emotional images. Participants either passively viewed the affective images or they performed a concurrent affective task-irrelevant task during image presentation. Incidental recognition memory was assessed either 15 minutes (recent memory group) or one week (remote memory group) after the encoding task. The early frontal ERP old/new effect did not differ between the full and divided attention condition, it was unaffected by the valence and arousal value of the images and time delay (recent memory vs. remote memory). Memory performance and the late parietal old/new effect were reduced in the remote memory group relative to the recent memory group, but the emotional influence on memory performance and parietal old/new effects did not differ between groups. Divided attention at encoding did not further modulate the influence of affective content on recognition memory performance, but electrophysiological results suggest that this is due to different underlying mechanisms. The parietal old/new differences associated with full attention were modulated by the valence value, while the valence and arousal value of affective stimuli influenced the late parietal ERP old/new effects associated with limited attention at encoding. Electrophysiological results suggest that visual attentional processes play a role in the recollection based recognition of positive/high-arousal images, but not of negative images.
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and females.

well known that morphofunctional basis of behavior algorithms and psychological characteristics significantly differ in males

Introduction. While studying the constitutional integrity of the organism, associations between somatic (anthropometric),

physiological (EEG) and psychological characteristics (three different systems) in males and females were investigated. It is

well known that morphofunctional basis of behavior algorithms and psychological characteristics significantly differ in males

and females.

Methods. The subject of the study was the professionally and age homogeneous sample of 192 Moscow students
(psychologists) (18-20 years old). The research was held in 2016-2018 and included 20 anthropometric, 10 psychometric and 100 EEG parameters. Psychosomatic, physiological/somatic and psychophysiological pair correlations were calculated. Heath-Carter somatotype components were used as somatic indices.

Results. The percentage of significant psychological/physiological correlations, summarized through all EEG bands, was 6.5% for males and 9.7% for females. Females had more associations in theta- and alpha-bands, males in beta band. Females had more significant correlations of EEG parameters with “self-independence” and “modeling” (self-regulation parameters, obtained from the questionnaire) predominantly in alpha-band. Males had more significant associations of EEG parameters with the self-regulation parameter “self-independence” and the autonomic imbalance level, most of them in alpha-band as well. At the same time the frequency of significant correlations of somatotype components with EEG parameters was 2.6% for females and 11.3% for males. The frequency of psychosomatic correlations had the comparable level for females (6.7%) and not found for males.

Conclusion. The level and frequency of significant correlations of somatic, EEG and psychological parameters demonstrated the tendency for all three systems’ characteristics covarying, though do not allow us to make a reliable prognosis of individual psychological traits based on physiological and somatic parameters. More significant correlations were found for EEG alpha-band parameters, indices of skeletal soma component for males and mesomorphy for females, self-independence and partly autonomic lability level for both sexes, “modeling” (social conformity) for females only and personal anxiety for males only. These results allow us to suggest, that for males the most reliable markers of the mentioned psychological traits at rest are electric brain activity (EEG alpha-band parameters), while somatic status (skeletal somatic parameters) is more informative for females.

Partly supported by RFBR grant 16-06-00248a.

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PSYCHOPHYSIOLOGICAL PECULIARITIES OF CHILDREN WITH HEREDITARY AND NONHEREDITARY DEPRIVATION BY HEARING

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Among the abnormal children, a significant proportion are children deprived by hearing. Speech regulates behavior and all activities of the child, so deep hearing and speech impairments contribute to the social isolation of children. The purpose of the study was to study the peculiarities of the psychophysiological status in children with hereditary and non-hereditary hearing deprivation.

140 children aged 9-16 years were researched, including 84 schoolchildren of the special general education boarding school and 56 schoolchildren of the general education school. According to medical indications, two groups were formed: 1 - children with non-hereditary hearing loss; 2 - children with hereditary hearing loss. The functional state of the CNS was carried out using a computer chronoreflexometry. Psychological features were investigated using psychological testing: Phillips’ anxiety level and “Pick the right person”, the aggressiveness level using the Wagner “Hand test”.

According to the data received, the level of anxiety is higher in children with non-hereditary hearing defect than with hereditary. Significant differences are revealed in boys at the scales: fear of inconsistency with the expectations of others, problems and fears in relations with teachers. In boys with non-hereditary hearing damage, the level of demonstrativeness and frustration of the need for achievement is significantly higher than in boys with hereditary hearing damage (p<0.05).

Boys with non-hereditary deprivation of hearing are more introverted than with hereditary deprivation, which is manifested by the predominance of introceptive response, while boys with hereditary hearing damage are characterized by extrapunitive reactions.

Girls with hereditary hearing damage significantly more often display reactions associated with “fixation on an obstacle” than girls with non-hereditary hearing damage (p<0.01). At the behavioral level, this is manifested by a more pronounced to conflict, aggressiveness directed to the outside. Girls with hereditary hearing damage are 1.4 times more demonstratively than boys.

Complex visual motor reaction (VMR) with more stability are performed by girls with hereditary hearing impairments and boys with non-hereditary hearing impairments, and simple VMR with more stability are performed by girls with non-hereditary hearing impairments and boys with hereditary defect. The behavior of boys with hereditary hearing impairments is more outward oriented, they are more inclined to expel their emotions on others and provoke aggression. With non-hereditary defects, boys are more prone to withdrawn, inclined to self-blame and auto-aggression, often causing depressive conditions. This dictates the need to take into account the etiological factor and gender approach to their education and psycho-correction.

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Different associations between COMT Val158Met polymorphism and P300 amplitude in healthy subjects and schizophrenic patients

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Event-related potentials are very sensitive and stable quantitative measures, and therefore are interesting for genotype–
phenotype association studies. Reduced amplitude of the auditory oddball P300 response is one of persistent disturbances in schizophrenia, and has been widely employed in schizophrenia research as a potential endophenotype. However, genetic factors involved in this deficit remain poorly understood. P300 studies suggested involvement of prefrontal cortex (PFC). The catechol-O-methyl transferase (COMT) enzyme catabolizes dopamine and plays a major role in the regulation of dopamine levels in the PFC. Val158Met polymorphism influences the COMT enzyme activity so that Met/Met variant shows 40% less activity than Val/Val one and, thus, is associated with higher dopamine levels. There are few studies of Val158Met polymorphism influence on the P300, and obtained results are controversial. The goal of the current research was to study a role of Val158Met polymorphism in modulating of P300 amplitude in male samples - healthy subjects and schizophrenic patients.

The data of 27 healthy subjects and 36 schizophrenics were included in the analysis. The auditory evoked potential P300 was obtained in two-stimulus oddball paradigm. EEG was recorded with 19 electrodes. P300 was determined at 9 electrode positions (frontal, central and parietal regions). Extraction of DNA from saliva samples was performed. The Val158Met polymorphism was directly genotyped using real-time polymerase chain reaction. Patients had substantially decreased P300 amplitudes compared to controls (p<0.01). The interaction “Genotype x Diagnosis x Hemisphere” was significant (p<0.05) when the samples of Val and Met homozygotes were compared. In the control group significant effect of interaction “Genotype x Hemisphere” (p<0.05) was disclosed when only central (C3, C4) and parietal (P3, P4) electrodes were included in the analysis. This result was related to opposite direction of asymmetry of P300 amplitude in the samples of homozygotes, and might be explained by the asymmetrical distribution of dopamine in the brain. Marginally significant effect of “Genotype” was observed in patients group (p=0.067), because P300 amplitudes were the highest for Met homozygotes, and the lowest for Val ones. Thus, decreased level of dopamine in PFC related to schizophrenia might lead to inverse relationship between the P300 amplitude and the level of COMT activity.

The obtained results demonstrated the different effects of Val158Met polymorphism in healthy and schizophrenic men. These findings may well be derived from specific genetic associations with prefrontal cortex functioning in schizophrenia. Supported by Russian Foundation for Basic Research (grant 16-06-00117).

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Age-related differences in object recognition with interference in children
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Introduction: Processing of visual information involves different brain mechanisms. However, we still know not enough about the development of these mechanisms in children. The goal of this study was to check hypothesis that brain mechanism responsible for ability to recognise overlapping objects is maturing earlier in children than brain mechanism responsible for ability to recognise incomplete objects.

Methods: The sample consisted of 54 7-years-olds (M= 7.47 years, SD = 0.35, 26 boys and 28 girls) and 48 9-years-olds (M= 9.61 years, SD = 0.43, 22 boys and 26 girls). The children were assessed with the “Visual recognition tasks” from child neuropsychological assessment battery (Glozman, 2013). A first task investigates the ability to recognise overlapping objects. Second task requires children to recognise incomplete visual objects.

Results: Multilevel modeling was used to address the study hypotheses, with the amount of correct identified objects as the dependent variable, with age as between-participants factors and the task condition type as levels of repeated within-participants factors. The main effect of age was significant F(1,100)=50.21, indicating that there are age-related differences in visual recognition between two age groups. The main effect of type task was also significant F(1,100)=35.52, indicating that children had better results for identification of overlapping objects. Most interestingly, we have revealed significant interaction between type of task and age - F(1,100)=24.88. Particularly, 9-years-olds had better results for identification of incomplete objects in comparison to 7-years-olds. However, we did not find the same tendency between these age groups for identification of overlapping objects.

Conclusions: This research demonstrates that there are clear age-related differences in the ability for visual recognition of objects with different kind of interference. However, it can be assumed that brain mechanism responsible for ability to recognise overlapping objects is maturing earlier than brain mechanism responsible for ability to recognise incomplete objects.

Funding: The research was supported by Act 211 Government of the Russian Federation, agreement 02.A03.21.0006

Picture 1: https://www.eventure-online.com/parthen-uploads/175/18001/add_1_457521_72a21265-7c9d-4b67-bf25-b34fd9798039.png

Picture 2: https://www.eventure-online.com/parthen-uploads/175/18001/add_457521_72a21265-7c9d-4b67-bf25-b34fd9798039.png

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The Role of Optokinetic Nystagmus in Vection Illusion
Neurovisualization of multidimensional psychophysiological structure of consciousness during the elementary process of brightness discrimination

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Introduction. Vector psychophysiology (Sokolov, 2013) is a promising research paradigm for studying mechanisms of conscious processes and consciousness. We offer a combination of methods including fMRI, EEG and psychophysics to study mechanisms of consciousness via brightness stimulus discrimination process. Methods. Study involved 35 right-handed healthy participants (16 men), 21.9±1.9 y.o. FMRI images were obtained by T²*-weighted using 3T MRI scanner (Siemens Magnetom Verio), block paradigm and SPM12 was used. Image acquisition parameters: 65 slices, TR=2200 ms, TE=25 ms, voxel size=2x2x2 mm, FA=90°, MB 5 (CMRR). During fMRI series subjects had to specify differences between 2 successively presented stimuli as ‘strong’ or ‘weak’ using 2-button joystick (right hand). Brightness of 9 achromatic homogeneous stimuli was logarithmically distributed, stimuli were presented in quasi-random order. We contrasted active task with passive fixation (p < 0.0001 uncorrected). In the second series visual evoked potentials (VEP) on instant stimulus replacement were recorded. Some stimuli were presented on CRT-screen. Subjective dissimilarity estimation in pairs was conducted (scale 1–9) in the third series. VEPs to abrupt changes of stimuli were recorded resulted in 9x(9-1)=72 VEPs. VEP-matrix and psychophysical matrix were sample-averaged. Psychophysical matrix was correlated with every 2-ms VEP-matrix (0-600 ms) in each lead resulted in dynamics of relation between neural activation and conscious reply. Results. In the first series we found activation in following structures: (1) precentral gyrus, supplementary motor cortex, superior and middle frontal gyri (all bilateral), opercular part of the left inferior frontal gyrus; (2) superior parietal lobule, supramarginal and angular gyri (all bilateral); (3) bilateral thalamus; (4) caudate, pallidum, putamen (all bilateral); (5) anterior insula and middle frontal gyr; (6) bilateral thalamus; (7) bilateral caudate, pallidum, putamen; (8) bilateral insula; (9) bilateral precentral gyrus. These structures are related to visual perception and discrimination, motor planning, execution and control, decision-making, attention and working memory. To relate this data to structure of consciousness we analyzed EEG and psychophysics series. Multidimensional scaling of subjective differences provided two-dimensional spherical model: 9 stimuli forming a semi-circle in psychophysical space. Significant VEP and psychophysical data correlations resulted in specific distributed spatiotemporal pattern of microgenesis of consciousness. Systematic movement of correlation peak between electrophysiological and subjective data on scalp surface is related to obtained in fMRI series cortical structures. Conclusion. Combination of fMRI, VEP and subjective scaling methods effectively describes multidimensional psychophysiological structure of consciousness during the process of elementary sensory operation.
Introduction.
The emotional component of the word and its semantic meaning are mutually interconnected, but it’s unclear how they influence each other. It is also unclear which brain structures can determine this influence. We conducted an fMRI study to identify the relationship between emotions and semantics and to find its brain correlates.

Methods. The study involved 35 healthy right-handed participants (16 men), 21.9±5.8 y.o. The fMRI images were obtained via a T2*-weighted using a 3T MRI scanner (Siemens Magnetom Verio) and further processed using SPM12 (p<0.05, FWE-corrected). The image acquisition parameters were as follows: 65 slices, TR =2200 ms, TE=25 ms, voxel size=2x2x2 mm, FA=90° deg., MB 5 (CMRR). In the control series the subjects had to assess the degree of emotional expression in the auditory stimuli. In the series 1 the word “Yes” was pronounced with different emotional expressions (stimuli had semantic and emotional components), in the series 2 there were sounds produced by cats in different situations that does not contain a semantic component (only emotional). The series 3 was held in a week and contained stimuli from series 2 but some of the cat sounds from series 2 was given a specific semantic meaning in a training (so stimuli had semantic and emotional components).

Results. We found significant decreasing in activity of the anterior insula (responsible for emotional information processing) from series 2 to series 3, which indicates a decrease in the role of emotional component in the formation of the meaning. Similar results were obtained in the posterior cingulate gyrus: its activity decreases after the training. Change of emotional perception of initially meaningless stimuli (cat’s shouts) after learning was also proved by psychophysical experiments.

Comparison of series 1 and 3 also revealed a difference in the fusiform gyrus (responsible for word recognition). Furthermore, there is more activity in the right hemisphere in series 1 and 2; also in series 3 there is an increase in activation of the left hemisphere. This is due to the fact that the left hemisphere is conventionally treated as more verbal and responsible for the processing of vocabulary and language, and the right hemisphere is more responsible for the processing of emotional information.

Conclusions. After giving semantic meaning to emotional auditory stimuli, the activity of areas related to processing of emotional information decreased, at the same time the activity of the area responsible for word recognition increased.

The impact of body orientation on the cognitive map acquisition
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The aim of our study was to investigate the effect of body orientation on the accuracy of cognitive map acquisition (CMA). We assumed that a change of body orientation from the vertical to the almost horizontal position would lead to distortions in CMA formation. Nine virtual mazes to stimulate an observer-centered frame of references were created, differing in configuration complexity by the number of corridors and right and left turns. Virtual mazes were presented using an HMD Oculus Rift DK2. The experiment included three stages: in the first and third control stages, CMA accuracy testing was carried out under the condition of almost horizontal orientation. Fifteen participants (15M, age range 18-46) were tested. Their task was to pass through the virtual maze and to remember it spatial structure. After completing the task, they should reconstruct it using Sketch mapping method and then pass through the maze position where the task was performed. The results showed that the number of errors in the assessment of maze spatial arrangement in the 2nd stage was significantly higher as compared to control stages. Also we revealed that the number of errors increased with increasing configuration complexity of the maze: the number of reproduced turns was overestimated significantly for the most complex in configuration mazes. The average time during which participants passed the mazes in the 2nd stage was significantly larger than the time of maze passage in the 1st and 3rd stages. At the same time, the time of maze reconstruction did not differ significantly in all three stages. The sketch map accuracy was positively correlated to the mental rotation task, p<0.05. So, the body orientation has a significant effect on the cognitive map acquisition. Our results emphasize the importance of spatial egocentric frames of reference.

Do junior school pupils with intensive academic training have intense psychophysiological status?
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Introduction. Intensive academic training results not only in greater academic success. It is accompanied by certain changes in physiological and psychological level as well. To what extent are such negative physiological changes common for schoolchildren studying their first years, especially if the school imposes high academic requirements on them? Certain
psychophysiological changes reflect reduction in functional reserves of a schoolchild’s organism. So, the aim of this work was to study to what extent these changes are widespread among elementary school pupils passing intensive academic training.

**Methods.** The study involved 52 elementary schoolers aged 8-9 years of both sexes. The Projective 8-colour Luscher Color Test (LCT) in Aminev modification (1997) was used for assessment of stress and vegetative regulation. Respiratory indices were determined by evaluating vital capacity as well as when performing Breath Holding Stange test (BHST). Cardiovascular activity was assessed by evaluating heart rate, systolic blood pressure and diastolic blood pressure. An organism’s functional state and cardiorespiratory system functional reserves in schoolchildren were determined by vegetative Kerdo Index (KI) and Skibinskaya’s index. The data obtained passed statistical processing using the variation statistical method taking into account Student t-test and Wilcoxon-Mann-Whitney test.

**Results.** The psychophysiological state in 63.5% of pupils was determined by different manifestation rates of psycho-emotional stress and deviation from autogenic standard values, indicating an excessive level of excitation and imbalance of neural processes in children. In 67.3% of them low levels of vital capacity as well as reduced functional ability of respiratory system when carrying out BHST (94.2%) were documented. In almost all children KI positive values were noted which characterized cardiovascular system functionality as reduced. After physical exercise there was an inconsiderable increase in positive KI in boys (40.2±2.77) and in girls (49.22±1.79) (p<0.01), which could indicate a relative age sympathicotonia and stress in adapting to learning activities. Calculation of Skibinskaya’s index also found significantly lower cardiorespiratory system reserves in the studied (boys – 3.92±0.33, girls – 4.57±0.47; p<0.01).

**Conclusions.** Most junior schoolers were in the state of psychophysiological tension and significant stress. They were observed to have imbalance in vegetative regulation of hemodynamic and respiratory parameters which manifested in prevalence of sympathetic influences, decrease in functional reserves of an organism. These results should be taken into account when planning the educational process at school with the objective to preserve the health of junior pupils.

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**Which advertising materials does a 5-year-old child base on while choosing the products?**

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Introduction. The purpose of the research was to analyze how a child chooses the products in the markets and later to compare the results with the choice of his/her parents.

In view of the age-related features of child development, at the preschool age the greatest influence is exerted by the phenomena of psychological contamination (affecting the emotional sphere of the personality), imitation (involving the appropriation of behavior models that have been observed) and indoctrination.

Children entreat and even compel their parents to buy attractive products, which are far too often inferior, and this sometimes leads to friction with the parents, who refuse to do so. When parents explain that these products are deleterious to their health, 23 percent of children agree with them, but 60 percent actively protest and become upset (Strasburger et al., 2009).

It has already been shown that the extent to which a child has formed the theory of mind plays a significant role in their understanding of the purpose behind advertisement (Sergienko et al., 2013). Investigations into children’s perception of a package by using an eye-tracking device are rarely found in the research of child psychologists. Sequential presentation of visual patterns on a computer screen and documentation of children’s eye movements using an eye tracker will make it possible to analyze in greater detail their areas of interest and prove what advertising material has a special effect on children’s preferences.

**Methods.** The participants were 25 children between the ages of 3 and 7 (12 boys and 13 girls) and their 50 parents. In order to achieve our objectives, we used several psychodiagnostic procedures: a survey for children about their knowledge of the products, Theory of mind analyzing and eye tracking. The Eye Tribe Tracker (ET1000) and the Ogama program were used. For the subsequent statistical analysis, the following facts were used: the number of fixations, the total gaze duration, the percentage of the time on the areas of interest and the length of the saccades.

Results and conclusion. The gaze duration for the advertising the image of a fairytale character’s on a package is substantially longer than those for the taste and the brand. Food selection for preschool children is based predominantly on good feelings for a character depicted on a package. The study is founded by Russian Scientific fund #14-18-02135.

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**Changes in the parameters of respiration, blood pressure, heart rate variability, and cardiac performance during adaptation to the conditions of high-latitude marine expedition (Franz Josef land, 2017)**

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**Introduction.**

Climate of the Far North is considered unfavorable to human health. Our aim was to study the dynamics of the cardio-
respiratory system parameters and spectral parameters of the heart rate variability (HRV) and blood pressure variability (BPV) in participants of the high-latitude marine expedition (islands of Franz Josef Land, N81°, E55°).

**Methods.**
The results of examinations of 9 crew members (8 men and 1 woman) aged 43±3 years were used in the study. Using the method of simultaneous and continuous recording of respiratory and cardiovascular system indicators, we evaluated their main parameters and parameters of the autonomous regulation systems by HRV and BPV indicators. The measurements were performed at rest and during exercise stress tests. All measurements were performed twice: in the beginning (day 1 after exit from Murmansk port) and at the end (before port call) of the expedition with an interval of 4 weeks.

**Results.**
During the experiment, no considerable changes in the main parameters of the respiratory system and HR were revealed. However, a decrease in systolic BP measured by a finger transducer (fBP) and diastolic BP measured on the forearm was observed at rest in all participants. In HRV spectrum, an increase in LF range and LF/HT ratio was found. Similar shifts were also revealed in the respiratory test under conditions of free breathing, but they were also accompanied by a decrease in the pulse fBP and spontaneous arterial baroreflex sensitivity. Under conditions of controlled breathing at a rate of 6 cycles per minute, the above-mentioned BP shifts were accompanied by an increase in VLF power in HRV and fBP spectra. Assessment of the reactivity of the cardiovascular system parameters during exercise tests showed that changes in LF power in HRV spectrum and HF power in the systolic fBP spectrum became less pronounced during free mask-on breathing. Transition to breathing at a rate of 6 cycles per minute was accompanied by an increase in the degree of changes in VLF and HF power associated with a decrease in the relative LF power in the HRV spectrum and a decrease in the degree of changes in the total power of systolic fBP spectrum and HF power in the diastolic fBP spectrum with a decrease in cardiac performance parameters.

**Conclusion.**
The obtained results attested to adaptive changes in the parameters of autonomous HR and BP regulation that occurred within 4 weeks of the high-latitude marine expedition.

**Using subject's own name as an unconditional stimulus in a classical conditioning oddball paradigm: an Event-Related Potentials study**

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Although classical conditioning is probably the best investigated phenomenon of behavioral modification, and although Event-Related Brain Potentials (ERPs) are one of the most popular methods for the analysis of information processing in the human brain, only relatively few studies have examined conditioning effects on ERPs. Because auditory classical conditioning, due to its methodological simplicity, can be applied in children and severely disabled individuals, and because using highly aversive UCS in these groups is ethically problematic, looking for other kinds of UCS is important. The effects of a subject's own name (SON) on ERPs have been established in normal populations and severely brain-injured patients, in waking state and during sleep. The most consistent finding is that in a three-stimulus oddball, in which SON and a control stimulus (usually, a different name: DN) are presented as two rare stimuli, SON elicits a larger P3 component than DN. We expected to obtain a similar effect in response to neutral stimuli (tones, presented as CS) paired with names. In four experiments two harmonic tones (CS+ and CS-) were paired with a participant's own name (SON) and different names (DN), respectively. A third tone was not paired with any other stimulus and served as a standard (high-frequency stimulus) in a three-stimuli oddball paradigm.

The larger posterior positivity (P3) to SON than DN, found in previous studies, was replicated in all experiments. Conditioning of the P3 response was albeit observed in two similar experiments (1 and 3), but the obtained effects were weak and differed between the experiments. Only Experiment 4, in which the number of CS/UCS pairings and the Stimulus-Onset Asynchrony between CS and UCS were increased, showed clear CS+/CS- differences both in time (late posterior positivities and time-frequency (changes in the alpha and high theta activity) domains.

To summarize, these findings indicate that classical conditioning of electrophysiological responses using the own name as UCS is possible. The differential responses to CS+ and CS– in Experiment 4 were demonstrated in both time (i.e., late ERP positivities) and time-frequency domains (i.e., higher theta but lower alpha activity to CS+ than CS–). Generally, however, learning effects were relatively weak and unstable. Therefore, we do not believe that the paradigm can be used in clinical applications in its present form; rather, further methodological work is needed.

The study was supported by the Ministry of education and science of Russian Federation and the DAAD (grant # 25.12803.2018/12.2)

**Electrophysiological patterns of brain activation in high- and low creative subjects solving non-creative tasks**

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Introduction Successful task solving process requires involvement of specific brain structures, depending on the objectives, as well as the particular rhythmic activity. Current study aimed to reveal differences between electrophysiological patterns of solving non-creative tasks by high and low creative subjects.

Methods To form the experimental groups the study was conducted in two phases. At the first stage 110 students participated in the experiment. The creative potential of each subject was rated according to the results of Torrance test. The EEG data were obtained at the second stage from 27 subjects (17 males, mean age = 19.9 ± 0.4 years) with the lowest and the highest creative potential. EEG was recorded from 19 standard scalp sites according to the 10-20 system.

Results The statistical analysis was applied to the EEG power in the rest state and during the verbal, imaginative, spatial cognitive tasks (visually presented) solving. There were no differences in performance of task solving between two groups. ANOVA RM showed no influence of creativity potential on the power of EEG in non-creative tasks. However, comparison of participants with the most prominent results in originality subscale (high-originality (HO) subjects) and low-originality (LO) subjects showed differences in EEG characteristics. Transition from the rest state to the task solving induced decreasing of alpha1 activity in the posterior area and widespread activation of beta2 in the HO group. At the same time, LO group demonstrated suppressing of alpha1 activity in the frontal areas and decreasing of beta2.

Conclusions We assume, that HO subjects choose insight way for solving non-creative tasks and their frontal cortex is not engaged in that process, but have to maintain more widespread activation of small neural networks. The opposite is probably correct for LO subjects.

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Executive Functions in Naive Middle-age Patients with Uncomplicated Essential Arterial Hypertension

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Introduction

It has been shown that persons diagnosed with EAH in middle age, are characterized by a rapid rate of annual decline in executive functions [Debette, 2011].

The purpose of this study was to assess cognitive functions in EAH patients and, on this basis, to evaluate executive functions of the patients.

Methods

Research design, analysis and data interpretation were carried out in accordance with fundamentals of L.S. Vygotsky’s concept of mental development, and Vygotsky-Luria-Zeigarnik concept of psychological syndrome analysis. Psychological study was focused on the assessment of qualitative features of cognitive functions: the ability to keep the focus and follow a single strategy in problem solving, to control the process, to suggest the most appropriate solutions for generalizations in the course of the experiment.

The following methods were used: Trail Making test (TMT), MoCA test, Verbal fluency test, Stroop test, CERAD 10-word list, and Pictogram test.

The study involved 56 naive middle-age patients with uncomplicated EAH, stage 1-2, average age is 50.4±7.4, and 58 normotensive persons, average age is 46.0±7.4.

Results

EAH patients significantly differ from healthy subjects by the following parameters: TMT (B) (117.7±23.9 vs 102.0±26.7; p=0.01); TMT (B) – TMT (A) (81.7±41.2 vs 61.4±24.4; p=0.006); MoCA (28.1±1.7 vs 29.0±1.1; p=0.03); Stroop 3 (126.2±44.2 vs 114.5±27.5; p=0.002), and Stroop coefficient (60.6±37.4 vs 49.6±21.8; p=0.001).

The analysis of the results of Torrance test confirmed the hypothesis about violations of executive functions in naive middle-age patients with uncomplicated EAH.

The research was supported by RFBR; project 17-06-00954.
Personality may be a potential moderator of aging effects on both inhibitory processes and brain activity. This hypothesis is based on a wide range of individual variability in the processes of information selection and the structural and functional organization of brain activity in aging.

To test this hypothesis, a comparative analysis of the functions of attention systems and frequency-spatial organization of the brain activity at rest due to factors of the Eysenck’s personality, sex and age (22±3 and 63±6 years) was performed. EEG data were recorded using a 60-channel Neuroscan 4.4 system from 170 subjects. It was found that the personality-related variability of both brain activity and selective processes is most pronounced in elderly men. Neuroticism was the common for elderly predictor of the alpha3 power at rest: its increase was accompanied by significant left hemispheric synchronization of the oscillations in the temporo-parieto-occipital region in men and a tendency to the right hemispheric effect in women. Psychoticism was a predictor of the variability of high-frequency alpha and beta oscillations in women, and this effect increased with age.

The executive control of information selection was related to extraversion in young men and psychoticism in senior women. Also extraversion and psychoticism were predictors of vigilance system functions in older men. The frequency and regional specificity of changes in the resting-state EEG in men and women relating personality traits reflects the variability of age-related changes in hemispheric activity and potential resources for cognitive functions in old age. The findings prompt an assumption that dynamic interactionist models would be necessary to capture the multiple interactions between personality, brain activity, and behavioral inhibition/activation.

This work was supported by grant of the Russian Foundation for Basic Research (RFBR) No. 17-06-00166-a

THE MATCHED FUNCTIONING OF MAGNOCELLULAR AND PARVOCELLULAR VISUAL PATHWAYS IS THE BIOMARKER OF STRESS

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Introduction. The aim of this study was to examine the functional state of magnocellular and parvocellular visual pathways, features of their interaction in a chronic stress condition on model of professional burnout. The magnocellular system is more sensitive to the low spatial and high temporal frequencies, and they promote rapid information transmission to the neurons, mostly of the dorsal pathway. Because of these properties, the magnocellular neurons are involved in processing of information on the global organization of a stimulus and in analysis of movement of the observed object. The parvocellular system is more sensitive to the high spatial and low temporal frequencies. They provide a slower information transmission to the neurons of primarily ventral pathway. The parvo-system is responsible for description of color and fine details of the object. The interaction of magnocellular and parvocellular visual systems provides the integrity of perception and adaptive behavior.

Methods. Twenty one university employees and twenty university students participated in the study. Burnout was measured with diagnostic methods of the emotional burnout (V.V. Boyko). Contrast sensitivity thresholds was measured with the visual contrastometry (Gabor elements with spatial frequencies of 0.4, 3.6 and 17.8 cycles/degree were presented).

Results. Between-group comparisons revealed a statistically significant difference between groups (participants without burnout, participants with the resistance phase at a formative stage and participants with symptoms of formed resistance phase) with respect to contrast sensitivity thresholds at low (F(2,205)= 3.03; p = 0.05), medium (F(2,238)= 11.67; p < 0.001) and high spatial frequencies (F(2,200)= 5.11; p = 0.05). A post-hoc Games-Howell test revealed that participants with the resistance phase at a formative stage demonstrated increased contrast sensitivity at low spatial frequencies compared to individuals without burnout. Compared to individuals without burnout, participants with symptoms of formed resistance phase had reduced contrast sensitivity at medium and high spatial frequencies. Also participants with symptoms of formed resistance phase showed reduced contrast sensitivity at medium and high spatial frequencies compared to participants with the resistance phase at a formative stage.

Conclusions. Thus we have demonstrated the important role of matched functioning of magnocellular and parvocellular visual pathways in adaptive behavior in burnout. We propose to consider the functional state of magno- and parvosystems as a biomarker of chronic stress.

Conscious behavior self-regulation and cardiovascular activity in patients with essential hypertension

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EFG data were recorded using a 60-channel Neuroscan 4.4 system from April 2016 to 2017. The aim of this study was to examine the functional state of magnocellular and parvocellular visual pathways, features of their interaction in a chronic stress condition on model of professional burnout. The magnocellular system is more sensitive to the low spatial and high temporal frequencies, and they promote rapid information transmission to the neurons, mostly of the dorsal pathway. Because of these properties, the magnocellular neurons are involved in processing of information on the global organization of a stimulus and in analysis of movement of the observed object. The parvocellular system is more sensitive to the high spatial and low temporal frequencies. They provide a slower information transmission to the neurons of primarily ventral pathway. The parvo-system is responsible for description of color and fine details of the object. The interaction of magnocellular and parvocellular visual systems provides the integrity of perception and adaptive behavior.
Introduction
A conscious self-regulation of voluntary activity, in which goals are set and activities are organized to achieve them, is an important indicator of the productive activity of cardiac patients. The current study examines whether patients with essential hypertension have any psychophysiological specifics regarding conscious self-regulation of their behavior.

Methods
The relationships between conscious behavior self-regulation and basal cardiovascular activity were assessed in cardiac patients diagnosed with various forms of essential hypertension. The sample of 67 patients of cardiology unit (28 men and 39 women, mean age 47, SD=11) completed the Morosanova Behavior Self-Regulation Style Questionnaire (2010). The questionnaire allowed identifying the components of a patient’s regulatory processes (planning, modeling, programming, evaluation of the results) and a patient’s regulatory traits (flexibility and self-dependence). To obtain the measures of the patients’ cardiovascular activity we collected the data of their heart rate, systolic blood pressure, and diastolic blood pressure. The degree of associations between the studied characteristics was measured by a correlation analysis.

Results
Results indicate that hypertension patients in comparison with healthy subjects have normal level of modeling processes and higher levels of planning, programming and results evaluation. In general, regulatory processes activity positively correlates with diastolic blood pressure (\( r > 0.05 \)). In behavior, it manifests in hypertension patients' maturity, awareness, and independence in goal formation, their realism and stability, propensity to carefully thinking out and structuring the activities planned. In a situation of changing conditions, they are able to change their plans of actions, adequately assess them and their role in their implementation. Patients’ regulatory traits, in comparison with healthy subjects, differ by a decrease in flexibility, which negatively correlates with the growth of systolic blood pressure (\( r > 0.05 \)). This is manifested by a decline in their ability to modify regulatory activity under conditions of external and internal changes. No relationships between heart rate and components of conscious behavior self-regulation in hypertension patients are revealed (\( r < 0.05 \)).

Conclusions
We conclude that specifics regarding conscious self-regulation of behavior in patients with essential hypertension is in significant interrelation with psychophysiological characteristics of blood pressure but not heart rate. Higher basal level of the total peripheral resistance is associated with more expressed regulatory processes of modeling, planning, programming and results evaluation. Higher cardiac output in patients with essential hypertension is associated with less flexibility. These data may be used in behavioral treatment programs for hypertension patients.

Difference of psychophysiological responses induced by two different types of painful stimuli
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Introduction: People experience various forms of pain. Pain involves physical pain (e.g., pain caused by burning or poking pain) and psychological pain (e.g., pain caused by loss of or rejection significant others). Previous studies have been conducted to identify the brain regions to find the mechanism of physical and psychological pain. The goal of this study was to identify the difference in autonomic responses between the physical and psychological pain.

Methods: One hundred sixteen young adults participated in this study. As indices of autonomic nervous system (ANS) responses, skin electro-dermal activity, electrocardiogram and photoplethysmogram were recorded while the participants were exposed to both physical and psychological pain stimuli. After the presentation of the stimuli, then they were to assess the level of intensity of their experiencing emotions, a state of arousal and emotional valence. Skin conductance response (SCR), heart rate (HR), heart rate variability (HRV), blood volume pulse (BVP) and pulse transit time (PTT) as autonomic responses were also extracted respectively from those signals.

Results: From the result of psychological response, both types of pain fell within the same arousals-unpleasant emotion dimension with no difference in intensity as well. Both autonomic responses induced by both types (physical and psychological) of pain increased in SCR, HR, and HRV but decreased in BVP and PTT. SCR by physical pain, when compared to that of psychological pain, was significantly higher while HRV and PTT by psychological pain, when compared to those by physical pain, were significantly lower.

Conclusions: It is confirmed that sympathetic responses by physical pain can be characterized as sympathetic-adrenal-medullary (SAM) activation and peripheral vasoconstriction while those by psychological pain can be characterized as both sympathetic and parasympathetic activation together at the same time. These results are deemed to indicate a difference in sympathetic responses by two different (physical and psychological) pain stimuli (supported by NRF-2015R1D1A1A01058095; Correspondence: Jin-Hun Sohn, jhsohn@cnu.ac.kr).
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The interaction between personality traits and sympathetic arousal in response to stress
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Introduction: The role of personality and behavioural characteristics in risk of stress-related disorders has been recognized for several decades. In particular, people with type A personality characterized by competitiveness, time urgency and hostility were often observed to have greater risk of cardiovascular diseases. However, the mechanisms underlying this relationship are still not fully understood. Therefore, we aimed to study the interaction between temperament and character dimensions of Cloninger’s neuropsychological model of personality and physiological autonomic regulation at rest and in response to mental stress using electrodermal activity (EDA) as an index of sympathetic cholinergic regulation in young healthy adults.

Methods: The studied group comprised 85 university students (49 women, age 22.8±1.0 years, body mass index: 22.1±3.0 kg/m²) with excluded effect of underweight/overweight, smoking, and use of substances which could affect autonomic nervous system. Examinations were performed under standard conditions between 9.00 a.m. – 12.30 p.m. EDA [μS] was continuously recorded using ProComp Infinity (Thought Technology Ltd., Canada) during 5 minutes of rest and 5 minutes of mental arithmetic test and the mean values per period were calculated. Personality traits were assessed according to Cloninger’s Neuropsychological model, which integrates the neuropsychological and psychological aspects of personality using Slovak version of the Temperament and Character Inventory – Revised. Evaluated parameters - temperament dimensions: novelty seeking, harm avoidance, reward dependence, cooperativeness, self-directedness, cooperativeness, and self-transcendence.

Results: EDA was significantly increased during mental arithmetic test compared to rest (6.31 [4.31-9.53] vs. 2.92 [1.11-5.33] μS, median [interquartile range]; <i>p</i><0.001). Significant negative correlations were found between EDA and temperament trait reward dependence, character traits cooperativeness, and self-transcendence at rest (<i>r</i>=-0.377, <i>p</i><0.001; <i>r</i>=0.318, <i>p</i><0.01; <i>r</i>=0.283, <i>p</i><0.01; respectively) and during mental stress (<i>r</i>=-0.380, <i>p</i><0.001; <i>r</i>=0.390, <i>p</i><0.001; <i>r</i>=0.367, <i>p</i><0.001; respectively).

Conclusions: Our study revealed novel connections between temperament and character personality traits and neurophysiological regulation at rest and during mental stress in healthy probands. These findings could help to understand the mechanisms of stress-related psychosomatic disorders from the perspective of individual personality characteristics. Acknowledgements: This publication is the result of the project implementation “Biomedical Center Martin” ITMS code: 2622020187, supported by the Operational Programme Research and Innovation funded by the ERDF, and was supported by Grant VEGA 1/0044/18.

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Diagnostic accuracy of the Maslach Burnout Inventory-Student Survey
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Introduction: The absence of clinically validated cut-off values for assessing burnout as a dichotomous phenomenon has hindered the progress of student burnout research. Hence, the present study was aimed at developing clinically validated cut-off values and evaluating the diagnostic accuracy of the Sinhala version of the 15-item Maslach Burnout Inventory-Student Survey (MBI-SS) in assessing burnout among collegiate cycle students.

Methods: This prospective validation study was conducted among 194 grade thirteen students in a selected educational division in the Kurunegala district, Sri Lanka. Clinically validated cut-off values for the subscale scores of the index test was developed by computing ROC curves, using the psychiatric clinical diagnosis as the reference standard. Diagnostic accuracy of the MBI-SS test results based on “exhaustion+1” criterion was assessed comparing with the results of the clinical diagnosis.

Results: The clinically validated cut-off values for exhaustion, cynicism and reduced professional efficacy subscale scores were 12.5, 7.5 and 10.5 respectively. The sensitivity, specificity, positive and negative predictive values of the Sinhala version of the 15-item MBI-SS were 91.9%, 93.3%, 86.4% and 96.1% respectively. The positive and negative likelihood ratios were 13.48 (95% CI=7.15-25.44) and 0.09 (95% CI=0.04-0.20) respectively.

Conclusions: By using the clinically validated cut-off values for the subscale scores and based on the “exhaustion+1” criterion, the Sinhala version of the 15-item MBI-SS could be effectively used as a screening tool to assess burnout among collegiate cycle students.

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Deficit of holistic brain mechanism in children with weakness in grammar understanding
**Introduction:** The weakness in grammar understanding is one of the specific language impairments in children (SLI). (Bishop, 1997). The brain mechanism of this developmental disorder is still not understood. The use of the term “specific” implies that the areas of deficit are directly and exclusively related to language processes. However, Luria (1976) proposed the non-linguistic cognitive mechanism that can explain the deficit in grammar understanding. The goal of this research was to examine the hypothesis that Russian-speaking children with weakness in grammar understanding have deficit in holistic brain mechanism.

**Methods:** 345 Russian-speaking children aged between 7 years 2 months and 8 years 5 months participated in the study. We have revealed 19 children (M=7.35 years, SD = 0.36, 12 boys and 7 girls) with weakness in grammar understanding using the task “Comprehension of grammatical structures” from Luria’s neuropsychological assessment battery (Glozman, 2013). The control group included 19 children (M=7.09 years, SD = 0.42, 12 boys and 7 girls) with typical grammar understanding. The children from experimental and control group were matched for IQ, gender and age.

The Rey-Osterieth Complex Figure (ROCF) test was used to assess the holistic processing in children. Piecemeal (immature) strategy in coping ROCF can be interpreted as a weakness in holistic brain mechanism.

**Results:** We have revealed that majority of children with weakness in grammar understanding (64 %) used piecemeal immature strategy when copying the ROCF. In contrast, the majority of children from control group (72 %) used holistic strategy. According to Luria’s hypothesis holistic brain mechanism may play important role in different abilities including visuospatial abilities and grammar understanding (1976). This explanation by Luria makes sense in view of idea that there are important parallels between visual perception, especially perception of spatial relations, and grammar understanding. The basic notion is that both processes require the segmentation of the input into parts, the recognition that certain parts may be aggregated as portions of a single structure of known type, and the understanding of the whole in terms of the relationship between these parts.

**Conclusions:** We hope that our results provided insight into cognitive and language mechanisms in typically developing children and the underlying nature of SLI, helping to elucidate the nature of impaired mechanism in children with poor grammar understanding. It can be assumed that weakness in holistic brain mechanism can explain the deficit in poor grammar understanding in children with SLI.

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**Junior medical students: psychophysiological state evaluation while learning activity**

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**Introduction:** Students’ learning activities at a medical university require strain of psychological and physiological resources. Long-term emotional stress may be accompanied not only by lowering academic success (Taha & Sabra, 2012), but by negative psychophysiological ones (Uchakin et al., 2004), burnout syndrome (Costa et al., 2012) and mental disorders (Costa et al., 2014) as well. This is why monitoring students’ psychophysiological state is an important task for health promotion programs.

**Methods:** The study involved 324 medical students of the 1st-2nd years of study of both sexes aged 18-24. Measurements were obtained during practical classes in situations related to the educational process. Psychophysiological state was determined using heart rate (HR) measurement, Spielberger State-Trait Anxiety Inventory (STAI) and a Projective Luscher Color Test (LCT) in Aminew modification (1997). The frequency of current heart rate (CHR) was compared with the proper heart rate (PHR). Evaluation of differences’ significance was carried out using the methods of variation statistics, Student <\(t\)>-test.

**Results:** Studies showed that CHR made 85.1±1.3 beats/min (PHR – 67.2±0.4 beats/min). In 93% of students surveyed CHR deviation relative to PHR exceeded the norm by 27% (p<0.01), indicating psychoemotional strain during the educational process. According to LCT findings, 38% of students were noted to be in satisfactory psychophysiological state (18.4±0.4), 32% – in uncomfortable one (24.2±0.6). Only every third student (30%) experienced psychophysiological comfort (10.7±0.8). Assessment of psychoemotional strain level revealed signs of forced stress in 9% (47.4±1.5) and the stage of stress formation in 52% (21.6±1.6) of students. Determining the level of situational anxiety by STAI, as a certain condition in the limited moment of time and the level of personal anxiety as a sustainable property, showed preponderance of students with a medium level of personal anxiety (64%) and a high level of situational anxiety (51%). 45% of students were identified to have a moderate, the so-called useful level of situational anxiety, contributing to formation of motivation to achieve success in studying.

**Conclusions:** Junior medical students’ state evaluation showed that the majority of them had certain psychophysiological shifts while studying. Adverse changes in the heart rate were identified, as well as there were fewer psychophysiological states of comfort, increase in stress against the background of a higher level of personal anxiety and a high level of situational anxiety. These results should be taken into account when organizing the educational process and creating prevention programs in medical schools.

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**Personality as moderator of aging effects on inhibition functions and brain activity**
Personality may be a potential moderator of aging effects on both inhibitory processes and brain activity. This hypothesis is based on a wide range of individual variability in the processes of information selection and the structural and functional organization of brain activity in aging.

To test this hypothesis, a comparative analysis of the functions of attention systems and frequency-spatial organization of the brain activity at rest due to factors of the Eysenck’s personality, sex and age (22±3 and 63±6 years) was performed. EEG data were recorded using a 60-channel Neuroscan 4.4 system from 170 subjects. It was found that the personality-related variability of both brain activity and selective processes is most pronounced in elderly men. Neuroticism was the common for elderly predictor of the alpha3 power at rest: its increase was accompanied by significant left hemispheric synchronization of the oscillations in the tempo-parieto-occipital region in men and a tendency to the right hemisphere effect in women. Psychoticism was a predictor of the variability of high-frequency alpha and beta oscillations in women, and this effect increased with age.

The executive control of information selection was related to extraversion in young men and psychoticism in senior women. Also extraversion and psychoticism were predictors of vigilance system functions in older men.

The frequency and regional specificity of changes in the resting-state EEG in men and women relating personality traits reflects the variability of age-related changes in hemispheric activity and potential resources for cognitive functions in old age. The findings prompt an assumption that dynamic interactionist models would be necessary to capture the multiple interactions between personality, brain activity, and behavioral inhibition/activation.

This work was supported by grant of the Russian Foundation for Basic Research (RFBR) No. 17-06-00166-a

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Transcranial alternating current stimulation of frontal theta rhythm has no after-effects to improve working memory
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Numerous studies have shown strong relationship between frontal midline theta (4-8 Hz) (FMT) activity and working memory (WM) performance. Activation of the cortical generators of FMT plays a key role in manipulation of information in WM. Such studies, however, cannot by definition demonstrate any causal relationship. Therefore, ethically correct intervention studies are necessary, such as non-invasive brain stimulation experiments. Transcranial alternating current stimulation (tACS) is a non-invasive technique capable of inducing long-term changes in oscillatory activity of the brain. The current study had initial goal to check the effect of tACS on accuracy in a set of match-to-sample WM tasks.

Two types of tasks were used: with mental manipulations and just retention tasks. Fifteen (6 females, mean age = 25) healthy adults participated in two testing sessions (after sham and tACS). The locations of stimulation electrodes were based on the results of a simulation of field distribution performed in SimNIBS. tACS was applied for 20 min over Fpz and CP2 at 6 Hz, 1 mA.

No after-effects of tACS were observed in the stimulation sessions as compared to sham.

The data suggest that tACS delivered before the WM task is not able to produce any observable changes in WM performance. Future studies could apply simultaneous stimulation and EEG recording during maintenance of information in WM for better understanding of the theta tACS effects.

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Personality Characteristics and Mental Functions in Patients with Essential Arterial Hypertension and Normotensive Persons
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Introduction.

Present-day science postulates that one of the reasons for disregulation of blood pressure is prolonged emotional tension in stress conditions. The purpose of this study was to assess personality characteristics and mental functions in patients with essential arterial hypertension (EAH).

Methods.

Psychological assessment has been conducted with Sixteen Personality Factor Questionnaire (16PF); Ways of Coping Questionnaire (WCQ) Test; Cognitive Emotion Regulation Questionnaire (CERC); Life Style Index (LSI) Test; Hamilton Depression Rating Scale, Hamilton Anxiety Rating Scale; Heckhausen’s Motivational Test; Trail Making Test (TMT), MoCA Test, Verbal Fluency Test, Stroop Test, and the Pictogram Test. Brain MRIs have been obtained using a 3-TMR scanner MAGNETOM Skyra 3T (“Siemens”).

The study involved 56 naive middle-age patients with uncomplicated EAH, stage 1-2, average age is 50,4±7,4; and 58 normotensive persons, average age is 46,0±4,7.
Introduction: The limitations of the existing motivation measure inventories have necessitated objective psychophysiological correlates. Eye-tracking could be a way to improve the reliability of psychological research. Benefits of eye-tracking are its non-invasive, remote, speed recording, resilience to consciousness control. Applying the eye-tracking requires a solution to two problems: identification of value-driven attention eyemovement markers versus neutral or composition-driven attention markers; selection of eyemovement markers of deception. Available data confirm the validity of the method, but set of markers of value-driven attention as well as markers of deception and their variability are highly controversial.

Methods: The first experimental design was a presentation of neutral or meaningful visual stimuli and stimuli selected with the composition (size, color, location). The second experiment was a stimuli presenting with true or false answer; varied: dichotomy or multiple choice question, type of stimuli (graphic, text), deception’s type (random choice, false description, false denial). Stimuli: projective images, standard demographic questions. Duration of stimulus presentation – 10000 ms. The stimuli were counterbalanced, slides’re separated by a mask (25% gray, duration - 500 ms). Hardware: SMI iView Red 250Hz. Participants: N=108.

Results: A stable complex of eye-movement markers reliably differentiates value-driven attention was established, it includes total dwell time, first fixation duration, averaged fixation duration and saccade speed characteristics. A similar generic set of interrelated eye-movements markers of a false answer was identified. The true answer is accompanied by a predominance of focal attention indicators, while random choice of false answer or active lying are manifested in increased ambient attention. The type of deception has a direct impact on the list of specific lie markers and the expression of differences. The passive deception was reflected in an orientation viewing and an accelerated motoric response. Active deception has a sharp decrease in the number of eyeblinks and pupil diameter; quantitative, temporal and speed data are increasingly important. Deception caused general changes in speech activity: increased verbalization latency, repetitions, erroneous choices, narrowing the list of typical topics. False denial led to the reduction of speech production, avoiding face fixation and acceleration of motor reaction, but didn’t led to decreasing fixation count on the hiding stimulus. False description provoked story’s elongation and speech production.

Conclusions: Selected markers formed the basis of truth-or-lie detection technology for psychological testing. The special software has been developed what measure background of individual response rate and set flexible criteria for marker-assisted selection of meaningful stimuli and false responses.
Background. Some researchers noted that the apparent motion is observed when the points do not differ being closely spaced relative to each other (Exner, 1876, 1888; Thorson et al., 1969; Biederman-Thorson et al., 1971). But in their studies the data applied only to peripheral vision, and no direct measurements of the two-point spatial resolution were carried out. In our work we measured the detection thresholds of apparent motion in fovea under the same conditions as in the experiments, where direct measurements of two-point resolution had been conducted. Methods. Three subjects with normal vision participated in the experiments. To minimize the number of simultaneously activated photoreceptors and to eliminate the effect of eye movement we used point light stimuli with extremely small angular dimensions (7 arcsec), short-time presentation (12 mc), and high brightness (4000 cd/m²). As sources of light, two LEDs were used. One LED was mounted on a movable carriage and was driven by a stepper motor. Light beams formed by the diaphragms were merged at the beam splitter cube. The distance between the light sources can be set with the step of 1 arcsec. The measurements of thresholds were carried out by the method of constants. Results. In the experiments with two-point resolution task subjects were asked whether they observed 1 or 2 points. The values of the thresholds varied in the range 80-100 (with errors +/- 5) arcsec. In experiments with measurement of the apparent motion thresholds the same two light points were presented with time delays 0, 20 or 40 ms. The subjects answered whether a movement was occurred and assessed its direction. The optimal motion detection thresholds were obtained for asynchrony 40 ms: 30-40 (with errors +/- 10) arcsec. Discussion. 1) Based on measurements of two-point resolution and detection thresholds for apparent motion, obtained under the same experimental conditions and for the same subjects, it can be asserted that motion detection occurs at a distance between points that is much lesser than necessary for spatial distinguishing points. Thus, for foveal vision, the observation of Exner is confirmed. 2) We can assume that the apparent motion with closely spaced stimulus points belongs to the group of hyperacuity phenomena. This fact, firstly noted by S. Exner, can be viewed as one of the phenomena of hyperacuity in the sense that the detection threshold of the apparent motion is lesser than is the size of one photoreceptor (<1').

The function of the alpha rhythm during the solution of complicated mathematical problems

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The aim of the work is to investigate the brain mechanisms of mathematical abilities, determined by K. Mangina’s Test. The composition of the test includes a set of pair geometric figures, in which the first small figure is an element of a more complex - the second figure. The study was carried out by a group of young people (10 people) studying at the Faculty of Mechanics and Mathematics of Moscow State University. The purpose of the work is to reveal the function of the alpha rhythm as a possible marker of Parkinson's disease. The author’s method was used - "Microstructural analysis of brain oscillatory activity", which works with narrow band frequency selective generators (Danilova, 2002). The method determines the localization of activated brain structures in different hemispheres and in accordance with the coordinates of the “Stereotactic Atlas of the Human Brain” (Talairach, Tournoux, 1988). When the alpha generators were divided into two frequency ranges (8-11 Hz and 11-13 Hz), new data were obtained about their connection with different hemispheres. Only in the left hemisphere within three seconds there was an increase in activity of low-frequency alpha rhythm (8-11 Hz), whereas in the right hemisphere activity of high-frequency alpha rhythm (11-13 Hz) decreased. In this case, the increase in the activity of theta-generators occurred in parallel in both hemispheres. Two other groups of high-frequency alpha (11-13 Hz) in the left hemisphere and low-frequency (8-11 Hz) in the right hemisphere had a very low level of activity. For all three time intervals in solving mathematical abilities, the level of low-frequency alpha rhythm was significantly higher than the level of activity of the high-frequency alpha rhythm (n = 10, p <0.05, T crit = 10, T emp = 9). The duration of theta generator activity was shorter than the alpha of the generators in solving the mathematical abilities of the Test K. Mangina. The growth of alpha generator activity in solving mathematical abilities was revealed in Posterior Circular BA 30, Anterior Temporal G. BA 20, as well as in the subcortical structures of the brain. The brain structures that were activated by theta-generators were concentrated in different sections of the Cingular cortex. The fact that alpha generators are involved in many brain structures emphasizes their very important function - as a special mechanism of local inhibition. The work is supported by the grant of the RNF No. 14-18-03253 P
Emotional information is known to evoke bodily responses involving specific autonomic patterns. However, these patterns of response could be modulated both by the location of the emotional information in the visual space and by psychological traits of individuals. Hence, the aim of this study was (1) to compare autonomic markers variations in response to emotional pictures presented in central and peripheral vision (CV, PV) and (2) to investigate the relation between these variations and depressive and anxious traits.

Twenty-four healthy participants were presented with 3 sets of 16 pictures (unpleasant, neutral and pleasant) from the International Affective Picture System, at three eccentricities (-12°; 0°; +12°). The sets had been balanced as far as the physical properties of the pictures, among which brightness, contrast and spatial frequencies. Participants had to fixate a cross in the center of the screen and to report the location of the pictures (left, center or right). Participants fulfilled questionnaires (depression, BDI; anxiety, STAI; social anxiety, BFNE) and the pupil diameter and the cardiac frequency indices, both under the sympathetic-parasympathetic control, were recorded.

Participants showed greater pupil constriction to unpleasant than pleasant pictures, but only in PV. A greater latency of cardiac acceleration for unpleasant than for pleasant stimuli was also observed, but only for stimuli presented on the left side. Interestingly, the more the participants were anxious, the more their pupil diminished in response to pleasant stimuli in CV. In addition, the more the participants were depressed, anxious and socially anxious, the shorter was their cardiac acceleration latency in response to left pleasant stimulation.

This study (1) confirms the fact that the sympathetic system is more activated by pleasant than unpleasant visual information and (2) illustrates for the first time the reduction of such activation by depressive and anxious traits.

EEG CORRELATES OF IDEOMOTOR PERFORMANCE OF DANCE MOVES IN DANCERS OF DIFFERENT PROFESSIONAL LEVELS
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Introduction. The modern psychophysiological studies of real and ideomotor movement is mostly concentrated on the psychomotor movements for creating the rehabilitation programs, perfecting the athletic skills, advancing the professional skills.

The relevant selection for studying the brain organization of the ideomotor performance of complex movements consists of the dancers, having the experience of long-term education influence their the neural networks circulation.

The aim of research is to study the EEG correlates of ideomotor performance of dance moves in dancers of different professional levels.

Methods. 60 sport/variety dancers (18 – 25 years old, all female) divided into two groups depending on their skills: 1) professional (30 people) and 2) beginner (30 people) dancers.

We used the electroencephalography method (EEG). The EEG signals were recorded in range of 4.0 to 35.0 GHz from 21 scalp electrodes, set according to a monopolar International 10-20 System scheme.

For statistical analysis, we used the 3-way MANOVA and the comparative post hoc analysis according to the Tukey criteria.

The processing was conducted in STATISTICA 13.0.

EEG recording was performed during wakeful relaxation (with eyes closed) and ideomotor performance of simple and complex movements of well-known rock-and-roll and dance improvisation. The EEG spectral power and coherence indexes were analysed.

Results. We found that ideomotor performance of familiar dance movements is accompanied by the decrease of cortex activity in low frequency band in occipital areas and its increase in high frequency band in frontal areas.

Differences in frequency-spatial organization of bioelectric cortex activity between the professionals and beginners during the ideomotor performance of the familiar movements are reflected in the power of intra- and interhemisphere connections between anterior and posterior areas (p≤0.05).

Ideomotor performance of dance improvisation compared to familiar movements is accompanied by the increase in EEG alpha activity. These differences are more pronounced in professionals as opposed to the beginners (p≤0.05).

The specific EEG pattern in professional dancers performing improvisation is activation of the predominantly left hemisphere cortex with high interhemisphere integration in beta band over the “creativity axis” (between anterior areas of the right and posterior areas of the left hemispheres).

Conclusions. Based on the results we can conclude that the EEG correlates of ideomotor performance of dance movements can be characterized by the special spatial-frequency organization of bioelectrical cortex activity and differentiated depending on the sort of movements and dancer’s professional level.

Visual Enhancement of Touch and Body Ownership: an ERP study
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Introduction

Multisensory integration of visual and tactile stimuli, simultaneously presented in the same spatial location, facilitate the
tactile detection and induce super-additive responses in the neural activity (Visual Enhancement of Touch, VET). Here, we asked whether and how VET is modulated by the sense of body ownership, by comparing conditions in which visual stimuli occurred near to the participant’s hand or to another person’s hand.

**Methods**

Thirteen healthy subjects underwent a VET paradigm in which event related potentials (ERPs) and reaction times (RTs) to tactile stimuli were recorded in two different scenarios, depending on the presence/absence of another person’s hand (‘With-Alien-Hand’/ ‘Without-Alien-Hand’). In both scenarios, tactile (electrical) stimuli were delivered to the participants’ hand, while visual stimuli (colored-led) could appear either near to or far from the stimulated hand. According to the specific scenario, far position could be either close to the alien hand or in an empty portion of the table. In the ERPs analysis, responses elicited by unimodal visual stimuli (V) was subtracted by those elicited by bimodal visuo-tactile stimuli (VT). The obtain (VT-V) waves were compared to the responses elicited by unimodal tactile stimuli (T). Both ERPs and RTs data were analyzed by means of a 2*3 repeated measures ANOVA with Scenario (With-Alien-Hand; Without-Alien-Hand) and Condition (T; VT Far; VT Near) as within subject factors.

**Results**

The point-by-point ANOVA on ERPs data showed that, in both scenarios, a super-additive response (VT-V>T) in the N2-P3 complex was present only when visual stimuli appeared near to the participant’s hand. Crucially, in the P3 component, this super-additive response to the Near condition was greater in the With-Alien-Hand than in the Without-Alien-Hand scenario (t= 4.41; p=0.0003). Behavioral results on RTs paralleled the ERPs findings showing a significant Scenario*Condition interaction (F_{2,16}=4.6; p<0.01) with faster RTs in the Near condition of the With-Alien-Hand compared to those of Without-Alien-Hand scenario (p=0.01).

**Conclusions**

Taken together, these preliminary findings suggest a body ownership dependent modulation of the multisensory integration process. Indeed, the super-additive response to visuo-tactile stimuli on the own hand is selectively boosted by the presence of another person’s hand, which makes more relevant for the system to implement an implicit self-other discrimination mechanism.

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**Interhemispheric frontal EEG alpha asymmetry psychological characteristics and somatic status**

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**Introduction.** The aim of the research was to evaluate associations of the interhemispheric frontal EEG alpha asymmetry, somatic and psychological peculiarities of the organism in search of the informative reliable markers of the constitutional integrity of the organism.

**Methods.** The subject of the study was the sample of 199 Moscow students, 130 females and 69 males (18-20 years old). The research included 20 anthropometric and 10 psychometric parameters. Heath-Carter somatotype components were used as somatic indices. A laterality coefficient (LC) for alpha band was calculated as follows: LC = ((L - R) / (L + R)) × 100. Spearman rank correlations between LC and psychometric and anthropometric characteristics were calculated. Comparison of the subgroups of males and females with LC<0 and LC≥0 using t-test (for parametric characteristics) and Mann-Whitney U-test (for nonparametric characteristics) was carried out as well.

**Results.** For males negative associations were found out between LC for alpha band as a whole and psychometric characteristics (self-regulation parameters, obtained from the questionnaires). No correlations between LC and somatic parameters in male group were revealed. On the contrary, a number of associations between LC and somatic features in female group were observed. Associations with somatic parameters, characterizing mesomorphy somatotype component, were obtained mainly. The most of such correlations were observed for LC in 7-9 Hz alpha-band, including negative associations with body weight, limbs circumferences, shoulder width, chest transversal diameter, forearm diameter, mesomorphy somatotype Heath-Carter component; positive association with ectomorphy somatotype component. The same for 9-11 Hz alpha-band: negative associations with body weight, limbs, chest and waist circumferences, shoulders width, chest transversal diameter and forearm diameter. No association between LC and psychometric characteristics were registered in female participants.

**Conclusion.** The results of the study support the finding of another episode of our research that psychological traits of females are determined mostly by somatic factors, while psychological traits of males – by EEG parameters.

Supported by RFBR grant 16-06-00248a.

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**PSYCHONEUROENDOCRINE STATUS OF WOMEN WITH THE THREAT OF INTERRUPTION OF PREGNANCY**

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According to statistics, among women on treatment in a gynecological hospital, 35% of women need specialized psychological help. The aim of the study was study the psychological and endocrine status of pregnant women with the
Introduction:
The situation of not being included by belonging to a group is known as social exclusion (Williams et al., 2000). When excluded by others, the fundamental needs of a person are threatened, which is a negative reaction to exclusion (Need-Threat; Williams, 2009). Need-Threat is reduced through experiencing inclusion by others (Tang & Richardson, 2013). Our previous study indicated that the reduction of Need-Threat by inclusive experiences in people with low trait self-esteem (LSE) was smaller than in people with high trait self-esteem (HSE). Moreover, attention allocation for signs of inclusion (stimuli that anticipate inclusion by others) was small in LSE, which could be the cause of the difficulty in ameliorating the effects of exclusion in LSE. We investigated whether amelioration from exclusion would be modulated by attention allocation for signs of inclusion in LSE. We used the event-related potential (P3b) reflecting the degree of attention to stimuli as an index of attention allocation.

Methods:
University students (20 women and 10 men, $\bar{x}$age $= 21.5 \pm 1.0$) participated in this study. They were divided into high and low trait self-esteem groups. Participants played a Cyberball task, in which throws to the participant are considered a sign of inclusion. Participants' Need-Threat score was assessed after each session of Cyberball that included exclusion and inclusion sessions. We instructed participants to count the number of throws they received (signs of inclusion) as a way of increasing attention allocation to signs of inclusion. We recorded EEG from 21 sites. Results were analyzed using two separate, 2 (exclusion/inclusion session) × 2 (high/low self-esteem) analysis of variance (ANOVA) with P3b amplitude for throws to the participant and Need-Threat score as the dependent variables.

Results:
The results of the ANOVA on P3b amplitude for throws to the participant indicated no main effects of session or self-esteem, nor any interactions. Moreover, the results of the ANOVA on Need-Threat score indicated significant interactional effects. The post-hoc test showed that LSE had higher Need-Threat score than HSE following an exclusion session ($p<0.05$). On the other hand, there was no significant difference between LSE and HSE following an inclusion session.

Conclusion:
There were no significant differences in P3b amplitude for signs of inclusion and Need-Threat score between LSE and HSE by counting the number of throws to the participant in an inclusion session. These results suggest that paying attention to signs of inclusion might modulate amelioration in LSE.
increasing, the diagnosis of the mental problem, however, depends on questionnaires and subjective judgment of doctors. An objective indicator of diagnosis would be very helpful.

Methods
A total of 98 participants (normal 36, depression 31, panic disorder 31) conducted about 30 minute-tasks which are composed of six sessions of each five minutes long depicted in Figure 1a. During executing the tasks, their electro-cardiac signal was measured and processed to extract 49 features of heart rate variability. All six sessions and the difference between two selected sessions were utilized to combine 256 signal domain shown in figure 1b. All extracted features were used in machine learning techniques, such as SVM, kNN, and DT, to classify normal vs. depression and normal vs. panic disorder for all 256 domains. The accuracy of all algorithms was averaged over 100 iterations and validated with 10-fold cross-validation.

Results
Figure 2 shows the results of classification for the mental disorders. For the classification of normal vs. depression, the SVM algorithm showed higher accuracy than the other two algorithms and the maximum accuracy was 73.00% at domain # 130 (including S1~S5 and D0). The standard deviation of the second half (129~256, including all single session S1~S5) of all domain was larger than that of the first half (1~128, including only three single sessions of S1~S3) of all domain. For the classification of normal vs. panic disorder, the SVM algorithm also showed higher accuracy than the others, and the maximum accuracy was 73.94% at domain # 1 (including S1~S3). The standard deviation of the first half of all domain was larger than that of the second half of all domain. The accuracy roughly goes down as the domain is getting complicated.

Conclusions
Features of the 256 domains of session combination, three algorithms were used to discriminate depression and panic disorder from normal, respectively. As a result, we were able to confirm which algorithm performed better, and which session contributed significantly to the classification accuracy. The accuracy distribution of two mental disorder case over 256 domains is different from each other. This also revealed that there exists an effective session for each mental disorder. If other bio-signals apply to those tasks, it could be helpful to diagnose various mental diseases in the near future.

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Linear discriminant analysis of multiple physiological signals for classifying psychiatric disorder
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Introduction: Psychiatrists have used a Diagnostic and Statistical Manual of Mental Disorders (DSM) as standard criteria including symptoms and diagnostic guidelines to diagnose psychiatric patients. Because this approach mainly relies on clinical interviews and self-report questionnaires answered by patients, recent researches have suggested physiological signals as indicators for an objective assessment of psychiatric diseases. The aim of this study is to classify major depression disorder (MDD) and panic disorder (PD) using physiological signals. Methods: Participants were 30 MDD patients, 31 PD patients and 40 healthy controls. Electrodermal activity (EDA), electrocardiogram (ECG), photoplethysmogram (PPG) and finger temperature (FT) were measured while participants perform psychophysiological profile (PPP) which consisted of 5 minute-long phases of rest, stress presentation (mental arithmetic test), and recovery. For features extraction of multiple physiological signals, the mean values of physiological parameters were calculated at the each three minutes except for the first- and last minute of these conditions. The extracted 13 features are as follows: skin conductance level (SCL), heart rate (HR), standard deviation of interbeat intervals (SDNN), root mean square of the difference of successive R to R intervals (RMSSD), number of successive NN intervals which differ by more than 50 ms (NN50), proportion of all N-N intervals that are larger than 50 ms (pNN50), very low frequency, <0.04 Hz (VLF), low frequency (LF, 0.04-0.15Hz), high frequency (HF, 0.15-0.4Hz), LF/HF ratio, total power (TP), respiration rate (RR), and mean of fingertip temperature (FT) from the acquired signals. Linear discriminate analysis (LDA) is used to classify of three groups. Results: The result indicates that LDA classifier performed 72.4% accuracy. Also, the LDA showed recognition accuracy of 66.7%, 81.7%, and 70.5% in depression, panic, and control groups, respectively. Conclusions: We identified that three psychiatric groups were discriminated using LDA classifier. The findings show that multiple physiological responses under PPP are able to discriminate the differential psychopathological diagnosis.

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Emphatic responses in facial muscles are modulated by attractiveness and gender
Introduction. The most primal component of empathy – emotional mimicry – involves the processing of perceived emotions and reacting with a similar affect. Two muscles, corrugator supercilli (CS) and orbicularis oculi (OO), could have special significance for the process of empathy with pain, however the involvement of the activation of the two muscles in the process requires further research taking into account other factors affecting emotional mimicry and pain. It is pointed out that the attractiveness and sex of the observed person have particularly strong relationship with the reactions of the facial muscles of observers, and that is why it is interesting to investigate how physical attractiveness and pain effect the level of reactions of the CS and OO facial muscles.

Methods. Thirty participants (15 women) took part in the study. They watched short video-clips, 16 with physically more attractive man and woman, 16 with less attractive man and woman, showing experiencing pain. EMG signal was registered with bipolar electrodes from CS and OO on the right side of the face. After the experiment, each participant filled in Polish version of IRI questionnaire. A 2 x 2 x 2 ANOVA was conducted, with the within-group factors of actor’s sex and attractiveness, and with between-subject factor of participant sex.

Results. Participants revealed stronger electrical activation of CS when observing less attractive actors’ pain, than in case of more attractive actors. In addition, facial pain expression of more attractive woman elicited stronger electrical activation of CS than the pain expression of more attractive man did. There were no differences between male and female, nor between more or less attractive actors expressing pain in the electrical activation of OO. The positive correlation between Personal Distress scale and electrical activation of the CS in case of female actors was revealed. No relationship between empathy scales and electrical activation of OO was revealed.

Conclusions. The reaction of CS muscle in response to observing another person’s pain is modulated by sex and attractiveness of people experiencing pain. At the same time, in case of OO muscle no such relation was observed. Similarly, only the CS muscle reaction was related to the level of Personal Distress of the observer: the higher the Personal Distress, the stronger CS reaction was. The present results suggests that the CS muscle is particularly active during empathizing with pain of other’s.

Influence on childhood emotional neglect and BDNF Val66Met polymorphism on psychological symptoms and cortical structures

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Introduction. The interactive effect of emotional neglect (EN) experiences in childhood and genetic factors is known to induce posttraumatic stress disorder (PTSD) symptoms. One of the polymorphisms involved in this gene-environment interaction is the Val66MET polymorphism of brain-derived neurotrophic factor (BDNF). This study is aimed to examine the interactive effect of EN and BDNF Val66Met polymorphism on the PTSD symptoms and cortical structures of the brain.

Method: A total of 255 participants were included, yet 19 were excluded due to insufficient data, which remained data of 236 participants (141 healthy volunteers and 96 PTSD patients) were executed for further analyses. T1-weighted structural magnetic resonance imaging, BDNF rs6265 genotyping through blood assessment, and psychological assessments were administered. The cortical thickness were analyzed using FreeSurfer and 2x2 ANCOVA was analyzed by SPSS 21.0.

Result: Significant interactive effect of genotype (CC, CT, and TT) by low/high EN were observed for severity of PTSD symptoms; CC homozygotes showed significantly more symptoms compared with TT homozygotes only when they experienced high EN. Differences of cortical thickness between people with CC homozygotes and people with TT homozygotes of high EN were observed for the left pars orbitalis and right entorhinal. The thickness of left pars orbitalis was positively associated with digit span score and negatively related with the score of blaming other, while the thickness of right entorhinal was negatively correlated with rumination score and positively associated with scores of putting into perspective, refocus of planning, acceptance, and positive reappraisal.

Conclusion: Results of this study suggest gene-environment interaction of EN and BDNF polymorphism could influence on psychiatric symptoms and changes of cortical structures. This study was supported by a grant from the Brain Research Program through the National Research Foundation of Korea (NRF) funded by the Ministry of Science, ICT and Future Planning (NRF-2015M3C7A1028252).

Forgiveness as an essential component of suicidality reduction

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**Background:** Traditionally, suicide has been viewed as violence towards the self. Although an increasing number of studies has examined the role of forgiveness in suicidal behaviors, little attention has been given to how different subtypes of forgiveness, namely forgiveness of self, forgiveness of others and forgiveness of situations, could alleviate the effects of depression on suicide. Hence, the aim of this study was to examine forgiveness as a moderator of the path between depression and suicidal behaviors.

**Method:** The sample was consisted of 305 participants of which 87 were males and 218 were females. The mean age was 41.05 (SD: 14.48; Range: 19 – 80). Depression, anxiety, and forgiveness (i.e., forgiveness of self, forgiveness of others, forgiveness of situation) were measured using the Beck Depression Inventory II, the Beck Anxiety Inventory, and the Korean Heartland Forgiveness Scale, respectively. Level of suicidality was measured through a structurized interview (i.e., Mini International Neuropsychiatric Interview).

**Results:** Depressive symptoms positively correlated with levels of suicidality. Results of hierarchical regression analysis showed that forgiveness moderated the path between depression and suicidality. Only forgiveness-of-self was a significant moderator; forgiveness of others and forgiveness of situation were not significant.

**Conclusions:** These findings suggest that suicide might be related with self-image and that forgiveness-of-self is essential in reducing levels of suicidality. It is suggested that self-acceptance and the promotion of self-forgiveness should be considered as an important factor when developing suicide prevention strategies.

Picture 1: https://www.eventure-online.com/parten-uploads/175/18001/add_1_442670_21fd0f87-39ac-4996-b97e-b67b55a5edaf.GIF

Picture 2: https://www.eventure-online.com/parten-uploads/175/18001/add_442670_21fd0f87-39ac-4996-b97e-b67b55a5edaf.GIF

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**The Influence of Emotions on Long Term Working Memory: An ERP study**
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**Introduction:** Enhanced attention and memory consolidation for emotional over non-emotional associated information has been well established in research. However, it remains unclear the extent to which different memory domains such as working memory and long term memory overlap and interconnect to process emotional information, as well as whether emotions facilitate the memory process for both positive and negative valence emotions. To fully understand the influence of emotions on memory, an old/new recognition paradigm was used while electroencephalography (EEG) was recorded; we then extracted neural responses (event-related potentials; ERPs) related to specific cognitive processes.

**Methods:** 45 young adult participants (28 females) aged 18-30 years (mean age =19.7±1.65), were recruited from the University of Ottawa. Participants completed a novel old/new recognition task on a computer. Matching and non-matching pictures (faces with emotional expressions: happy, neutral, and angry) were presented in the testing phase. Images were presented at different angles from the learning phase to also examine the interaction between working memory and long term memory.

**Results:** Front-facing images had faster reaction time and higher accuracy compared to images at different angles. Angry (µM<\slash> = 91%; 1081ms) and happy emotions (µM<\slash> = 92%; 1061ms) had higher accuracy and faster reaction time in comparison to neutral expressions (µM<\slash> = 88%; 1089ms), µp<\slash>< 0.01. Happy expressions elicited higher amplitudes in the P200 (µM<\slash> = 4.05µV), neutral expressions elicited higher amplitudes in the N200 (µM<\slash> = -3.30µV) and angry expressions elicited higher amplitudes in the N400 (µM<\slash> = 0.86µV), µp<\slash>< 0.05.

**Conclusion:** Participants had more difficulty recognizing faces at different angles relative to front-facing images, which require no mental reorganization after recall. Successful recall and reorganization of the images at an angle (accuracy above 85%) suggests working memory and long term memory are interrelated. Higher amplitudes in the P200 and N400 suggest enhanced processing for emotional over neutral expressions. These results support the claim of an emotional advantage in memory, specifically for positive facial expressions.

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**Time-frequency analysis of delta and theta oscillatory activity in attention deficit hyperactivity disorder**
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The aim was to search for oscillatory biomarkers that would serve as auxiliary criteria for diagnosis. The task was undertaken through the study of event-related oscillatory responses during cognitive processing. Participants were 70 unmedicated ADHD cases and 38 normal controls who were between 6 and 11 years of age (ADHD: 115.46±18.26 months, control: 119.18±17.75 months). All participants were right-handed and were within the normal IQ range (90-129). In ADHD, comorbidity served as an exclusion criterion. Tasks consisted of computerized Go/No Go (response selection) and Reversal
Task (response inhibition). Event-related responses were recorded (prestimulus: 500 msec, poststimulus: 1200 msec; Dt= 1 ms; cutoff between DC and 100 Hz. 3 dB, 12 dB/c) and preprocessed for baseline shifts, eye movements and muscular movements). Multivariate Analysis of Covariance (covariate: age) with Repeated Measures on the last factor showed a significantly longer reaction time in the ADHD group in the Go/No Go task. In both tasks, the error rate of the ADHD group was significantly higher. The extraction and identification of the oscillatory components were performed using time-frequency analysis technique (TFHA). Delta amplitude and theta duration discriminated the clinical from the healthy group. Findings suggest that the ADHD Group suffers not only from attentional processing (as represented by the theta oscillatory component) but also from cognitive processing (as represented by the delta oscillatory component).

Introduction

It is known that in adults the intensity of emotional reactions is associated with the nature of lateral preferences. It is shown that the increase in the number of left signs in the sensory and motor spheres correlates with the intensity of emotional reactions in various tests (Leutin, Nikolaeva, 2008). The evidence has been obtained that the difference in emotional reactions in people with different profiles results in a significant difference in the effectiveness of adaptive processes and the incidence of cardiovascular disease and neurotic disorders (Nikolaeva et al., 1993). At the same time, the data on the peculiarities of emotional response of children and its connection with lateral features is not enough to make unambiguous conclusions. According to the hypothesis explaining this difference in cardiovascular reactions to stress, people with the left profile have two centers of vegetative regulation-in the right and left hemispheres, whereas people with the right profile have only one center located in the right hemisphere. In this case, under the stress or in the process of adaptation, the activated right hemisphere produces an additional load on the right hemispheric center of vegetative regulation, which leads to a greater probability of cardiac disorders (Goldberg, 2003).

Methods. The assessment of the lateral preferences was carried out using a set of tests, the most common in the literature (Leutin, Nikolaeva, 2011). For the evaluation of cardiomyth variability the hardware and software complex “OMEGA-M” were used. The study took place in three stages, during each of them300 R-R intervals were recorded. In the first stage there was a record of 300 R-R intervals at rest in the background, at the second stage the records were done during recalling aboutrewards by children, and the third one duringrecalling about punishments in families. Results. 20% children in our sample were left handers. In the transition from a state of rest to a state of emotional situations in families the activity of the sympathetic part of the autonomic nervous system increased. These reactions were different in right handers and left handers: sympathetic activation was more severe in right –handed children.Conclusion. Heart rate changesof left-handed children are within their adaptation resources, heart rate variability of right-handed children was beyond their adaptation resources and the distribution of R-R intervals shown multimodal structure.

The study is founded by Russian Foundation of Fundamental Research, project #18-013-00721
synchronization (ERS) of MFT during encoding (I only) and maintenance (I, S, R). Furthermore, MFT was selectively enhanced in HC for S compared to I and R during maintenance (i.e., not due to task difficulty or source memory requirements). In contrast, despite clear presence of MFT, SZ patients failed to show significant MFT ERS or task-specific MFT modulations. **Conclusions**: These findings support previous evidence suggesting that MFT oscillations are closely related to WM processes in HC. Our new auditory WM paradigm allowed a functional dissociation of attentional “bottom-up” (I) and cognitive “top-down” (S) control processes, strongly suggesting that MFT is an electrophysiological correlate of inhibition of information stored in WM. Inasmuch as these measures reflect proactive control processes, SZ patients exhibited robust functional deficits of proactive control during these auditory WM tasks.

![Picture 1](https://www.eventure-online.com/parthen-uploads/175/18001/add_445601_da58f030-0114-4f67-b5ff-54354f0ec7f9.png)
**Caption 1**: Schematic for auditory WM tasks

![Picture 2](https://www.eventure-online.com/parthen-uploads/175/18001/add_1_445601_da58f030-0114-4f67-b5ff-54354f0ec7f9.png)
**Caption 2**: Task-specific modulations of MFT in HC (top) and SZ (bottom)

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**The Effect of Cognitive Load and Emotional Arousal on Liar’s Gaze Aversion Behavior**
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Gaze Aversion has been used as an indicator of lie in criminal investigation or research because it provides information of liar's inner state such as emotion and cognition. When liars experience anxious or difficult cognitive activities, they automatically avoid the eye-contact. The polygraph, which measures physiological responses such as blood pressure, and skin conductance, has been used in lie detection. However, since it estimates psychological state by measuring only physiological responses, truth tellers who experience emotional arousal such as anxiety could be possible to be regarded as liars. So, Gaze aversion can compensate for the drawbacks of the polygraph. Because Gaze aversion reflects automatic responses by emotional and cognitive load. However, researches on Gaze aversion are somewhat mixed because they did not consider the effects of emotion and cognition separately. The purpose of this study is to investigate the effects of emotional arousal and cognitive load by manipulating levels of arousal in tasks and question types on Gaze aversion in lie detection. 112 participants were randomly assigned to four liar groups. The study used a 2 (Emotional arousal: High stake, Low stake) x 2 (Cognitive load: High load, Low load) experimental design. High stake group performed a mock crime (i.e., stealing cash), while low stake group performed a mission (i.e., reading a letter). And then, the interview was conducted with questions to induce cognitive load (backward answer, forward answer). The fixation duration (mm) of Gaze aversion was measured using a wearable eye-tracker during the interview. As a result, although the emotional arousal was equally high, Gaze aversion was the highest in the high cognitive load condition and lowest in the low load condition \(\eta(1, 108) = 4.894, \text{adj.} \eta^2 = .043\). In detail, high stake – high load group showed most frequent Gaze aversion than other groups, while high stake – low load group showed most infrequent \(\eta(1, 108) = 3.266, \text{adj.} \eta^2 = .164\). These results indicate that high cognitive load group, compared with low group, showed more frequently Gaze aversion. However, the level of emotional arousal did not affect. This study found that Gaze aversion was more influenced by cognitive load than emotional arousal. Furthermore, this suggests that even though liars tried to control their eye-movement, they were more likely to avoid eye-contact when cognitive load was increased. Thus, it is expected to help identify lie detection of using Gaze aversion in the criminal investigation.

![Picture 1](https://www.eventure-online.com/parthen-uploads/175/18001/add_1_457461_28569efc-0531-498e-b2a6-f270cd21f04f.png)
**Caption 1**: Fixation duration (mm) of eye-contact

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**The Norms of Pupil Diameter and Eye Movements by Age and Sex**
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The polygraph measures the physiological responses including respiration, blood pressure, and skin conductance and it has been used in lie detection. However, it estimates psychological state by measuring only physiological responses also, the results of test could be manipulated by countermeasures which are anything that an individual do an effort to defeat. Although fMRI or EEG could be measured to compensate for this limitation, they also measure only physiological responses. So, eye-tracker is used to measure not only physiological responses but also behavioral responses. Pupil
Introduction: Electrodermal activity (EDA) changes in emotional disorders led to the hypothesis that it could be an important biopsychological trait in the etiology of depression. Major Depressive Disorder (MDD) is a psychiatric state due to psychological abnormalities and decreases EDA. However, previous studies measured a stable state with lack of stimulation conditions between MDD patients and healthy controls. Therefore, we propose a novel approach that EDA measures the physiological response to stimulations (i.e., induced stress) as a proxy for psychological processes and therefore it can be used to identify MDD patients and healthy controls.

Methods: For this purpose, 30 MDD patients and 31 healthy controls participated in the experiment. EDA was measured before, during, and after the Mental Arithmetic Task (MAT) for 5 min, respectively. Extracted EDA parameters included Standard Deviations of the SCL (SDSCL), Slope of the SCL (SSCL), Shannon entropy of the SCL (ShEnSCL), and Mean amplitude of the SCR (MSCR).

Results: SDSCL, SSCL, ShEnSCL, and MSCR during MAT were increased in both MDD patients and healthy controls, but there was significant difference of the increase between MDD patients and healthy controls. Additionally, resilience was lower in MDD patients than in healthy controls. The results of this study indicates that MDD patients had lower psychophysiological reaction under induced stress compared to relaxation states than in healthy controls.

Conclusions: Our results suggest that these extract EDA parameters of interest have the immense potential to provide objective decision contributing to the precise diagnosis and effective treatment of depression.
V. Kirenskaya

Hypnotizable

The psychophysiological study of early stages of attention and information processing in high and low hypnotizable persons.

Method:

Twenty-one participants with trauma saw an S1 stimulus that was either a minus sign ("-"), a plus sign ("+") or a equal sign ("=”) preceding a picture (S2). The S1 stimulus respectively cued whether the S2 stimulus show 4000 ms later was a negatively valenced picture, a positively valenced picture, or a neutral picture. EEG was monitored at 32 channels using a BioSemi Active II amplifiers (Amsterdam, Netherlands) and a mastoid reference. The late wave of the SPN was operationalized as the average amplitude of the 2000 ms prior to the onset of the S2 (picture) stimulus.

Results:

The late wave of the SPN to negative pictures did not vary significantly as a function of PTSD scores as predicted. There was also no significant relationship with dissociation or PTSD scores.

Discussion:

An initial investigation of the relationship between the SPN and psychopathology scores was not significant. Those with higher PTSD scores did not show showed larger SPN's in anticipation of the negatively valenced pictures. However, the sample was a community sample without a wide range of trauma and fairly mild symptom profiles. In addition, the negatively valenced had fairly low arousal ratings suggesting that the stimuli may not have been aversive enough. A second, larger sample is currently being collected in which PTSD symptoms are more significant and using a revised paradigm with more arousing negative stimuli.

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Effective connectivity between prefrontal cortex and right temporal parietal junction underlying deception

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Introduction.

The way brain processes deception remains one of the most controversial issues in current psychophysiology. Yet the question remains - which brain processes are involved in the execution of deceptive actions and how are they combined to mislead an opponent. Experimental findings revealed both in behavioral and neuroimaging studies, exhibited a number of processes which might impact deception execution. There are action inhibition for overcoming default tendency to act honestly, action selection to choose the most appropriate action to current behavioral goal and error detection as an automatic reaction to inappropriate stimulus response mapping. In addition to that, recent evolvement of ecologically valid experimental paradigms demonstrated the possibility of involvement of socio-cognitive processes need for with thinking about beliefs and expectations of others. It was shown that the right temporo-parietal junction (rTPJ) was specifically involved in the execution of manipulative honest and deceptive claims. The current study was aimed to extend those findings by investigation of changes in effective connectivity between rTPJ and regions of prefrontal cortex.

Methods.

Based on recent fMRI study of 24 healthy subjects (aged 19–44 years, 14 women) performed in the interactive game settings, the deceptive and honest claim executed to misled an opponent were associated with the involvement in functional interaction of both left and right IFG and right TPJ. Dynamic causal modeling (DCM12) was applied to reveal effective connectivity associated with deceptive or honest claim execution by modeling possible effective connections between prefrontal and rTPJ nodes.

Results.

As a result DCM analysis revealed the circuit comprising directed effective rTPJ-lIFG-rIFG connections differently modulated by the execution of manipulative honest and deceptive claims. Deceptive claims were characterized by greater positive modulatory influence of rPTJ over the left IFG. Execution of honest claims were associated with greater inhibitory control mediated from rIFG on the rTPJ.

Conclusions.

The obtained experimental findings argued for the greater involvement of action selection processes in deception execution modulated by socio-cognitive processes and favored the idea of greater involvement if inhibitory control exerted by right IFG needed for the manipulative honest claims, which can be considered as an example of sophisticated deception.

Acknowledgements. The study was supported by the Russian Science Foundation grant #16-18-00040

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The psychophysiological study of early stages of attention and information processing in high and low hypnotizable persons

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Deficit in selective attention in children with hypoxic-ischaemic encephalopathy
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Funding: The research was supported by Russian Foundation for Basic Research, grant 15-06-06491A.
Introduction: It is known that children, born with Hypoxic-ischaemic Encephalopathy (HIE), have a risk for neurocognitive deficits, especially for deficit in executive abilities. However, executive abilities include different functions, particularly, selective attention, working memory, voluntary control, abilities for programming and so on. Do children with HIE have global deficit in executive abilities? The goal of this research was to examine the hypothesis that children, born with HIE, have not global deficit in executive abilities.

Methods: The experimental group included 27 children aged 7–8 years (M=7.39 years, SD = 0.39, 19 boys and 8 girls). They were born full-term with perinatal Hypoxic-ischaemic Encephalopathy. The control group included 27 typically developing children (M=7.20 years, SD = 0.45, 19 boys and 8 girls). The children from experimental and control group were matched for gender and age. Children from both groups were assessed with subtests from Luria’s child neuropsychological assessment battery. These subtests are designed to assess selective attention and abilities for programming.

Results: One-way ANOVA has revealed group differences in selective attention - F(1,52)=35.52. Children, born with HIE, were less successful in performing selective attention task in comparison to typically developing children. However, we have not revealed significant differences between children from experimental and control group in abilities for programming - F(1,52)=3.42.

Conclusion: This study has shown that children with HIE have deficit in selective attention, but they do not have weakness in the abilities for programming. In view of the obtained results it can be assumed that Hypoxic-ischaemic Encephalopathy has specific negative effect on development of selective attention in children. However, it is necessary to do further research into the impact of Hypoxic-ischaemic Encephalopathy on development of executive abilities in children to reveal this impact on different executive functions including working memory, voluntary control and so on. Also we need to do these researches on different age groups.

Funding: The research was supported by Russian Foundation for Basic Research, grant no. 15-06-06491A.

Picture 1: https://www.eventure-online.com/parthen-uploads/175/18001/add_1_457584_cdc96ff4-a17f-434a-aa5e-e47ceac11b46.png

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Age-related differences in task-related and unrelated detection of stimulus change
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Introduction. The aim of our study was to investigate the processing of distracting stimuli in the visual modality by studying the effect of task-irrelevant features of imperative cues on behavioral and brain electric activity. A new version of the auditory oddball distraction paradigm was applied: A response was required to a frequent or rare (distracting) change in the properties of an object. ‘Surprise’ (Nogo) stimuli were also introduced. Older and younger participants were compared to study the effect of aging. Distraction-related components (N2b and P3a) for rare and the P3b component for ‘surprise’ stimuli were expected. For older participants larger behavioral distracting effects, diminished N2b and P3a, and a delay of all components were expected.

Methods. A dark grey disc with a bin underneath was presented. The participants (18 in each age group) reacted as fast as possible to a change in its light intensity (Experiment 1) or color (Experiment 2) with a keypress. A late response meant that the disc fell into the bin. For rare stimuli the change included a distractor - a schematic face. For ‘surprise’ events the bin disappeared, and the participants had to withhold the keypress. Event-related potentials (ERPs) to the change were measured and analyzed.

Results. Performance was worse for the ‘surprise’ stimuli in Experiment 1, but only in the younger group; in Experiment 2 it showed a ceiling effect. An effect of stimulus type emerged only in Experiment 2 with both groups performing better and being faster for the rare than for the rare stimuli. Younger participants were faster overall. The preliminary EEG analysis (at Fz, Cz, and Pz) shows for both experiments: (1) a larger and later frontocentral negative deflection (N2 range), a larger and later centro-parietal and a larger and earlier parietal positivity (P3 range) for rare stimuli; (2) a larger and earlier frontocentral and a larger and earlier parietal positivity (P3 range) for ‘surprise’ stimuli; (3) a frontocentral positivity (P2 range), larger for the rare stimuli in older participants. In general, ERPs were diminished and with a longer latency for older participants.

Conclusions. Behaviorally the pattern of results was similar in both age groups with stimulus type affecting only the more difficult task. However, the applied oddball paradigm was successful in eliciting the expected electrophysiological activity (N2b and P3a for the rare stimuli and P3b for the ‘surprise’ stimuli) and differences in processing distracting stimuli in both age groups.

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Reading in Russian early schoolchildren: eye-tracking and neuropsychological data
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Reading in Russian early schoolchildren: eye-tracking and neuropsychological data
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Introduction.
In our study, we investigate eye movements during silent reading (in Russian) in early stages of this skill acquiring. The first aim of the study was to create appropriate stimuli for eye-tracking studies of reading in Russian speaking children. The second aim was to test the widely known effects of words length and frequency onto eye movement activity. The third aim of our study was to analyze the relationship between the characteristics of eye movements and state of cognitive functions, namely executive functions, auditory and visual-spatial information.

Methods.
We developed the corpus of sentences for early schoolchildren. The corpus consists of 30 sentences with target words controlled for length and frequency. The eye movement data were collected for a group of 73 schoolchildren of second grade (average age is 8.9 ±0.33 years old) during sentence reading with EyeLink 1000 eye-tracker (SR Research, Ontario, Canada). All subjects passed a neuropsychological assessment adapted for children of 6–9 years old. Three integrative indices were calculated based on the results of the examination. They reflect the state of the following functions: (1) executive functions; (2) auditory information processing, and (3) visuospatial information processing.

Results.
The results showed that effects of words frequency and length were similar to the corresponding effects found in other languages. The number of fixations was greater and their durations were longer in longer words and in less frequent words. The covariance analysis showed that the functions of visual-spatial information processing and executive functions affect the organization of the eye movement activity during reading. The weakness of executive and visual-spatial functions results in increasing the number of fixations and their duration. We did not find any significant influence of the auditory information processing onto the eye movements activity. The role of the latter function remains unclear and requires further investigation.

Conclusion.
In our study the analysis of eye-movements during reading in Russian schoolchildren allowed to replicate effects of words length and frequency. Also the importance of executive functional and visual-spatial information processing in reading on early stages of the skill formation is shown.

The study was supported by Russian Foundation of Basic Research, project 16-06-00374

FEATURES OF STUDENTS’ SENSORIMOTOR INTEGRATION UNDER VARIOUS INTELLECTUAL WORKLOADS
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Cognitive processes which lie in the basis of the studying process are connected with perception and information processing processes (Winne, Nesbit, 2010). Effectiveness of those cognitive processes is governed by is determined by the features of plastic reconstructions in the brain (Sung, Ogawa, 2009) and by specific of mobilization processes that allow learning required material in short terms (Irani e.a., 2009).

Objectives. The main objective was investigation of the readiness of students to cope with educational workloads of various sizes and difficulties. To achieve that goal 87 full-time students of the 18,3±0,9 average age, 56 full-time students of the 22,2±1,01 average age and 61 distance learning students of 27,6±5,9 average age were involved in this study.

Methods. The reflexometry method was applied to assess regulatory level of students’ functional state. That method allowed describing the state of the sensorimotor integration, which is based on the plasticity of neural processes. Two basic fractal signal series presented as sensor chains with visual and acoustic stimuli of the short exposition times were described. The first series allowed determining the speed characteristics of sensorimotor responses to all stimuli. The second series made it possible to evaluate the students’ ability to form inhibitory reactions and the speed characteristics of sensorimotor integration when students were solving the visual differentiation exercise.

Results. It was found that all studied students demonstrated an average level of sensorimotor integration. When students were performing the sensorimotor exercise, determined reaction times for sound and color had only small differences in different focus groups, revealing higher values in groups of students of higher age. The mentioned differences in results originated from reaction features: amount of passes and false starts was found dominating for majority of students, but was determined higher for students of higher age and students learning distantly. It was showed that when students were performing a complex sensorimotor task, all of them did mistakes, the reaction time increased and the number of missed signals increased sharply.

Conclusions. Our investigation showed that university students do not have a high level of psychophysiological readiness to cope with the educational stresses of higher education. Being exposed to increasing educational stresses the students demonstrated abrupt decline in the investigated characteristics missing signals and doing mistakes, which should indicate the not sufficient levels of cognitive mobilization and of sensorimotor integration.
THE METHOD OF BURNOUT SYNDROME DIAGNOSTIC USING EYE TRACKING

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The burnout syndrome includes three distinct states in which people feel emotional exhaustion, display a detached attitude towards others and experience a low sense of their efficacy at work. One of the most known methods of burnout syndrome evaluation is the Maslach Burnout Inventory (MBI). MBI consists of three scales – emotional exhaustion (EE), depersonalization (DEP) and reduced personal accomplishment (RPA). The aim of this study was to develop a new method of burnout syndrome diagnostic in athletes using the eye tracking technique. 48 professional figure skaters (ice dancers) with experience in skating of more than 10 years participated in this research. According to their results providing by MBI figure skaters were divided into 3 groups: persons with great values of RPA, persons with great values of DEP and persons with low burnout level. The experiment session involved 32 presentations of matrices (2x2) containing 4 images. Each matrix consisted of photos of award, competition, failure and neutral image and was presented for 5 s in pseudorandom order. Eye movements were recorded binocularly (SMI RED 120; 120 Hz) while participants visually explored an image. Two-way ANOVA with repeated measures revealed the significant differences in eye movement parameters between groups of participants (F=4.220, p<0.01). Fixation count and fixation duration were significantly lower in RPA group while they observed the images of awards in comparison to other groups. At the same time these eye movement parameters were significantly lower in DEP group only for competition image. RPA and DEP groups also payed more attention to failure images than to neutral photos. Subjects with low burnout level did not demonstrate any differences in eye movements for different images. Thus the results showed that figure skaters suffering from burnout syndrome are tended to avoid images related to one of the burnout manifestation. The motivational sphere impairment is suggested to be a reason of such avoidance behavior. Eye-tracking data as a behavioral indicator was in consistent with questionnaire results. Therefore the developed method may be considered as an objective burnout syndrome diagnostic procedure.

Hemispheric asymmetry in the perception of asymmetric faces

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Introduction. Emotions are perceived differently depending on the asymmetry of the facial expressions, but the role of the lateral asymmetry of the brain functions in the perceiving subject remains unclear. Dominant eye can influence the evaluation of emotions expressed in different halves of the visual field (i.e. different halves of the perceived face). Methods. 32 right-handed healthy subjects took part in the experiment: 20 with a right dominant eye (group ‘right’), 12 with a left dominant eye (group ‘left’). The aim of the experiment was to reveal specific brain activity in process of evaluation of the facial emotional expressions depending on dominant eye. The subjects were asked to evaluate symmetrical and asymmetrical facial images with various strength of expressions of basic emotions generated by the FaceGen software. A block paradigm was used: 16 seconds - task (stimuli were presented randomly for 1500 ms, a black screen was presented between stimuli for 1067 ms), 16 seconds – rest (black screen). This block was repeated 5 times. The fMRI images were obtained by a T2*–weighted using a 3T MRI scanner (Siemens Magnetom Verio). The image acquisition parameters: 65 slices, TR=2200 ms, TE=25 ms, voxel size=2x2x2 mm, FA=90°, MB 5 (CMRR) block design and SPM12 software were used. Results. Group ‘right’ had the following structures activated in the task (p unc. <0.001): left posterior cingulate gyrus, right and left precuneus, left angular gyrus, left cerebellum exterior, left fusiform gyrus. Group ‘left’ (p unc. <0.001): right inferior occipital gyrus, right precentral gyrus, right middle frontal gyrus, right fusiform gyrus, right lingual gyrus. In the contrast analysis ‘right’ > ‘left’ groups following structures were activated (p unc. <0.001): right inferior occipital gyrus, left occipital fusiform gyrus, right hippocampus, right posterior orbital gyrus, left and right thalamus. There were no significant results for ‘left’ > ‘right’ contrast. Conclusions. There are systematic differences in the activation of brain structures in subjects with left vs right dominant eye in process of evaluation of facial expression.

The research was financially supported by the Russian Science Foundation, project 16-18-00066, and the Supercomputing Center of Lomonosov Moscow State University (non-financially).

Speech perception of preschool children in real-life classroom noise
Children’s speech perception in noise is more impaired than adults’ speech perception (Klatte et al., 2013). Previous studies on children’s difficulties with speech perception in noise have studied the effects of attention, phoneme processing, and memory (e.g. Klatte et al., 2013; Thompson et al., 2017). Those studies also have focused on the difficulties in school-aged children, hence few studies are available on the difficulties in preschool children with immature cognitive skills. The purpose of the present study was to measure the speech perception ability of preschool children in real-life classroom noise. Twenty-three native Japanese preschool children (mean age ± standard deviation, 5.4 ± 0.5 years; age range, 4.6-6.4 years) participated in a speech perception task. All of them were normally developing children. 10 Japanese words with two-syllables vocalized by a female adult were used as target words. The stimuli were mixed digitally with white noise (WHN) or classroom noise (CRN) at different signal-to-noise ratio (SNR): 6dB, 0dB, and -6dB. The CRN was obtained using a handheld recorder and binaural microphone placed at the center of a room where children were playing freely in a kindergarten. All test signals and noise were presented bilaterally through headphones using an audiometer. All stimuli were presented at 60dB. Participants performed individually and were asked to recall orally each of the words perceived. In CRN, the rate of correct answers in children aged 4–5 years was lower than that in children aged 5–6 years [\( \langle \bar{X} \rangle F(1, 21) = 7.58, \langle p \rangle < .05 \)]. Regardless of SNR, speech perception was more difficult in CRN than WHN [\( \langle \bar{X} \rangle F(1, 21) = 80.31, \langle p \rangle < .01 \)], and performance declined as SNR decreased [\( \langle \bar{X} \rangle F(2, 42) = 73.91, \langle p \rangle < .01 \)]. Moreover, there was a significant correlation between age in months and the rate of correct answers for the CRN-6dB condition [\( \langle r \rangle (22) = .47, \langle p \rangle < .05 \)]. The present study demonstrated that speech perception is more difficult for preschool children in CRN than in WHN, and the ability to perceive speech in CRN is affected by cognitive development. Thompson et al. (2017) reported that developmental improvement in speech-in-noise perception is related to attentional abilities. Our findings suggest that speech perception in younger children might be considerably affected in classroom noise due to immature auditory selective attention.

Modelling of state of emotional resonance in conditions of deprivation
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Introduction
The main problem within the psychophysiology is the analysis of information transfer mechanisms from one person to another by means of its emotional sphere. This sphere is involved in the organization of behavior by means of the long process of excitation circulation through the structures of the limbic system and involvement in this state of other functional structures of the brain. However, the mechanism of emotional transmission is not fully defined. There is an assumption that it is based on ultra-weak radiation of non-warm intensity, perceived by the human body.

Methods. We have studied the state of emotional resonance with two methods. The first method is to activate the recipient emotional state by the influence of a video fragment, which destabilize emotional background of recipient. The second method is to activate the recipient emotional resonance caused by the effect of the video fragment on its issuers. The reaction of the recipients was assessed by recording the heart rate in conditions during and after watching the video. The total duration of heart rate recording was 25 minutes. The impact assessment was carried out by the method of correlation rhythmogram, as well as with spectral analysis of cardiorhythmogram synchronized with the stages of the specified impact.

Results. There was a 2-fold increase in the power of the VLF-component of spectral analysis by the end of exposure, which is considered as an indicator not only of the suprasegmental level of activity of the sympathetic nervous system, but also an indicator of activity of the neurohumoral system of heart rate regulation. The variability of the mathematical analysis indicators of cardiac rhythm was less pronounced: values of variation range, the coefficient of variation and standard deviation of the normal R-R intervals values. The results of the nonlinear method of HRV scattergram analysis confirm that in two models of the study an autoregressive cloud is formed on the bisector of the coordinate angle, whose shape determines two types of reaction. The first type reflects the stabilization of rhythm; the second type probably reflects moderate sine arrhythmia, presented in the form of an ellipse.

Conclusion. Thus, the emotogenic video, used as a factor of emotional state and emotional recipient resonance activation, causes an increase in heart rate variability, mainly due to a significant contribution to the regulation of the functions of the humoral-metabolic component of the heart rate power.

The influence of color on emotion in visual stimulation: An event-related potential study
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Frontal-limbic brain activation during an emotional face processing task in patients with melancholic depression.

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Abnormal emotional perception may lead to neural disadaptation and contribute to the etiology of depressive symptoms. Evidence from behavioral and neuroimaging studies support the presence of emotional face processing and emotion recognition deficits in patients with MDD (Brockmeyer et al., 2013). In comparison with healthy subjects, patients with MDD exhibit decreased brain activation in frontal areas and increased activation in limbic regions in response to emotional stimuli (Zhong et al., 2011). However, hyperactivity in the rostral anterior cingulate gyrus, dorsolateral prefrontal cortex (DLPFC), and left inferior frontal gyrus has also been described (Van Wingen et al., 2012). However, they could not produce the required perceptually challenging condition. Color is known to facilitate outlining of pictures. Thus, this study investigated the influence of color on emotional perception with a manipulated spatial frequency by using LPP.

Methods:
Twenty-three university students (10 women and 13 men, aged 20.5 ± 0.9 years) participated in this study. For stimuli, 72 pictures (24 pleasant, 24 neutral, and 24 unpleasant) selected from the International Affective Picture System and free images on the Web were used. The arousal level of all pictures were stabilized. Analysis of variance of picture content (pleasant, neutral, and unpleasant) × color (color and grayscale) × spatial frequency (normal and low-passed) was performed for emotional perception and LPP amplitudes. The participants evaluated emotional perception with the Self-Assessment Manikin scale. The LPP amplitude was calculated time-locked to a stimulus onset.

Results:
The emotional perception (unpleasant rating) was statistically significant in the main effect of content and increased in the order of unpleasant (3.0 ± 0.1), neutral (4.5 ± 0.2), and pleasant (5.9 ± 0.1) (p < .05). For LPP amplitude, the main effects of content and spatial frequency were significant. The LPP amplitude increased for the pleasant pictures (8.3 ± 1.0 µV) as compared with the neutral (7.1 ± 1.0 µV) and unpleasant pictures (7.1 ± 1.1 µV) (<p> < .05), and for normal pictures (8.6 ± 1.0 µV) as compared with the low-passed pictures (6.4 ± 0.9 µV; <p> < .05).

Discussion:
In this study, we could not observe the influence of color on emotional perception. However, the LPP amplitude for the normal pictures was larger than that for low-passed pictures. As LPP seems to reflect the cortico-limbic activation and defensive motivation (Codispoti et al., 2007), we suggest that low-passed pictures might weaken the degree of motivation.

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Fact and fallacy of EEG connectivity
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The investigation of brain functional connectivity from channel level EEG data is still common practice in clinical applications. Nevertheless, channel level functional connectivity analysis can easily lead to wrong conclusions. For example, if one would unrealistically assume that only one brain area is active, all sensors would measure the activity of this area inducing a fallacious connectivity profile between EEG channels even in the absence of any brain functional connectivity. In this case, solving an electromagnetic inverse problem would clarify the presence of only one active brain source by providing an estimate of its location and strength. Unfortunately, fallacious results can arise also when functional connectivity is estimated at the level of brain sources. Indeed, the estimated activity of one brain source is influenced by and influences the activity at other brain locations in a way that depends on the properties of the specific inverse method used. This is quantified, e.g., by the Point Spread and Cross Talk Functions (Hauk et al. 2011). For example, the spatial dispersion of the Cross Talk Function informs about how different brain areas (erroneously) contribute to the reconstructed activity of a given brain source, thus providing an index of the disposition to fallacious connectivity of the inverse method used. Additionally, different connectivity metrics show different sensitivities to this issue. These facts need to be taken into account when estimating EEG functional connectivity in order to design reliable analysis pipelines.

A Study on the effect of modulating the quality of sleep by brainwave music
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In this study, we tried to examine the effect of brainwave music on sleep. In the behavioral experiment, we used Pittsburgh sleep quality index (PSQI) to explore the modulation of different brainwave music, for example, the rapid-eye-movement (REM) sleep brainwave music, the slow wave sleep (SWS) brainwave music on sleep. 20 healthy subjects (mean age 19.2 ± 0.96, 3 females) were recruited, dividing into the REM group and the SWS group. All the participants were instructed to listen to the musical stimuli for 30 minutes before they slept per day, and this process lasted for one week. Additionally, they filled out the PSQI questionnaire before and after the experiment. Their EEG data was recorded during sleeping in order to find the brain mechanism for musical intervention. The result of the behavioral data showed in Table 1 demonstrated that the sleep quality of the SWS group was improved. However, the sleep quality of the REM group had no significant change. Meanwhile, EEG data showed that spectral density increased in the range of low frequencies (0-3Hz) but decreased in the range of high frequencies (above 12Hz) after music intervention (Figure 1). Our work showed that SWS brainwave music might provide a potential tool for improving the quality of sleep if these differences can be confirmed by more data.

Cortical reactivity to emotional movies is shaped by viewer's empathy: Evidence from Gamma EEG activity
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Empathy underlies the ability to understand others’ emotional state and resonate with them in a coherent response. In order to increase our knowledge of how empathy affects emotional reactivity, the present study investigated the relationship between trait empathic abilities and cortical activation during different affective states elicited by ecological stimuli. 41 women, divided in High and Low empathy groups according to the IRI test score, watched 8 movie clips of four emotional categories (Erotic, Fear, Compassion and Neutral, average duration: 2 min each) while subjective evaluation and EEG activity were recorded. Emotional Valence and Arousal were analyzed with linear mixed-effects models including Film Category and Group as predictors and an F-test to evaluate their significance. A significant Film by Group interaction was found for both Valence (F(3,152)=3.1, p < 0.05) and Arousal (F(3,114)=4.65, p<0.05), and revealed that HIGH compared to LOW empathy participants rated all the emotional clips as more arousing, while the Fear clips were perceived from them as more unpleasant. Cortical reactivity was analyzed by computing spectral power in the Gamma EEG band (35-49 Hz) recorded in the last 30 seconds of the excerpts. We first identified the model that best fitted to the data, using multilevel modeling and adopting a model selection strategy based on AIC values, and then carried out an F test to evaluate the significance of each predictor. The Film by Group significant interaction (F(3,1404)= 4.69, p<0.001) showed in the HIGH empathy group a greater cortical activation to all the emotional categories compared to the neutral, whereas in the LOW empathy group an increased response only to the negative (Compassion and Fear) compared to the neutral clips was found. We also reconstructed source activation, using sLORETA, and correlated source activity with self-reported arousal.
score. Analysis showed in the HIGH empathy group and to Compassion movies only, a positive correlation in the right parietal region. Taken together, the present results highlight that higher levels of empathy are associated to greater sensitivity to all emotional stimuli, both at subjective and cortical level. Furthermore, specific processing of Compassion clips was found in the HIGH empathy group only with the main source being located in brain regions involved in attention and multimodal integration. This result is interesting because it provides evidence that a specific stimulus category designed to elicit prosocial behavior is characterized by distinctive cortical processing in people with high levels of empathy.

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Cerebellum and attention networks functioning: findings from a cerebellar transcranial Direct Current Stimulation and Attention Network Test study
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Introduction: The functional domain of cerebellum extends beyond its traditional role in motor control. In recent years this structure has increasingly been seen as playing a crucial role also in cognitive performance and attentional processes. Attention is defined as the ability to appropriately allocate the cognitive resources to relevant stimuli and, according to Posnerian model, three interacting brain networks, naming alerting, orienting and executive, modulate attentive processes. The aim of this study was to investigate the possible influence of cerebellum in the functioning of the aforementioned attentive networks, using transcranial Direct Current Stimulation (tDCS) delivered over the left cerebellar hemisphere, combined with the Attention Network Test (ANT).

Methods: Fifteen healthy subjects underwent a cathodal, anodal and sham stimulation, in three separate sessions and performed the ANT task prior and after each tDCS session. The main ANT outcome measures (i.e. the efficiency of the alerting, orienting and executive networks and the mean overall RT) were analyzed separately by means of ANOVA for repeated measures, with experimental “condition” (cathodal, anodal, sham) and “timing” (pre-tDCS and post-tDCS) as the within-subject factors. The overall accuracy was calculated as the percentage of correct responses for each ANT session. Moreover, in order to evaluate whether the tDCS stimulation exerted any effect on a specific target, cue or cue-target combination, an ANOVA for repeated measures was conducted, with “cue” (NC, DC, CC, SC), “target” (C, I, N), “timing” (pre-tDCS and post-tDCS) and experimental “condition” (cathodal, anodal, sham) as the within-subject factors.

Results: The efficiency of alerting and orienting network was similar for each tDCS sessions. Only cathodal cerebellar tDCS significantly reduced the efficiency of the executive network (p=0.002). After anodal and sham tDCS, a significant reduction in RT emerged for both congruent (anodal: p=0.06; sham: p=0.04) and incongruent targets (anodal: p=0.09; sham: p=0.06). After cathodal tDCS, a reduction bordering of significant emerged only for congruent target (p=0.08).

Conclusions: These results showed that only cathodal cerebellar tDCS has selectively perturbed the functioning of the executive attention network, possibly inducing a functional cerebellar inhibition. In particular, after cerebellar modulation a specific difficulty in the processing of error-conflicting stimuli occurred. We speculate that cerebellum influences the functioning of the attentive executive network both indirectly coordinating the functioning of frontal and parietal areas involved in the perception of conflicting signals and directly making predictions of errors or behaviours related to errors.

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The Central-Peripheral Trade-off Effects Elicited by Negative Emotional Stimuli in Directed Forgetting: ERP Evidence from the Encoding Phase
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Introduction
Researchers usually explored directed forgetting of negative emotional memory by using emotional stimulus as materials such as words, pictures, or videos, and analyzed memory performance of emotional stimulus as a whole in their experiments. In the present study, we used complex emotional pictures that were created by center items and peripheral background composite visual pictures were used in study phase, which were created by placing negative or neutral items onto negative or neutral background scenes. 208 item and 208 background pictures were used in test phase.

Methods
Participants: Participants were 32 healthyright handed undergraduates from Shandong Normal University(10 males and 22 females, mean age=20.2 years), with normal or corrected-to-normal vision.
Materials: 104 colourful item-background composite visual pictures were used in study phase, which were created by placing negative or neutral items onto negative or neutral background scenes. 208 item and 208 background pictures were used in test phase.
Design: The present study used a 2×2 factorial design with emotional valence of center item: neutral, negative) ×2(emotional valence of peripheral background: neutral, negative) ×2(cue: remember, forget) within subjects experimental design. The dependent variable was memory performance, including center item recognition correct rate, peripheral background recognition correct
rate, and ERP data in encoding phase.

Results
The behavioral results showed that directed forgetting of center items and peripheral backgrounds has different patterns: only center items showed directed forgetting effect, but peripheral backgrounds did not. Both emotional valence of center items and emotional valence of peripheral backgrounds did not affect directed forgetting of center items themselves. Further, there was no trade-off effects between negative items and neutral backgrounds, but there was a trade-off effect between neutral items and negative backgrounds. Such results indicated that memory trade-off of complex emotional memory not only appeared in neutral background condition but also appeared in negative background condition. In addition, ERP results showed that R cue induced a P3b, which related to selective rehearsal; F cue induced a frontal P2, which associated with inhibitory control.

Discussion/Conclusion
The present study shows that both attention inhibition and selective rehearsal in encoding phase play important roles in directed forgetting.

Key words: directed forgetting; negative emotional memory; center-peripheral memory trade-off; ERP

Picture 1: https://www.eventure-online.com/parthen-uploads/175/18001/add_1_461222_cfc9894d-c7d4-477e-b4db-b03fcf6309dc.pic_hd.png

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Visual and auditory system interaction: an fMRI study
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Introduction.
Interactions between different sensory modalities play an important role in forming of integral perceptual model of the world. An interaction between visual and audio modalities (audio-visual integration) has the most important function. Previous audio-visual integration studies usually used simple stimuli as geometric figures and audio tones which are not naturally associated in ecological valid setting (for example, as voice and face of close familiar person).

Methods.
The study involved 33 healthy right-handed participants (18 female), 22.3±1.8 y.o. The fMRI images were obtained by a T2*-weighted using a 3T MRI scanner (Siemens Magnetom Verio), block design and SPM12 software (FWE p<0.05) were used. The image acquisition parameters were as follows: 65 slices, TR=2200 ms, TE=25 ms, voxel size=2x2x2 mm, FA=90°, MB 5 (CMRR). To study audio-visual integration photos and bleating of sheep were used as stimuli. These stimuli were naturally molded into polymodal images and didn’t represent personal experience of the participants. 7 pictures and 7 sounds were used. Each picture was matched with a corresponding sound. Experiment consisted of 5 sessions. In first session (1) only pictures and in second session (2) only sounds were presented with task to passively perceive stimuli. In third session (3) the picture and the corresponding sound were simultaneously presented with the same task and bimodal associations between a sheep’s ‘faces’ and bleats were formed. In fourth (4) session sheep’s faces were presented and participant had to imagine corresponding sound, and in fifth (5) session vice versa. (4)>(1) and (5)>(2) contrasts as well as 1 to 5 series separately were analyzed (FWE p<0.05).

Results.
We found increasing activation of insula (predominantly right) for both contrasts. In (1) and (2) control sessions alone activation of this area was not presented. This area was also activated in the third session when stimuli were presented simultaneously. This result corresponds to Bushara et al. (2003) results related to insula’s role in audiovisual integration.

Conclusions.
We found that insula can be treated as mechanism of forming of audio-visual bimodal complexes. These results suppose that this system starts to work after bimodal association between audio and visual parts of complex and it can be activated if only one stimulus from bimodal complex was presented.

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Resting heart-rate variability predicts susceptibility to mental fatigue in a demanding cognitive task
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Introduction: Studies of mental fatigue frequently use electrocardiogram (ECG) recording and heart-rate variability (HRV) calculations to assess the fatigue-related changes in parasympathetic nervous system activation. Specifically, most of these studies have examined changes in HRV during a prolonged performance of a task. Recently, however, it has been suggested that the level of resting HRV, and the magnitude of changes in HRV between two different time points during an
experiment (i.e. phasic HRV) might reflect for different psychophysiological adaptation mechanisms (e.g. self-regulatory mechanism) [Laborde et al, 2017, Frontiers in Psychology, 8]. Therefore, in one experiment, we compared the predictability of phasic and resting HRV on the performance of a cognitively demanding and prolonged task.

**Methods:** We adapted a cross-modal switching task for Time-on-Task (ToT) paradigm [Lukas et al, 2014, Acta Psychologica, 153]. On each trial, participants were asked to decide whether the stimulus in the cued modality was presented for a short or a long duration. The experiment had three phases. First, participants (N = 21) completed questionnaires referring to sleepiness and fatigue, and a resting ECG was recorded (5 min.). Second, participants performed the task for 1.5 hours without rest. Subjective fatigue, reaction times, error rates, respiration, and ECG were recorded. Third, after a break (12 min.), an additional block of trials (12 min.) was administered. HRV was calculated in both the frequency- and the time-domain. Behavioral and HRV data were divided into five ToT intervals, and phasic HRV was defined as changes from resting to the first interval and the change from the first to the fifth interval.

**Results:** The analyses yielded increased subjective fatigue, compromised performance, and increment in HRV with increasing ToT. Separate ANCOVAs were performed on behavioral data with the resting, and the phasic HRV measures as covariates. Significant covariate effect was found for resting HRV: we found a positive trend between the level of resting HRV and the decline in performance with ToT. In addition, a significantly positive association was found between resting HRV and the increase in subjective fatigue.

**Conclusions:** The results suggest that a higher level of baseline HRV has a negative association with the compromised performance under fatigue. More specifically, a high level of parasympathetically mediated vagal nerve activity indexed by resting HRV reflects less effective resource allocation and self-regulatory mechanisms in a fatiguing cognitive task.

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**Mouse tracking reveals new dimensions for the analysis of response-related potentials**

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A response action consists of at least two stages: initiation and execution. Recording keystrokes and button presses is the method most commonly used in the field of cognitive psychophysiology; this method provides data on response accuracy and response time, which seem to be mostly related to the initiation stage. On the contrary, mouse tracking provides continuous data on response dynamics. Particularly, we assume that mouse movement duration is an important response parameter that is related to the execution stage of the response. Here, we applied this method to probe the functional significance of the response-related event-related potential (ERP) components such as correct-related negativity (CRN) and a P\(_e\)-like positivity.

We used the condensation task, which involves complex stimulus-to-response mapping: participants had to make responses to four auditory stimuli relying on the combination of two independent stimulus features. During each trial, participants had to respond to auditory stimuli by moving a computer mouse either to the top-left or to the top-right mousepad corner. EEG was recorded during the experiment. The following parameters of mouse movement were assessed: movement initialization time and movement duration. Within each subject, we divided the trials with correct responses into four quartiles for each of the mouse movement parameters separately. We compared ERP waveforms for trials within each pair of marginal quartiles.

Both movement initialization time and movement duration were higher for errors compared to correct responses. These mouse movement parameters were uncorrelated. We found that CRN amplitude within 10-110 ms time window was higher for early correct responses compared to late ones (\(p=0.004\)). In addition, we found a significant effect of mouse movement duration on ERP in early P\(_e\) time window (120-265 ms): amplitude of the P\(_e\)-like positivity was significantly higher for long correct responses compared with short correct responses (\(p<0.001\)).

We suggest that the early P\(_e\)-like component is not specifically related to errors; rather, both CRN and P\(_e\)-like component seem to be related to response uncertainty. Particularly, uncertainty during response execution stage seems to result in increased P\(_e\)-like component and prolonged mouse movement. We also assume that early correct responses are mostly premature responses, and increased CRN may indicate stronger performance monitoring arising after response initiation.

The study was implemented in the framework of the Basic Research Program at the National Research University Higher School of Economics (HSE) in 2018.

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**The revealing of periods in Lempel-Ziv complexity of EEG signal**

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**Introduction.** The human brain as a distributed nonlinear dynamical system can be efficiently represented with a set of its informational characteristics. Such characteristics measured through the brain electrical activity (EEG, or electroencephalogram) include the Shannon entropy (e.g., Bruhn, J., H. Ropcke, et al., 2000) and the Lempel-Ziv complexity (LZC) (Lempel, Ziv, 1976). In our present study, we have revealed new features of brain dynamics via the analysis of LZC for EEG signals.
**Methods.** We used EEG recordings from Cz lead made in the relaxed arousal state with open and closed eyes. We calculated Lempel-Ziv Complexity for alternating window width $<i>LZC(w)</i>$. To do that, we fixed the initial point of the recorded EEG and found the corresponding LZC for the intervals of different lengths, starting from the interval of 10 samples length and then for 11 samples and so on up to the greatest interval of 3000 samples. We got the dependence of LZC value versus window width for the selected Cz EEG channel: $<i>LZC(w)</i>$, see Fig.1.

Figure 1

On Fig.1 one can observe, that the dependence $<i>LZC(w)</i>$ has two distinct components: a trend that could be well approximated by the exponential function and a quasiperiodic component. To investigate the second one, we subtracted the exponential trend from LZC and constructed the power spectrum for the detrended time series. By Wiener-Khinchin theorem, we got the autocorrelation function of this component and applied Fourier transform to it.

**Results.** The Fourier image of the autocorrelation function for the de-trended LZC function is plotted on Fig.2.

Figure 2

Here one can clearly see quasi-periodical oscillations centered around the frequencies 0.33, 2 and 3.17 Hz. We have observed such oscillations in all de-trended LZC functions based upon the EEG-signals recorded for 10 subjects with open and closed eyes both.

**Discussion.** Among the three observed frequencies, the lowest one is most probably related to the length of the window: 3000 samples correspond to the period of oscillations 6 seconds with the frequency of 0.1(6) Hz, that is half of the lowest frequency on the spectrum plot. The nature of two other peaks can be originated in the inner dynamics of the brain processes. We consider these oscillations to indicate the periodical change of the EEG ‘vocabulary’ (a typical set of ‘words’, or signal codes). Interestingly, we have not found any significant difference between recording states of open and closed eyes.

Support: RFBR grant #18-013-01086

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**Gender bias when interacting with avatars**

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Gender differences exist in almost every aspect of our life. Individuals have an array of different societal expectations in regards to behaviors, communication, appearances, attitudes, and roles in society, but these expectations tend to be based on the general principle of whether the individual is male or female. Currently a lot of social studies have been done with the help of virtual reality technologies. The effectiveness of their application was been proven in the studies of many social phenomena – in nonverbal communication, in training social skills, in rehabilitation of social anxiety and etc. A lot of attention has recently been paid to the problem of gender differences during social interaction with virtual partners – avatars. Unfortunately a problem concerning gender differences during interactions with avatars of different ethnic appearances has been little studied. The goal of our study was to investigate the gender peculiarities of the interaction with avatars of different ethnic appearances. Using the CAVE virtual reality system we studied gender features of interpersonal distances maintained with avatars. Four three-dimensional virtual scenes with avatars were designed. Four types of avatars with different ethnic appearances, were created, including avatars of Slavic, Asian, North Caucasian, and African-American appearance. All avatars were male. Forty-one participants (22 F, 19 M) (all positioned themselves as Russians) were tested. They were immersed in virtual environments with the help of the CAVE virtual reality system. Their task was to come to the avatar, to present herself/himself in a free form and to give instructions for the further work. During the execution the interpersonal distances were registered. After leaving the CAVE the participants were asked to filled out a questionnaire assessing the presence effect. The results showed gender differences in keeping interpersonal distances: women preferred to keep shorter interpersonal distances with virtual partners compared with the distances chosen by men. Also it was revealed the impact of ethnic appearance on interpersonal distances. Women more closely approached the avatars of their own ethnic group and kept further from avatars of other ethnic groups. Unlike women, men adhered to the same distance with avatars of different ethnic groups. Both kept equally far from the avatar of African-American appearance. Gender differences manifested also in the Presence effect estimates. To more accurately assess gender behavior in virtual environments female avatars should be also studied. This method can be successfully applied for studying gender features in different social phenomena.
Changed oscillatory dynamics of perception angry facial expressions in predisposed to depression individuals

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Depression is one of the most common mental derangements that is connected to changes in the emotional and cognitive disturbances, which is demonstrated in the corresponding brain areas. Models of depression assumed higher activity in amygdala, orbitofrontal cortex, striatum which are important for emotional identification. Lower neural activity in the dorsolateral prefrontal and anterior cingulate cortex are essential for emotion regulation. The aim of our study was to figure out if the emotional perception of the faces shown to the subjects influences the oscillatory dynamics in healthy individuals with predisposition to depression (PD).

Predisposition to depression (PD) was measured in 46 healthy volunteers (24 men and 22 women aged 18 to 28 years) by means of depression scale of the Achenbach Adult Behavior Checklist (Achenbach, Rescorla, 2003). Median split of depression scale was applied to divide the sample into low and high PD groups. We choose from the Ekman and Friesen collection five different real male and female faces with three types of emotional expressions - angry, happy, and neutral. The volunteers rated the emotional expressions as hostile or friendly by using a scale.

Event-related spectral perturbations (ERSP) were calculated using the new time function of the EEGLAB toolbox (Delorme, Makeig, 2004). The ERSP shows the mean log event-locked deviations from the baseline-mean power at each frequency (Makeig, 1993). ANOVA analysis was used for each frequency range, using the factors time, laterality, and rostrality as within subject factors and the depression score as a between subject factor. Statistical significance was defined as a P-value of less than 0.05 after Greenhouse–Geisser correction.

There were no significant differences between low and high PD subjects during perception of the neutral and happy faces. During the first 200 ms angry faces evoked the decreasing alpha spectral power (SP) after presentation in frontal areas in low PD subjects, but the increasing alpha SP in high PD subjects. The increasing alpha SP in frontal areas could reflect the decreasing of brain activity related with emotional regulation during perception of negative stimuli.

EFFECT OF THE STABILOMETRIC PLATFORM BIOFEEDBACK TRAININGS ON VOLUNTEERS’ PSYCHOPHYSIOLOGICAL INDICES

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Introduction
The research is aimed at studying a 10-day course of 5-minute biofeedback trainings of support reaction influence on healthy volunteers’ postural control and psychophysiological characteristics.

Methods
The two groups of 20-23 year old men were compared: biofeedback (BFB) group (n=12) and control group (n=12). Before and after trainings background physiological values (psychophysiological and stabilometric parameters) were recorded in both groups.

Stabilometric test was held according to Romberg’s test (30 seconds with open eyes and 30 seconds with closed eyes) on a stabilometric platform ST-150 (Russia). Psychophysiological testing was performed on NS-Psychotest (Russia). The latent period of psychophysiological reactivity and attention parameters were recorded. All subjects of the BFB group changed the body position in response to the mark shifting on the screen. Statistical analysis was done on Statistica 8.0 package.

Results
The results of the stabilometric Romberg test with open and closed eyes in BFB group show decrease in area and length of statokinesiogram. On 10th day of the research value of S, mm² will decrease by 32% (p < 0.05) in the open eyes phase, and 68.3% on closed eyes phase; value of L, mm will decrease an 21.1% (p > 0.05) declined and to 24.9% (p < 0.05) on closed eyes phase, in comparison with the values of these parameters in control group subject.

Psychophysiological testing of the BFB group shows decrease in sensorimotor reaction latent period on 4.06% (p<0.05), time and number of errors in psychophysiological Shulte tests performance. In addition, decrease sensorimotor reaction latent period in “Simple visual-motor reaction” test at 4.06% (p < 0.05) directly indicates the increase in the speed of reaction in the BFB group volunteers.

Conclusion
Preliminary results of this study indicate a significant effect of biofeedback supportive reaction trainings on the stabilometric platform on volunteers’ speed and latent period of sensorimotor reaction and cognitive processes: attention and quality of decision-making. The results can be implemented to improve postural control and psychophysiological reaction of professional athletes and social groups with balance disfunction.

Supported by the V.I. Vernadsky Crimean Federal University Development Program for 2015 – 2024.

THE INFLUENCE OF 50-DAY CONTROLLED BREATHING COURSE ON THE STRESS LEVEL OF HEALTHY
An Attempt to Assess the Processing of Verbs by the Simultaneous Measurements of ERPs and NIRS

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Researchers have reported that people with motor disabilities have difficulty in the processing of verbs it is difficult to assess in details of the knowledge of verbs by speeches or behaviors. This study explored whether the knowledge of verbs can be assessed by the simultaneous measurements of event related potentials (ERPs) and brain hemodynamic changes of near infrared spectroscopy (NIRS).

10 Japanese undergraduate (aged 21-23 years, average of 21.5 years) participated. We used silent reading tasks which is composed of object and verbs in Japanese. Before experiment, we investigated about 495 verbs and selected 17 verbs with high correct answer rate and 16 verbs with low. A object word presented in the center of the computer screen, followed by a verb presented as target word. Four seconds later, participants were required to judge that sentence was correct or incorrect and to press button when the sentence was right. EEG was recorded at Cz in reference to the earlobe. Irradiation and detection probes for NIRS measurements were arranged in Frontal lobe. EEG data was examined into 1000ms epochs commencing 100ms prior to the onset of the verb. NIRS data was examined between 5 sec before the onset of object and 4 sec after the onset of verb. After this, a difference between average of pre-verb and of post-verb was calculated. As regards ERP results, N400 was detected both for incorrect sentence of well-known and little-known verbs. However, the amplitude of N400 was higher for the little-known verbs than for the well-known verbs. As regards NIRS results, the deoxy-hemoglobin concentrations in left frontal regions for incorrect sentences were the tendency to decrease. Oxy-hemoglobin concentrations were not shown remarkable difference between correct and incorrect sentences. It is seemed that the differences of the knowledge of verbs were reflected to the amplitude of N400 and the deoxy-hemoglobin concentration. This study suggest that the knowledge of verbs could be assessed by using ERP and NIRS. Specifically, this approach may be useful for children with motor disability or difficulties of speech. However, participants may be knowing many verbs of little-known group because N400 was detected for incorrect sentences. That participants were the undergraduate may have influenced. The detailed research in children who have little vocabulary is necessary. Also further examination is necessary about the usefulness of simultaneous measurement of ERPs and NIRS.
Introduction: Many environmental and psychosocial factors affect the obese people’s eating habits. We presumed that internal neural mechanism of children with obesity (CWO) may underlie the eating behaviors of them, and it may lead to the excessive weight gain. The aim of this study was to investigate the cortical information processing of the CWO during visual Go/NoGo task. 

Methods: Seventeen CWO (mean age ± standard deviation: 10.6 ± 1.9 years old) and age matched healthy controls participated. The neuropsychological tests and event related potential (ERP) study with visual Go/NoGo test were performed. We calculated the area amplitudes (AA) of major components (P1, N1, P2, and P3) and analyzed them by repeated measures of analysis of variance: Three within-subjects factors were Condition (Go and NoGo), Block (block 1and block 2), and Location (frontal, central, parietal, and occipital), and between-subjects factor was Group (CWO and controls).

Results: There were significant main effects of Group for P1, N1 and P3 AA, and Group x Location interaction for P2 AA: In both Go and NoGo conditions, CWO showed grater occipital P1 AA (F = 13.534, <i>p</i> = 0.000) and fronto-central N1 AA (F = 10.158, <i>p</i> = 0.002) than that of controls, and showed greater frontal P2 AA than controls (F = 4.601, <i>p</i> = 0.034). In both Go and NoGo conditions, P3 AA of CWO were always smaller than that of controls (F = 10.681, <i>p</i> = 0.001). In addition, we also found the Condition x Location interaction of P3 AA: Go P3 AAs of both CWO and controls were highest at parietal location, and NoGo P3 AAs of them were highest at frontal location (F = 48.378, <i>p</i> = 0.000).

Conclusions: Our results suggest increased visual vigilance of CWO than controls (from the greater P1, N1, and P2), however, the lack of conceptualization of them (from the smaller P3) may affect the eating behavior of CWO.

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BRAIN REACTIVE CHANGES WHILE HAND MOVEMENTS WERE PERFORMED IN TRAUMATIC BRAIN INJURY PATIENTS (fMRI AND EEG STUDY)

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Traumatic brain injury (TBI) is one of the most common forms of cerebral pathology in young age. Post-traumatic impairments as a rule include multiple damage of cortical and subcortical structures and conductive pathways. Consequences of TBI are often associated with disorders in different spheres – cognitive, motor, emotional etc. It should be noted that in the absence of neurological impairments and hemiparesis, patients may have various difficulties when they return to their professional activities and these problems can remain for a long time. However, the neurophysiological mechanisms of these impairments have not been studied sufficiently and further investigations are required. The aim of the present work was to study fMRI and EEG reactive changes while hand movements were performed in TBI patients and healthy persons.

The study involved 22 healthy right-handed subjects (age 25.1±3.9) and 9 TBI patients (age 27.9±7.3) without hemiparesis and local lesions in the sensorimotor cortex. EEG and fMRI studies were performed on the same day by using identical tasks – clenching-unclenching fingers of the right and left hands separately. fMRI studies were performed on 3T MRI scanner. EEG was recorded from 18-channels by using 10–20% system; the digitization frequency was 100Hz and the band pass was 0.3–35Hz. EEG power and coherence was calculated for main spectral bands.

FMRI analysis showed that reactive changes have had larger interindividual variability of the main topographic activation zones while left-hand movements were performed in comparison with right-hand movements in healthy subjects. In TBI patients the diffuse component of reactive changes was increased and demonstrated a larger number of brain structures – cortex areas and subcortical formations, including nonspecific zones for the motor analyzer. These changes were the most clearly expressed in the dominant hemisphere (during movement of the right hand). Analysis of EEG data demonstrated increased coherence in the high-frequency alpha rhythm (10-13Hz) during movement performance by both hands in healthy subjects. In TBI patients increased coherence in the slow (theta and delta) bands was observed while hand movement tasks were performed. EEG changes in the slow rhythms may indicate an increased involvement of deep subcortical brain structures in providing motor functions in patients and these results correlate with fMRI data. Thus, fMRI and EEG data demonstrate more pathological reactive changes in dominant hemisphere and cortical brain structures after TBI. It can indicate that mostly young brain structures (in the ontogenetic plan) are more sensitive to traumatic effects.

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Physical activity, cigarette and hookah smoking vs stress: psychophysiological correlates in students

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Introduction
University students are exposed to a high level of stress. Physical activity is an important means of managing stress (Lippke et al., 2015). Some students in stress coping turn to smoking. The association between stress and smoking-related behavior is proven for smoking cigarettes (Lawless et al., 2015), and hookah use (Grinberg, 2015). The goal was to determine the nature of students' psychophysiological interrelations between weight and height indicators, stress level and physical activity and cigarettes and hookah smoking as stress-reducing behavior.

**Methods**

During the survey 318 female and male university students (mean age 20.0±2.1) specified their weight and height and the degree of exposure to stress. The severity of stress-reducing behavior was determined during the questioning based on frequency and duration of physical activity, the experience and frequency of smoking cigarettes and hookah. The data were processed by the methods of variation statistics and correlation analysis (p<0.05).

**Results**

The average weight of students was 60.1±1.1 kg, height - 169.5±9.2 cm. Every fourth student (25.8%) experienced severe stress, every second (49.1%) – moderate stress, every fifth (19.5%) – low stress, 5.6% of the students did not experience stress at all. Nine out of ten students was involved in physical activity once or more times a week (89.1%). Every sixth student smoked cigarettes (15.7%), one out of five (18.9%) – a hookah. Correlation analysis showed that, with the increase in somatometric indicators, students reported a decrease in stress level (r=0.12 due to the weight; r=0.14 due to the height). The increase in height and weight was accompanied by increased physical activity. Taller students were more often involved in physical activity during the week (r=0.15), and the duration of the session was longer (r=0.12). For heavier students, these links proved to be more closely connected – they were also more often involved in physical activity during the week (r=0.16), and the duration of the session was also longer (r=0.14). On the other hand, taller heavier students smoked cigarettes more often (r=0.14 and r=0.11), while taller students smoked a hookah more often (r=0.11).

**Conclusions**

The prevalence among students of physical activity as stress-reducing behavior exceeded the prevalence of moderate or severe stress. Hookah smoking was more popular coping than cigarette smoking. Despite being involved in more strenuous physical activity, taller students had a greater risk of addictive behavior when smoking cigarettes and hookah, which could have negative consequences for their mental health.

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**Comparative analysis of inhibitory processes of healthy preschool children and children with the autistic spectrum disorder**

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The concept of executive functions is now widely used by researchers (Buttelmann, Karbach, 2017; de Cock et al., 2017; Kaunhoven, Dorjee et al., 2017; O’too, Monks, 2016; Luna et al., 2015). From a theoretical point of view this concept allows describing the peculiarities of plastic reconstructions in the brain, from a practical standpoint it is possible to improve Self-regulation in early childhood. Executive functions include inhibitory control, working memory and cognitive control. There are no any correct data about inhibitory controls of children with autistic spectrum diseases (ASD). The purpose of the research was to compare the inhibitory controls of children with ASD (30 persons) and healthy children (30 persons).

Groups were equalizing to level of intelligence. Methods were used: nonverbal intelligence assessing with Raven Colored Progressive Matrices, the Theory of mind assessing test Sully-Ann, inhibitory processes assessing the mushroom test by W. Mishel and reflexometry- assessing with the paradigm of “Go/Go”, handedness using the sets of tests. 28 children with ASD were left-handed and two children were ambidextrous ones. Just 4 children from healthy group were left-handed and other 26 were right-handed. In the group of children with ASD just 6 children passed the mushroom test (9 children from group of healthy children had passed this test). In healthy children the levels of intelligence positively correlated with inhibitory controls and its negatively correlated with the number of mistakes in reflexometry. Just 1 child from the group with ASD had the formed Theory of mind. In the course of individual work, the Theory of mind was formed in 4 children. Both the Theory of mind and inhibitory processes correlate with the intelligence levels of healthy children. The reaction times of children with ASD were longer than of those healthy children and children with ASD had more mistakes during reflexometry.

The study is founded by Russian Foundation of Fundamental Research, project #18-013-00323 A, 18-013-00721 and Russian Scientific fund #14-18-02135

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**The connection of lateral preferences with the specificity of cardiac rhythm variability in children**

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It is known that in adults the intensity of emotional reactions is associated with the nature of lateral preferences. It is shown that the increase in the number of left signs in the sensory and motor spheres correlates with the intensity of emotional...
reactions in various tests (Leutin, Nikolaeva, 2008). The evidence has been obtained that the difference in emotional reactions in people with different profiles results in a significant difference in the effectiveness of adaptive processes (Nikolaeva et al., 1995) and the incidence of cardiovascular disease and neurotic disorders (Nikolaeva et al., 1993). At the same time, the data on the peculiarities of emotional response of children and its connection with lateral features is not enough to make unambiguous conclusions. According to the hypothesis explaining this difference in cardiovascular reactions to stress, people with the left profile have two centers of vegetative regulation in the right and left hemispheres, whereas people with the right profile have only one center located in the right hemisphere. In this case, under the stress or in the process of adaptation, the activated right hemisphere produces an additional load on the right hemispheric center of vegetative regulation, which leads to a greater probability of cardiac disorders (Goldberg, 2003).

The assessment of the lateral preferences was carried out using a set of tests, the most common in the literature (Leutin, Nikolaeva, 2011). For the evaluation of cardio rhythm variability the hardware and software complex “OMEGA-M” were used. The study took place in three stages, during each of them 300 R-R intervals were recorded. In the first stage there was a record of 300 R-R intervals at rest in the background, at the second stage the records were done during recalling about rewards by children, and the third one during recalling about punishments in families. 20% children in our sample were left handers. In the transition from a state of rest to a state of emotional situations in families the activity of the sympathetic part of the autonomic nervous system increased. These reactions were different in right handers and left handers. Heart rate changes of left-handed children are within their adaptation resources, heart rate variability of right-handed children was beyond their adaptation resources and the distribution of R-R intervals shown multimodal structure. The study is founded by Russian Foundation of Fundamental Research, project #18-013-00721

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Optimization of the cardiovascular system functional state utilizing biofeedback correction method during the ascent of the Everest

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Introduction.

A decrease of blood oxygen saturation level is observed in athletes in conditions of natural hypobaric hypoxia at high altitudes. This leads to corresponding shifts in functional state of athletes, in particular, in the cardiovascular system and its autonomic regulation.

We used biofeedback (BF) method for correcting the functional state of high-altitude expedition members. We assumed that this approach would facilitate and accelerate the adaptation of athletes to high altitude by normalizing their heart rate (HR). Additionally, continuous HR recording allowed us to assess the state of autonomic regulation system using HR variability indices.

Methods.

A study of HR variability dynamics during the sessions of BF-training at high altitudes (Everest expedition of F.F. Konyuhov) was carried out. The sessions were held before the ascent of the mountain (session 1) and during the acclimatization at 6400 m (session 2) and 5300 m (session 3) above sea level. Two expeditionists close in age, body habitus, athletic performance and physical conditions participated in the experiment. Each session of BF-training included several computer game trials. The goal of a trial was to decelerate the HR. Each trial continued for 80-105 seconds. All BF-sessions were held in the late evening hours (between 10 pm and midnight).

Results.

Both participants were effective in decelerating the HR in all sessions of BF-training and demonstrated a certain dynamics of HR variability in each session. Revealed dynamics of HR variability shows that before the ascent of the mountain the HR slowing was achieved by an increase in sympathetic activity (increase in LF/HF ratio) accompanied by a decrease in the overall level of autonomic activity (total power spectrum, TP). By the third session of BF-training (with consolidation of a new skill) HR deceleration was accompanied by an increase of overall level of autonomic activity (TP) and a decrease in the stress index in both participants. The changes in autonomic balance (the LF/HF ratio) during last session were oppositely directed in our participants.

Conclusion.

Our data suggest that the achievement of the final goal in BF-correction sessions (the deceleration of the HR) by two participants of the experiment was accompanied by shifts in the activity levels of autonomic regulation systems. Moreover, the direction of these shifts depended on the stage of skill formation and was specific for each subject.

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Improved discriminability of EEG conditioned responses in Oddball Classical Conditioning Paradigm

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**Methods.** The nature of cortical plasticity in the course of learning is one of the most intriguing questions of the modern cognitive neuroscience. Aversive conditioning is a type of associative learning produced by continuous pairing of neutral and aversive stimuli. Aversive conditioning and electroencephalography together provide a good framework for expanding our knowledge about fast learning-related cortical changes.

**Results.** We showed that aversive conditioning in this paradigm strongly influences brain activity; therefore, the learning process can be detected by EEG regardless of behavioral measures. We found that pairing of neutral sounds with aversive electrical shocks may cause tangible changes in multisensory integration, as indicated by (1) the desynchronization of lower beta activity in the hemisphere contralateral to expected electrical shocks and (2) the enhanced functional connectivity between auditory and somatosensory cortex in gamma frequency band. We also found larger P3a and LPP amplitudes to conditioned stimuli which can represent signatures of increased attentional and emotional significance of these stimuli. Moreover, ERP were modulated by personality, in which higher anxiety and neuroticism values were associated with attenuated LPP.

**Conclusion.** Our results reproduced and extended previous findings about multisensory integration in classical conditioning and demonstrated the improved discriminability of ERP responses through incorporation of the oddball paradigm in associative learning.

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**EEG correlates of individual differences in working memory**

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**Introduction.** According to Baddeley & Hitch (Baddeley 2012) model working memory (WM) consists of short-term storage components and central executive. Central executive is responsible for the manipulation of information. Also it controls attention and prevents memory from interference of irrelevant stimuli. Despite the growing interest to the WM in last decades all existing neuroimaging studies have at least one limitation for investigation of individual differences in WM performance. At first, most of WM studies had been using n-back paradigm but this task can’t distinguish manipulation and retention functions. Second, usually the studies included only tasks with moderate difficulty. And last, sample size in the studies didn’t exceed 14 subject in each group. We expected to reveal EEG correlates of temporary storage and central executive components of WM and to assess their contribution to individual differences.

**Methods.** 156 participants (82 females, mean age = 21.23, SD=3.22) were included to the final sample. The participants were distributed into High, Medium and Low performance groups according to the average performance in the tasks. The WM tasks employed varied in two dimensions. First, they differed in complexity from average to highly demanding. Second, we used two types of tasks, which required either only retention of stimulus set or retention and manipulation of the content. The EEG was recorded from 19 electrodes arranged according to the 10-20 system and referred to the average earlobe. Two additional electrodes were used for horizontal and vertical EOG.

**Results.** A series on repeated-measure ANOVA revealed Group (High, Medium, Low performance) by Task (with manipulations vs simple retention tasks) interactions in theta (3-7 Hz, p=.0007) and alpha1 (7-10 Hz, p=.004) frequency bands. Synchronization of theta and desynchronization of alpha1 was more pronounced in Manipulation condition in High performance group. Moreover, the difference in spectral power in theta and alpha1 between two conditions and performance in the tasks significantly correlated (r=0.27, p=.0008 and r=0.28 p=.0006, respectively).

**Conclusions.** The difference between magnitude of theta synchronization and alpha1 desynchronization in Manipulation and Retention conditions may serve as an indicator of the effective allocation of neural resources between temporary storage and central executive WM systems. As a result, we cautiously conclude that successful encoding, maintenance and manipulation of information in WM strongly depends on the individual differences in executive functions.

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**Visual perception of urban vandalism**

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**Introduction.** Under the term “urban vandalism” we mean: deliberate damage of property, e.g. wall painting, windows breaking and throwing stones in the municipal transport. The assessment of psychophysiological correlates of vandalism is a challenging task, therefor usually studied in simulated settings. The main aim of the study was to assess the applicability of the eye-tracking method in detection the persons involved in vandalism within the urban environment.

**Methods.** Thirty two healthy adults participated in the study on voluntary basis. They were divided into two groups: 1. with
experience of vandalism (“vandal”); 2. without experience of purposeful destruction (“non-vandal”). The “vandal” group participants reported about the experience of breaking windows in municipal buildings with stones and sticks. In the experiment the image of a man breaking a window with a stick was presented to the participants of both groups. The duration of image exposure was 10 seconds. Pupil size and gaze behavior measured with SMI RED 500 eye-tracker were used as dependent variables.

Results We found statistically significant differences in velocity and amplitude of saccades between the groups. Both parameters had the minimal values in the “non-vandal” group. Besides, average pupil size in the “vandal” group was significantly larger than in the “non-vandal” one (4.4 vs 4.05 mm, p<0.05). Moreover, regions of interest in “vandal” group included primarily the destructive tool and posture of the actor. Meanwhile the gaze of “non-vandal” participants was predominantly fixated at the actor’s face and the object of destruction.

Conclusions The results of the statistical analysis demonstrate the presence of psychophysiological differences in visual perception of urban vandalism images in “vandal” and “non-vandal” participants in simulated environment. Thus, we can make a conclusion, that eye-tracker could be a reliable method for detecting subjects previously involved in urban vandalism.

Cognitive Processes Efficiency, Anxiety Disorders and Depression Symptoms in Naive Middle-Age Patients with Uncomplicated Essential Arterial Hypertension and White Matter Lesions

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Introduction.
Presence of cognitive disorders in patients with essential arterial hypertension (EAH) is most commonly associated with white matter lesions (WMLs) [Iadecola, et al., 2016]. However, it is logical to assume that emotional distress will also contribute to the cognitive impairment in EAH patients.

The purpose of this study was to assess cognitive functions and the presence of Anxiety Disorders and Depression Symptoms in EAH patients and healthy persons and evaluate the connection of the revealed psychological features with the presence of WMLs.

Methods.
The study involved 56 naive middle-age patients with uncomplicated EAH, stage 1-2, average age is 50.4±7.4, and 58 normotensive persons, average age is 46.0±4.7. WMLs have been revealed in 9 persons from the control group and 24 persons from the EH group. Brain MRIs have been obtained using a 3-TMR scanner MAGNETOM Skyra 3T (“Siemens”).

The assessment of cognitive functions has been conducted using the Trail Making Test (TMT) [Tombaugh, 2004], Montreal Cognitive Assessment (MoCA test), Verbal Fluency Test [Lezak, 1995], Stroop Color-Word Interference Test, CERAD Word List Memory Task [Morris et al., 1988], and Pictogram Test [Zeigarnik, 1965]. The assessment of emotional states characteristics has been conducted using the Hamilton Depression Rating Scale (HAM-D), and Hamilton Anxiety Rating Scale (HAM-A).

Results.
Persons with WMLs differ significantly from individuals with normal appearance white matter (NAWM) in the following indicators in Psychological assessment: MoCA total score (28.17±1.7 vs 29.06±1.1; p=0.03); Letter fluency (10.56±3.5 vs 13.53±3.3; p=0.003); Stroop 2 score (69.3±9.0 vs 62.4±13.8; p=0.016); Stroop 3 score (128.2±45.6 vs 114.4±30.6; p=0.043); Anxiety level (1.79±1.3 vs 0.53±1.1; p=0.01) in HAM-A and in Depression level (1.94±3.7 vs 0.22±0.8; p=0.009) in HAM-D. In Pictogram test they differ significantly from persons with NAWM in the following indicators: Quantity of the concrete images (0.7±0.1 VS 2.7±0.9; p=0.009); Markers of inertness of mental processes (0.8±0.2 VS 0.05±0.01; p=0.009); Decreasing accuracy of recalled words (3.7±1.1 VS 0.8±0.9; p=0.02); Decreased recall of affective words (5.7±3.3 VS 3.0±1.8; p=0.02).

Conclusions
The results indicate differences in cognitive processes efficiency between NAWM and WMLs both for EAH naive middle-age patients and for their normotensive peers and prove a positive correlation of the cognitive impairments revealed for HTN patients with marked anxiety and depression. These results justify the relevance in-depth study of emotional features and personality characteristics of EAH patients and healthy persons with WMLs in comparison with NAWM Individuals.

The research was supported by RFBR; project 17-06-00954.
providing evidences that a number of brain regions are needed to production of original ideas. However, it remains unknown the brain functions underlying social type of creativity.

We have studied EEG correlates of the social creativity by testing fluency, flexibility, and originality indices induced by interpretation of specially created pictures of social situations together with a search of the relationships between verbal, figural, and social components of intelligence and resting-state brain activity. Forty university students performed Russian versions of the Amthauer’s and Guilford-Sullivan’s tests before multichannel EEG registration at rest with closed eyes. We found positive correlations of social originality with low- frequency alpha oscillations but fluency and flexibility indices with high-frequency alpha in anterior cortex. Increase of the verbal component of social intelligence was related to power reduction of the delta and theta rhythms and to enhancement of the beta and gamma oscillations with more expansion of this effect on the right hemisphere. Similar relation was found for the figurual component of IQ with more pronounced effect in the central and posterior cortex. Reciprocal relations between social creativity and intelligence were obtained for the resting-state cortical activity on low frequency but congruent relations - on high frequency oscillations in the prefrontal cortex. However, only positive correlations were obtained between social creativity and IQ components. So, different intelligence-associated patterns of resting-state EEG rhythms were mostly observed in cortical areas overlapping with the DMN whereas social creativity was presented by alpha synchronization in the anterior cortex in line with the association of alpha frequencies with internal attention or ‘defocused’ selective processes. The results illuminate different oscillatory mechanisms in widespread neuronal networks which may be involved to perspective social cognition and original solving social problems depending on IQ structure and the individual strategies of search of ideas. The findings prompt an assumption that ongoing activity with internal attention to successful bringing social roles and various events from the past knowledge to the new mind are needed for social creativity.

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THE FUNCTIONAL STATE OF MAGNOCELLULAR AND PARVOCELLULAR VISUAL PATHWAYS IN SCHIZOPHRENIA
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The spatial-frequency characteristics of the visual system were studied in mentally healthy persons and in patients with schizophrenia using a test of contrast sensitivity in a comparison of the contrast of two gratings with the low, medium, or high spatial frequencies. The magnocellular channels are more sensitive to the low spatial and high temporal frequencies, and they promote rapid information transmission to the neurons, mostly of the dorsal pathway. Because of these properties, the magnocellular neurons are involved in processing of information on the global organization of a stimulus and in analysis of movement of the observed object. The parvocellular channels are more sensitive to the high spatial and low temporal frequencies. They provide a slower information transmission to the neurons of primarily ventral pathway. The parvo-system is responsible for description of color and fine details of the object.

METHOD. The images of Gabor gratings were with a spatial frequency of 0.4, 3.6 and 18.2 cycles/deg. Twenty five mentally healthy female subjects and 43 female patients with schizophrenia participated in our study. All of the patients were diagnosed with paranoid schizophrenia. The average age of the subjects was 34.9 ± 13.4 and 36.6 ± 10.7 years in the control and experimental groups, respectively.

RESULTS. In the first-episode schizophrenic patients (18 patients) who had received no antipsychotic drugs for a long time, an enhancement of contrast sensitivity as compared to mentally healthy subjects was observed when the patients were presented Gabor gratings with low spatial frequencies to which the magnocellular channel neurons are most sensitive. On the contrary, in the case of the contrast comparison of the gratings with the medium and high spatial frequencies, the contrast sensitivity was reduced in the first-episode schizophrenic patients irrespective of whether they had been non-treated or treated for a long time. In chronic patients with schizophrenia, reduced contrast sensitivity was observed in response to gratings with any frequency range tested. Some additional evidence of the internal noise enhancement in patients with schizophrenia has been also obtained. Our results make it possible to explain clinical data on specific disorders of visual perception at different stages of schizophrenia.

CONCLUSIONS. In schizophrenic patients, there is a mismatch discrepancy between the magnocellular and parvocellular system work. In the first-episode patients, the discrepancy is manifested in enhanced sensitivity of the magnocellular system, while in chronic patients, in reduced sensitivities of both the magnocellular and parvocellular visual channels.

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Coronary blood flow in patients with coronary heart disease: interrelations with emotional control and social support
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Introduction
Negative emotions, such as depression, hostility and anger are often described as risk factors for coronary heart disease (CHD). Social status and support are also considered important social psychophysiological factors associated with CHD
Introduction:
Empathy is considered to consist of two major aspects: affective empathy (preconscious mirroring) and cognitive empathy (conscious mentalizing) and their interaction. We report a constellation of symptoms observed in children and adolescents, who were brought to a pediatric developmental practice because of their attention- and learning problems. In addition they presented with high empathic and social skills overoccupying them with their social context instead of their very own tasks. These children and adolescents did not fit in any DSM classification.

Methods:
Based on the clinical descriptions of affected children/adolescents and their parents 11 questions (“hypermirroring questionnaire”) were developed and presented to 67 children/adolescents in addition to standardized clinical questionnaires, IQ testing, digit spans, auditory sensitivity and attention tests as well as a quantitative EEG. Data were collected in the context of clinical assessment, anonymized and subsequently retrospectively analyzed. The German law does not impose any legal restrictions on the use of anonymized data for research purposes and does not require formal approval of an ethics committee nor informed patient consent (BayDSB, http://www.datenschutz-bayern.de/verwaltung/epidem.htm 3.3).

Results:
A factor analysis revealed one factor related to high affective empathy, increased social awareness and engagement which was uncorrelated to all other factors, but correlated to an unusual pattern in their quantitative EEG. There were no activity changes present in the QEEG. A correlation analysis between the strength of the lagged phase coherence for the mirroring regions of interest and the behavioral measure factor 2 showed a significant effect for the gamma frequency band. The functional connectivity analysis between low vs high on factor 2 (social engagement) confirms changes within the mirror neuron network and between the mirroring and the mentalizing network.

Conclusions:
There exist disorders with deficient affective empathy and /or decreased social awareness and engagement in children like conduct disorder and oppositional defiant disorder. We suggest the existence of a hypermirroring syndrome, characterized by increased affective empathy and an overexpression of social awareness and engagement related to connectivity changes in the qEEG, when this is compromising the developing child. Within their social context these same children and
adolescents can also be seen as socially and empathically gifted.

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Validity and reliability of the Maslach Burnout Inventory-Student Survey in Sri Lanka
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³Teaching Hospital-Kandy, Sri Lanka, Kandy, Sri Lanka

Introduction: With ever increasing educational expectations and demands, burnout has emerged as a major problem negatively affecting the wellbeing of different student populations. Even though the validity of the Maslach Burnout Inventory-Student Survey (MBI-SS) is widely assessed across the globe, there is a paucity of related literature in the South Asian settings. Hence, this study was aimed at assessing the factorial structure, validity and reliability of the MBI-SS among collegiate cycle students in Sri Lanka.

Methods: The pre-tested Sinhala version of the MBI-SS was administered to a sample of 194 grade thirteen students in a selected educational division, Kurunegala district, Sri Lanka. The construct validity of the MBI-SS was assessed using multi-trait scaling analysis and confirmatory factor analysis (CFA), while reliability was assessed using internal consistency and test-retest reliability, which was assessed after an interval of two weeks.

Results: CFA revealed that the three-factor model of the MBI-SS fitted the data better than the one-factor or the two-factor model. Only one item (item 13) was identified as having poor psychometric properties. A modified version of MBI-SS, with item 13 deleted, emerged as an acceptable fitting model with a combination of absolute, relative and parsimony fit indices reaching desired threshold values. High internal consistency was observed for all the three subscales (Cronbach’s α>0.8) and the test-retest reliability was high (p <0.001).

Conclusions: The Sinhala version of the 15-item MBI-SS is a valid and a reliable instrument to assess the burnout status among collegiate cycle students in Sri Lanka. The Sinhala version of the 15-item MBI SS, due to its brevity, ease of administration and sound psychometric properties, could be used as an effective screening tool to assess student burnout at the school level.

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The level of steady potentials of the left and right hemispheres in children with learning disabilities
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One of the most important mental functions of a human being is speech (Bishop, 2013). Any changes in the child’s speech development reflect not only on cognitive functions, but also on the child’s socialization and personal characteristics. That is why it is so important to correct the child speech development as early as possible. Since there is evidence that the speech problems of preschool children may be associated with paranatal development (de Guibert, 2011), leading to disruption of interaction of brain hemispheres (Kang et al., 2015), the task was to assess the nature of the sustainable potential of the left and right hemispheres in children with learning disabilities.

The study involved 27 children with a learning disabilities, including 7 girls and 20 boys, from 4 to 6 years old (mean age 5.1 years). The level of nonverbal intelligence (Raven Colored Progressive Matrices Raven) and the steady potentials of the left and right hemispheres in children with learning disabilities were determined. This study analyzes the results of the dynamics of SPs in left and right prefrontal areas (field A9, Brodman) using miniature liquid nonpolarizing silver chloride electrodes of the original design and a DC amplifier with Rbx 100 Mom. The contact surface of the electrode was 0.8 cm².

SP registration was carried out at rest in a position sitting in a chair. The child was explained the procedure of research and demonstrated electrodes. He (she) was asked to close his (her) eyes, although not all children are fulfilled. The values of SP at the same time for the two hemispheres were measured and recorded in the protocol every 30-50 seconds. The total time of the study was 8-10 minutes.

The level of nonverbal intelligence is higher in boys with learning disabilities compared to girls. The emotional state in the overall sample corresponds to the norm. In girls the levels of SPs are higher than that of boys. In girls, the prevalence of right hemisphere activity over the left is more pronounced. Correlations were found between SPs in the right hemisphere at the first measurement and the level of nonverbal intelligence. The study is founded by Russian Foundation of Fundamental Research, project #18-013-00323 A and Russian Scientific fund #14-18-02135

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Increase of Lie Detection Accuracy through Integrated Measurement of Pupil Dilation and Polygraph
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Although polygraph is frequently used in lie detection, it has been reported that the accuracy of lie detection was reduced by the distorted results of using countermeasures and the characteristics of individuals, such as high trait-anxiety. To compensate for the problem, various methods have been attempted using the EEG, fMRI, pupil measurement. Especially, the pupil, which is less influenced by external stimuli and personal characteristics, was regarded as a reliable complementary index of lie detection. However, it is not fully investigated whether the pupil index is a substitute or complement for the polygraph. Therefore, the purpose of this study is to verify whether it is more effective to replace the polygraph with the pupil index or to use it integrally with the polygraph. 30 guilty groups carried out a mission to steal money and 30 innocent groups carried out a mission to take pictures in public places. After the mission was completed, the two groups were instructed to plead not guilty in the CGT. The interview was carried out wearing a polygraph and a wearable eye-tracker in the form of glasses that did not affect to the polygraph measurements. Pupil size and polygraph data (respiration, heart rate, and skin conduct) were measured using a program designed to measure simultaneously. The responses of the crime related questions were compared with those of the control questions. As a result, two of the four indices showed significant results. The pupil diameter was significantly dilated \( < \bar{F} < (1, 58) = 8.37, < \bar{p} < .005 < \bar{i} \), \( \bar{\eta}^{2} < (1) = .128 \) and the skin conduct was significantly increased \( < \bar{F} < (1, 58) = 10.38, < \bar{p} < < .002, < \bar{\eta}^{2} < (1) = .156 < \bar{i} > \) when the guilty group answered the crime related questions. Further, the integrated index, which was combined the pupil index and polygraph data, would compensate for the low discrimination sensitivity of breathing \( \text{AUC}_{\text{RESP}} < (1) = .437 \) and heart rate \( \text{AUC}_{\text{HR}} < (1) = .511 \) which has fallen below the chance level. In addition, the current study showed that the integrated index is the most sensitive index of lie detection compared to other individual indices \( \text{AUC}_{\text{PUPIL}} < (1) = .769 \). These findings suggest that not only pupil index complements the disadvantages of polygraphs, but also the complementary use of polygraphs and pupils increases the accuracy of lie detection.

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Insurance brokers as a model of rational moral choices: the contribution of allelic variations in the serotonin, dopamine and oxytocin pathways

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Introduction. Recent scientific data suggest that the decision-making processes underlying human moral choices are influenced by common variations of the DNA sequence. These findings, however, are often conflicting and difficult to replicate, as the influence of each of these single variants on moral choices is weak. Common methodological limitations of these studies include the enrollment of subjects from the general population and the analysis of individual polymorphisms. Methods. To overcome these limitations we enrolled a peculiar sample of subjects professionally trained to routinely exert volitional control on their emotions and to adopt rational choices, the insurance brokers (129 males), and a group of control subjects (109), matched to brokers for sex, age and education. Each participant was asked to answer to 27 written moral dilemmas and to donate a saliva sample for DNA extraction and genotyping. We genotyped 13 polymorphisms in the SLC6A3 VNTR 40 bp 3'-UTR, rs6313, rs13212041, rs6265, MAOA VNTR, dopaminergic (DRD4 VNTR 48 bp Exon III, SLC6A3 VNTR 40 bp 3'-UTR, rs4680, rs1800497), and oxytocinergic (rs53576, rs1042778, rs2268498) pathways that modulate neurotransmission processes and brain functioning. At first, the influence of each individual allelic variant on moral choices was tested to detect or exclude any main effect; then, the influence of genetic profiles reflecting the activity of each pathway was examined.

Results. None of the allelic variants showed any individual impact on moral choices of brokers. At the opposite, the genetic profile approach revealed that the oxytocin profile, reflecting the combination of SNPs associated in literature with higher levels of empathy, prosociality and enhanced oxytocinergic neurotransmission, increased the moral acceptability of brokers \( p_{\text{uncorrected}} = 0.009, p_{\text{Bonferroni corrected}} = 0.036 \) (Figure 1), but not of controls.

Conclusions. We hypothesized that, in brokers, the genetic profiles that increase oxytocinergic neurotransmission and prosocial behavior promote the utilitarian reasoning toward the group, intended as the species, at the expenses of the single individual. Moreover, these data encourage the analysis of genetic profiles, instead of single polymorphisms, to better represent the overall genetic effect and to boost the statistical power in the case of weak genetic influences.

Picture 1: https://www.eventure-online.com/parthen-uploads/175/18001/add_1_459128_4265777-ba7b8-4896-8983-bb3f8a885a40.png

Caption 1: Moral acceptability of utilitarian choices in controls and brokers: Low oxytocin genetic profiles versus High oxytocin genetic profiles. Data are means ± SEM.

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Exploring the brain contour of implicit infra-low frequency EEG neurofeedback: a resting state fMRI study

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**Introduction:** The most popular neurofeedback techniques are based on the principle of explicit learning when the participant is trained to maintain voluntary control over brain activity. However, implicit fMRI neurofeedback (NF) — presentation of information related to ongoing brain activity when participants pursue no explicit goal and, sometimes, even are unaware of the fact of feedback — is also inducing significant alterations in brain connectivity (RAMOT et al. 2016). The implicit approach is used in clinical practice during infra-low frequency (ILF) EEG NF. Although significant clinical effects of the neurotherapeutic ILF NF are described, its neural mechanisms are yet unknown (OTHEMER et al. 2013).

**Methods:** 52 healthy volunteers were randomized for a single session of ILF NF or sham NF. Immediately before and after the session a resting state fMRI scanning was performed. To test the hypothetical connectivity alterations related to the neurofeedback contour, we used network-based statistics approach, including into analysis the areas with known or supposed participation in the NF circuit, including fronto-parietal and salience networks hubs, lateral occipital cortex, striatum and thalamus (EMMERT et al. 2016).

**Results:** After real vs. sham NF an increased connectivity was observed through a network consisting of the right and left inferior lateral occipital cortex, right dorsolateral prefrontal cortex and striatum nuclei. The overall intensity of the connections within this network changed significantly greater in post vs. pre resting state fMRI session in the NF compared to the sham NF group (p<0.05, FWE-corrected; cluster-defining threshold at p<0.01, uncorrected). This contour has both similarities and differences with the described in other studies contour of the explicit neurofeedback. Similarities include involvement of the part of the lateral prefrontal cortex associated with the maintenance of working memory, and sensory areas relevant to the visual modality of the feedback (extractions of the feedback information). Important differences are presented by involvement of the striatum but not the salience network. It is proposed that salience network is responsible for conscious perception of reward, while unconscious reward is mediated by striatum. Next, the involvement of right, but not left, prefrontal cortex may be related to the leading role of the right brain in implicit learning.

**Conclusions:** We described the brain circuit of implicit infra-low frequency EEG neurofeedback, consisting of the lateral occipital cortex, right dorsolateral prefrontal area and striatum.

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**Friday, September 7th, 2018**

**11.30 – 12.30 a.m.**

**Poster Session 3**

01

**A Complex Psychophysiological Approach to the Analysis of Human Brain and Behavior Responses to Detect an Intentionally Hidden Information**

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Background. The modern lie-detecting technologies are mostly based on the analysis of autonomic nervous system indicators. In our research we consider the hiding information process as a psychophysiological complex of neurophysiological and behavioral responses. The study presents experimental data concerning registration and analysis of a set of psychophysiological indicators reflecting the activity of cognitive, emotional, and executive mechanisms of behavior, involved in information concealment. Methods. 12 males and 20 females, aged from 18 to 23 years (M = 20, SD = 0.18), were tested according standard test procedure “Knowledge of the Guilty”. First names and surnames along with pseudonyms were used as the stimuli in experiments where the task for participants was to conceal the response to his/her first name or surname. Emotional responses were registered using electrocardiogram (ECG), photoplethysmogram (PhPG), and galvanic skin response (GSR). The frequency characteristics of the electroencephalogram (EEG) and amplitude-temporary parameters of cognitive event-related potentials (CERP) were used as the indicators of intensity of brain cognitive processes. The recording activity of nervous systems was carried using 256-channel “Brain Amplifier” (Brain Product Co., Germany). Behavioral indicators - facial expressions, eye movements, gaze fixation time (GFT), pupil diameter (PD) - were monitored using eye-tracking system RED-500 (Siemens, USA). Results and Discussion. The results revealed statistically significant (Wilcoxon test, p ≤ 0.05) differences in all objective indicators related to false and true answers. The emotional indicators included the ECG, PhPG and GSR indexes. Differences on a cognitive level were reflected in latencies of CERP and the ratio of power spectrum of EEG in alpha- and beta-bands. The minimum value of the latency of P300 (440 ms) was observed while true answering. In the case of false answer, the latency of the response increased up to 560 - 620 ms. A mathematical algorithm, developed to assess differences in ERP and EEG parameters, allows detecting cognitive aspects of false responses with a probability of about 94%. The results of the localization by method ‘LORETA’ brain structures, realizing a person’s behavior in a situation of choice between true or false response, showed that different subjects activated different areas and structures of the brain. On a behavioral level PD and GFT on the words associated with hidden information were most effective. The proposed approach to analysis of ‘lie processes’ allows to shed light on their complex nature.
02

Word meaning acquired by auditory-motor associations: the role of the left perisylvian cortex
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¹National Research University Higher School of Economics, Moscow, Russian Federation
²Moscow State University Of Psychology and Education, Moscow, Russian Federation
³Moscow State University of Moscow State University. The aim of the work is to reveal the function of the alpha rhythm as a possible marker of Parkinson’s disease. The author’s method was used - “Microstructural analysis of brain oscillatory activity”, which works with narrow band frequency selective generators (Danilova, 2002). The method determines the localization of activated brain structures in different hemispheres and in accordance with the coordinates of the “Stereotactic Atlas of the Human Brain” (Talairach, Tournoux, 1988). When the alpha generators were divided into two frequency ranges (8-11 Hz and 11-13 Hz), new data were obtained about their connection with different hemispheres. Only in the left hemisphere within three seconds there was an increase in activity of low-frequency alpha rhythm (8-11 Hz), whereas in the right hemisphere activity of high-frequency alpha rhythm (11-13 Hz) decreased. In this case, the increase in the activity of theta-generators occurred in parallel in both hemispheres. Two other groups of high-frequency alpha (11-13 Hz) in the left hemisphere and low-frequency (8-11 Hz) in the right hemisphere had a very low level of activity. For all three time intervals in solving mathematical abilities, the level of the low-frequency alpha rhythm was significantly higher than the level of activity of the high-frequency alpha rhythm (n = 10, p < 0.05, T crit = 10, T emp = 9). The duration of theta generator activity was shorter than the alpha of the generators in solving the mathematical abilities of the Test K. Mangina. The growth of alpha generator activity in solving mathematical abilities was revealed in Posterior Cingular BA 30, Anterior Temporal G. BA 20, as well as in the subcortical structures of the brain. The brain structures that were activated by theta-generators were concentrated in different sections of the Cingular cortex. The fact that alpha generators are involved in many brain structures emphasizes their very important function - as a special mechanism of local inhibition. The work is supported by the grant of the RNF No. 14-18-03253 P

03

The function of the alpha rhythm during the solution of complicated mathematical problems
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²HCL Technologies, Moscow, Russian Federation

The aim of the work is to investigate the brain mechanisms of mathematical abilities, determined by K. Mangina’s Test. The composition of the test includes a set of pair geometric figures, in which the first small figure is an element of a more complex - the second figure. The study was carried out by a group of young people (10 people) studying at the Faculty of Mechanics and Mathematics of Moscow State University. The purpose of the work is to reveal the function of the alpha rhythm as a possible marker of Parkinson’s disease. The author’s method was used - “Microstructural analysis of brain oscillatory activity”, which works with narrow band frequency selective generators (Danilova, 2002). The method determines the localization of activated brain structures in different hemispheres and in accordance with the coordinates of the “Stereotactic Atlas of the Human Brain” (Talairach, Tournoux, 1988). When the alpha generators were divided into two frequency ranges (8-11 Hz and 11-13 Hz), new data were obtained about their connection with different hemispheres. Only in the left hemisphere within three seconds there was an increase in activity of low-frequency alpha rhythm (8-11 Hz), whereas in the right hemisphere activity of high-frequency alpha rhythm (11-13 Hz) decreased. In this case, the increase in the activity of theta-generators occurred in parallel in both hemispheres. Two other groups of high-frequency alpha (11-13 Hz) in the left hemisphere and low-frequency (8-11 Hz) in the right hemisphere had a very low level of activity. For all three time intervals in solving mathematical abilities, the level of the low-frequency alpha rhythm was significantly higher than the level of activity of the high-frequency alpha rhythm (n = 10, p < 0.05, T crit = 10, T emp = 9). The duration of theta generator activity was shorter than the alpha of the generators in solving the mathematical abilities of the Test K. Mangina. The growth of alpha generator activity in solving mathematical abilities was revealed in Posterior Cingular BA 30, Anterior Temporal G. BA 20, as well as in the subcortical structures of the brain. The brain structures that were activated by theta-generators were concentrated in different sections of the Cingular cortex. The fact that alpha generators are involved in many brain structures emphasizes their very important function - as a special mechanism of local inhibition. The work is supported by the grant of the RNF No. 14-18-03253 P
HEMISPHERIC DOMINANCE FOR NON-EMOTIONAL INFORMATION? AN AUTONOMIC APPROACH.
L. De Zorzi, S. Ranfaing, J. Honoré, H. Sequeira
University of Lille, Lille, France

The physiological reactivity to emotional information is known to be modulated by psychological traits. However, few is known about how the location of such information in the visual field modulates this reactivity. The aim of this study was (1) to compare physiological variations in response to neutral and emotional pictures presented in central vision and in the left and the right hemifields, and (2) to investigate the relation between these variations and depressive trait.

Twenty-four healthy participants were presented with 3 sets of 16 pictures (unpleasant, neutral and pleasant) from the International Affective Picture System, at three eccentricities (-12°: 0°: +12°). The sets had been balanced as for main physical properties of the pictures, among which brightness, contrast and spatial frequencies. The participants had to fixate a cross in the center of the screen and to report the location of the pictures (left, center or right). Participants fulfilled questionnaires (depression, BDI; anxiety, STAI) and we recorded cardiac and electrodermal (ED) responses to pictures.

A greater cardiac deceleration to right than left presented stimuli was observed for neutral pictures but not for emotional ones. Interestingly, this effect was positively correlated with depression scores. Besides, participants showed greater ED responses to right presentation for neutral pictures and the reverse pattern was observed for emotional ones.

This study seems to show (1) a stronger coding of neutral pictures when they appear in the right hemifield and also (2) that this effect is modulated by depression scores. These results could indicate that the neutral information is preferentially processed by the left hemisphere, as a complementary role to the right hemisphere dominance to process emotional one.

BIOELECTRICAL BRAIN CORTEX ACTIVITY IN INTELLECTUALLY GIFTED CHILDREN OF PRIMARY AND MIDDLE SCHOOL AGE IN SOLVING COGNITIVE TASKS
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Introduction. The characteristics of brain systems providing cognitive activity of intellectually gifted children remain less researched in modern psychophysiology. Thus, the study aimed at researching the bioelectrical cortex activity in intellectually gifted children of primary and middle school age in solving cognitive tasks was performed.

Methods. 120 comprehensive school students of primary (7-12 years old) and middle (12-15 years old) school age took part in the study. Depending on the age and level of intellectual giftedness they were divided into four groups: 1) primary school age, intellectually gifted (28 people); 2) primary school age, not intellectually gifted (26 people); 3) secondary school age, intellectually gifted (32 people); 4) secondary school age, not intellectually gifted (34 people).

We used the electroencephalography method (EEG) of measurement. The EEG signals were recorded in the frequency range of 0.5 to 35.0 GHz from 21 scalp electrodes, set according to a monopolour scheme according to the International 10-20 System.

For statistical analysis, we used the 3-way MANOVA and the comparative post hoc analysis according to the Tukey criteria. The processing was conducted with the help of STATISTICA 13.0 computer software.

EEG recording was performed during wakeful relaxation (with eyes closed) and solving cognitive tasks that were divided into verbal and nonverbal (by character) and convergent and divergent (by type).

Results. The formation of the brain system providing the verbal divergent activity, from primary to middle school age, is carried out by coherent connections development from intrahemispheric in posterior cortex areas, between anterior and posterior cortex areas of right hemisphere in delta band to long interhemispheric connections in all frequency bands. In middle school age brain cortex is already functionally specialized for cognitive activities.

In middle school aged intellectually gifted students the brain cortex functional specialization for cognitive tasks solving was found. For convergent tasks, the numerous strong long interhemispherical functional connections in alpha 1 frequency band; for convergent tasks – the “creativity axis”, the expressed diagonal functional connections between anterior cortex areas in the right hemisphere and posterior cortex areas in the left hemisphere in theta 2 band.

Conclusions. The results of the study showed that the distribution character and the power of the cortex functional networks in cognitive activities are differentiated depending on the type and character of tasks and are due to the level of intellectual giftedness and age characteristics of students.

The Effectiveness of Bilateral Repetitive Transcranial Magnetic Stimulation in Anhedonia among Patient with Major Depressive Disorder: A pilot study
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Abstract

Introduction: Anhedonia is a main symptom of major depressive disorder (MDD) and a predictor of the poor results of treatment. There are no effective pharmacotherapies or psychotherapies for anhedonia. The aim of this study was to investigate the effectiveness of bilateral repetitive transcranial magnetic stimulation (rTMS) in reducing anhedonia among
patients with MDD.

**Methods:** In this clinical trial study, Patients with MDD were referred to Atieh Clinic, Tehran, Iran, during January 2016 to September 2017 and were randomized into two groups receiving real and sham rTMS. In real rTMS group, for ten sessions, patients received a 10-Hz rTMS on the left dorsolateral prefrontal cortex (DLPFC) and a 1-Hz rTMS on the right DLPFC. Then the Snaith-Hamilton Pleasure Scale (SHAPS) and the Hamilton Depression Rating Scale (HDRS) were used to evaluate the participants both before and after treatment.

**Findings:** According to the results, bilateral rTMS cured anhedonia ($P<0.04$) and depression ($P<0.002$).

**Discussion:** This study indicated that rTMS could be considered a new treatment in order to cure anhedonia in patients with MDD.

**Keywords:** Anhedonia, Transcranial Magnetic Stimulation, Major Depressive Disorder

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**07**

**Search of informative EEG characteristics for Heath-Carter somatotype components**

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**Introduction.** A very preliminary attempt is undertaken to determine the "model" EEG characteristics for Heath-Carter somatotype components by means of factor analysis.

**Materials and methods.** 3 groups of patients were chosen from the whole sample of examined female healthy students, aged 18-20, with pronounced Heath-Carter components of somatotype: ectomorphy, 4-7 points ($n=10$); mesomorphy, 4-7 points ($n=32$); endomorphy, 4-7 points combined with moderate and weak development of mesomorphy lower 4 points ($n=12$). In each group factor analysis was held for the number of EEG parameters including power and coherence in alpha band in frontal, occipital and temporal leads.

**Results.** The meaning of factors is the same for all somatotype components, but maximal loadings belong to different EEG parameters in ecto-, meso and endomorphy groups. The first factor for all somatotype components has the greatest number of loadings on power parameters mainly for low-frequency alpha for different leads. For endomorphy and ectomorphy the first factor has loadings on coherence F1-F2 in some frequency sub-bands. All loadings are positive.

The second factor for mesomorphy has positive loadings on interhemispheric coherence, mainly occipital. For ectomorphy positive loadings are on frontal-temporal and frontal-occipital coherence in the left hemisphere are added, while the single interfrontal coherence has negative loading. For endomorphy the second factor has positive loadings mainly on left intrahemispheric coherences, mostly in 9-11 and 11-13 Hz, as well as on interhemispheric coherence in temporal leads.

The third factor for ectomorphy has positive loadings mostly on power parameters in high frequency alpha band; only one significant loading for mesomorphy. For endomorphy the third factor has negative loadings on interoccipital coherence through almost all alpha band.

The fourth factor for ectomorphy has negative loadings on frontal-temporal and frontal-occipital coherence in the left hemisphere for low frequency alpha, and positive loadings on frontal-occipital coherence in the right hemisphere and interfrontal coherence for 11-13 Hz sub-band. For endomorphy, in contrast to ectomorphy, positive loadings on left frontal-temporal and frontal-occipital coherence for low frequency alpha are fixed. For mesomorphy the fourth factor has positive loadings on frontal and occipital power parameters for high frequency alpha.

**Conclusion.** Modest number of patient (the examination of students is in progress) did not allow to include the whole pull of EEG parameters in the analysis and examine the male part of the sample. Still the results gives rise to the research of combined variability of somatic and EEG traits. Supported by RFBR grant 16-06-00248a.

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**08**

**Age-related differences in processing speed in children**

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Age-related differences in the processing speed has been observed in a great variety of tasks. In spite of the great amount of researches in this area, we know relatively little about the nature of this developmental tendency. The aim of this study was to assess whether age-related differences in reaction time (RT) can be explained satisfactorily in terms of a global age-related differences in processing speed alone.

The sample consisted of 48 7-year-olds, 50 8-year-olds, 46 9-year-olds, and 35 adults. The test battery consisted of three types of RT tasks: simple, discrimination, and choice.

We have revealed clear age-related differences in processing speed not only between children and adults but also between three age groups of children. However, using transformation method proposed by Madden et al. (2001) and Ridderinkhoff & van der Molen (1997) we revealed that there are not only global age-related differences but also process-specific age-related differences in processing speed. Among children, age-related differences larger than predicted by the global difference hypothesis were evident when tasks required spatial orientation discrimination and stimulus–response rule complexity, but not for response suppression or reversal of stimulus–response contingencies. The observed process-specific, age-related differences in processing speed generally are consistent with the principle of heterochronicity of human brain development (Casey et al., 2005).
Gaze behavior in mixed facial emotion recognition task
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Gaze behavior and facial emotions are important parts of human social interaction. Natural emotions expressions frequently have low intensity and mix with each other. We studied relation between the number of fixations in lower (LF) and upper (UF) part of face stimuli and the recognition time (RT) for every trial during facial emotion recognition task. In experiment morphed emotional faces were used. The samples of basic emotions (fear, anger, sad, happy, disgust and surprise) and neutral face expression of actor AF01 were borrowed from KDEF database. We mixed every emotion sample with each other in different proportions (one emotion in the couple was present in 50%, 66%, 75%, 80%, and 83%). Therelater we made samples with different intensity by mixing the resulting emotion sample with neutral sample in different ratio (50%, 33%, 25%, 20%, 16% and 100%, i.e. morphing without neutral sample). We used emotion samples with 50% intensity and various morphing ratio and samples with 50% morphing ratio and different intensity. Participants (20 males, 17 females, mean age 22.44±2.37) were instructed to make the most accurate judgments; they were no limited in time for recognition task and could choose more the one answer. For statistical data analysis we used ANOVA and Student’s t-test. We found the relation between recognition of mixed emotions and eye movement parameters and RT. Correct answers (at least one emotion in sample was recognized correctly) accompanied by greater fixation numbers than wrong answers (UF: \( <i>F</i>\_{1,11478}=22.37, <i>p</i><0.001; 9.48±0.12 vs 5.68±0.10), \( LF: \langle F\rangle_{1,11478}=17.46, <i>p</i><0.001; 6.01±0.06 vs 3.83±0.45, \langle p\rangle_{1,11478}=-28.99, <i>p</i><0.001; <i>F</i>\_{1,11478}=10401, <i>p</i><0.001). Suppose, correctly face emotional recognition demands detection of several mimic features. The larger fixation number was observed in UF of emotional face in comparison with LF (6.01±0.74 vs 4.93±0.04, \( <i>t</i>\_{1,10401}=-12.91, <i>p</i><0.001). We suppose that this phenomenon is due to eye region of emotional face contain the greater amount mimics features of particular emotions than mouth area. Looking at unnatural mixed emotional faces (e.g., happy-fear) characterized by greater fixation numbers and longer response time than looking at more natural mixed emotional faces (e.g., happy-surprise) (UF: \( <i>F</i>\_{20,11478}=8.44, <i>p</i><0.001; 8.86±0.17 vs 7.14±0.09, \langle t\rangle_{20,11478}=-8.87, \langle p\rangle_{20,11478}=4844, \langle p\rangle_{20,11478}=4.68, \langle t\rangle_{20,11478}=-8.44, \langle p\rangle_{20,11478}=4693, \langle p\rangle_{20,11478}=4.01; TR: \langle F\rangle_{20,11478}=6.8, <i>p</i><0.001; 4.32±0.09 vs 3.41±0.04, \langle t\rangle_{20,11478}=-9.01, \langle p\rangle_{20,11478}=4564, \langle p\rangle_{20,11478}=0.001). Thus, the spatial distribution of fixations and RT relate with facial emotion recognition specificity in mixed facial emotion recognition task.

THE CULTURAL DIFFERENCES IN EYE MOVEMENTS DURING SCENE PERCEPTION
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Introduction. Previous cross-cultural eye-tracking studies have found that culture shapes eye movements strategies during scene perception. However these researches have been limited to the American, Chinese and African samples. There are no evidences how Russians view pictures with focal object on a complex background. To examine this issue we monitored eye movements of Russians while they viewed scenes containing objects on relatively complex backgrounds. Methods. This study recruited 23 participants from the Western and 25 participants from the Eastern regions of Russia. We hypothesized that subjects from Western regions will fixate more on the focal objects on a complex background in comparison with subjects from Eastern regions. Experimental material and the procedure were the same as Chua et al. (2005) to maintain the reliability and validity. Each experiment consisted of study phase and recognition phase. During the study phase 36 pictures of focal objects with realistic complex backgrounds was presented in the pseudorandom order. For the recognition-memory task performance during the recognition phase the original 36 objects and backgrounds together with 36 new objects and backgrounds were manipulated to create a set of 72 pictures. Half of the original objects were presented with old backgrounds and the other half with new backgrounds. This procedure resulted in four picture combinations: 18 previously seen objects with original backgrounds, 18 previously seen objects with new backgrounds, 18 new objects with original backgrounds, and 18 new objects with new backgrounds. Results. The results showed that number of fixations, first fixations times on focal objects and fixation durations were significantly differed (\( F=20.161, \langle df\rangle=1, p<0.001\)) between groups. Subjects from Western regions fixated more frequently on the focal objects, tended to look on them more quickly and recognized more objects during recognition-memory task. Fixation durations of subjects from Eastern regions during background viewing were smaller. Thus, subjects from Eastern and Western parts of Russia demonstrated different strategies of scene perception due to the cultural differences in these regions. Discussion. The obtained results suggested the hypothesis of socialization practices influence. Subjects from East regions live in relatively complex social networks. Therefore attention to context is more important for their socialization processes. Subjects from West regions live in less constraining social worlds that emphasize independence and allow them to pay less attention to
Effects of tDCS on DLPFC functions

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Background. There is a growing body of literature suggesting that noninvasive brain stimulation techniques (e.g., tDCS), can modulate brain activity in ways that benefit aspects of cognition that are directly related to learning, memory, attention, acquisition, and performance (Coffman et al. 2012; Coffman et al. 2014; Filmer et al. 2014). Research suggests that stimulation of the left dorsolateral prefrontal cortex (DLPFC), a region of the brain involved in working memory processes (Barbey et al. 2013), significantly improves performance. However, the specificity of the improvement to other cognitive processes has been less studied (Hill et al. 2016; Brunoni et al. 2014; Dedoncker et al. 2016). The aim of this study was to investigate the effect of tDCS on DLPFC-related (i.e., working memory and decision making) and non-DLPFC-related (i.e., perception and response time) functions using psychological outcomes. Methods. 17 healthy individuals (8 males) were tested after sham and active tDCS. They took part in a double-session of active (2mA, duration 1200 s) and sham tDCS in a randomized, cross-over design. The 5-cm anode was positioned over the right cheek and the 5-cm cathode over the left DLPFC. Cognitive functions were assessed immediately after tDCS procedure. We used cognitive tasks from PEBL battery to measure cognitive function - working memory by the N-back task with different types of stimuli (consonant letters and squares); visual perception by the Object Judgment task; reaction time by the Simple Response Time; decision making by the IOWA task. Results. The analysis (Wilcoxon signed rank test) revealed that no significant differences were obtained in measured parameters: N-back correctness 1 (V = 63, p-value = 0.538), N-back correctness 2 (V = 49, p-value = 0.5505), IOWA reaction time (V = 86, p-value = 0.6777), Object Judgment reaction time (V = 72, p-value = 0.8536), Simple Response Time (V = 76, p-value = 1). Conclusions. Cognitive measures showed no significant differences between active stimulation conditions and no stimulation, as well as one of the sham conditions and no stimulation. Consequently working memory and decision making were not significantly altered by tDCS.

The influence of face race on the gaze cueing effect: eye tracking method

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The spatial attention shift in the cued direction is manifested in a faster response time to the target in congruent than in incongruent trials. This effect is more pronounced for peripheral compared to the central cueing conditions. However, if a face looking left or right is used as a central cue, the response time is reliably faster when gaze is directed toward the target. This effect of short-term redirection of visual spatial attention to the same object that other people are looking at is known as the gaze cueing effect (GCE). There is evidence that the strength of this effect depends on many social factors, such as the trust in a partner, her/his gender, social attitudes, etc. Our task was to study the influence of face race on the strength of GCE. We used the eye movement parameters as a measure of GCE strength in the performance of the Posner Cueing Task. Participants were instructed to fix the black dot in the centre of the screen until it changes color to green or red, and then as soon as possible to make a rightward or leftward saccade, depending on color of a fixed point. A male distractor face was shown in the centre of the screen simultaneously with a fixed point, so that fixation point was located in the center of the nose bridge. The gaze direction of the distractor face changed from straight ahead to rightward or leftward at the moment when color of a fixed point changed. It could be either congruent or incongruent with required saccade direction (50x50%). Twelve face distractors were chosen. Three race categories: Caucasian (own-race), Asian and African (other-race) were used (four faces in each category). Twenty five Caucasian participants (4M, 21F, age 18-26) were tested. During the performance the eye movements were registered. The results showed that the latency of correct saccades was significantly shorter in congruent than non-congruent trials (t=2.646, p=0.014) only in the conditions of own-race face distractor presentation. Also the significant influence other-race faces on the velocity of mistaken saccades was revealed. The velocity of saccades in the wrong direction was lower in the other-race versus own-race face distractor condition (t=2.610, p=0.015). The results showed that the race of face distractors influence the strength of the gaze cueing effect, that manifested in the change of latency and velocity of the ongoing saccades.

Sensorimotor Integration and the Inner Picture of Health of the Primary Schoolchildren

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Objectives. The primary school age is a sensitive period for developing voluntary psychic functions needed for successful
We investigated the effects of a distracting face stimulus (unattended stimulus/cue) on a visual forced-choice task by combining the gaze cueing effect with the Simon task. We hypothesized that due to decreased inhibitory control, unattended stimuli would have greater effects on older adults what could be detected by an increased amplitude and latency of the P3b component in ERP measures. While performance measures were similar across the two participant groups, differences were observed in ERP measures. Bilinguals exhibited larger P3b amplitudes (1.55 µV, \( <p=0.040 \)) during retrieval. Moreover, bilinguals exhibited smaller (-0.53 µV) LPC amplitudes compared to monolinguals (-2.16 µV, \( <p=0.007 \)) during the retrieval phase.

Conclusions: These findings suggest that performance measures alone may not be sensitive enough to identify differences in cognitive processing between bilinguals and monolinguals. The larger P3b in bilinguals relative to monolinguals suggests that the former group has more resources available in the phonological loop for task completion. The smaller LPC amplitudes in bilinguals relative to monolinguals suggest that bilinguals may find the task easier than monolinguals. Overall, we posit that working memory is more efficient in bilinguals compared to monolinguals, as reflected by neural activity during encoding and retrieval.
Participants had to press the left/right button when target letter B/J was presented. The target stimulus location and the response could be congruent (CS) or incongruent (ICS). Older adults were significantly slower and had larger Simon-effect than young adults. Target-locked P3 had larger amplitude and earlier latency in the younger group compared to older adults, and in the CS compared to the ICS condition. The response-locked lateralized readiness potential (LRP) was larger and had earlier onset in older adults and the ICS condition evoked larger LRP amplitude than CS in this age group. We hypothesized that an important social cue like gaze would influence spatial visual attention; however, it did not have a significant effect on our investigated parameters. The unattended face-locked N170 had larger amplitude and longer latency in the older group but in a later old/new test, young adults recognised more faces than older participants and only they had a significant P3 component in this task. Our study could reinforce 5-healthy older people’s declined cognitive control in perceptual and motor processes. Moreover, older adults process unattended and distracting face stimuli longer and to a greater extent than young adults but their performance was worse in a later old/new test. Finally, our data could not detect coherent results about the effect of gaze cueing and distraction on the visuospatial or the motor processes. In conclusion, older adults have less effective cognitive control but they cannot take advantage of processing distracting stimuli.

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Long-range temporal correlation of intrinsic alpha oscillation predicts consistency of internally guided decision-making

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Degree of decision consistency is one of the characteristics of individual decision making. However, the neural substrates underlying the individual difference of the decision consistency has not been clarified. The present study investigated the relationship between the temporal consistency of intrinsic brain activity and the decision consistency in the two types of decision making: One is internally guided decision making in which no correct answer based on external circumstances is available, and another is externally guided decision making in which a single correct answer exists. To assess individual differences of intrinsic brain activity, twenty-four healthy undergraduate students performed eyes closed resting state EEG recording for five minutes. After that, as the internally guided decision-making task, they conducted an occupation preference judgment (e.g., “Which occupation would you rather do? … Lawyer or Designer”). In addition, for the externally guided decision-making task, they performed a salary judgment (e.g., “Which occupation is highly paid? … Lawyer or Designer”). The order of the tasks was counterbalanced across participants. For resting state EEG data, we conducted detrended fluctuation analysis (DFA) for scaling a slow decay of autocorrelation. For the decision-making series of each task, we calculated the rate of trials in which a certain occupation word was repeatedly chosen or rejected. Current data demonstrated that front-central alpha (8-13 Hz) DFA exponent was positively correlated with the degree of decision consistency in the occupation preference judgment. In contrast, no such relationship was found in the salary judgment. That is, higher temporal consistency of intrinsic brain activity related higher decision consistency in the internally guided decision-making but not in the externally guided decision-making. The present results imply that the temporal consistency of intrinsic brain activity forms the foundation of the consistency of one’s own internal criteria.

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Mnemic activity in preschool children: differences in motor and sensor functional asymmetry

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Introduction. The actuality of issue of studying the development of children’s cognitive activity is determined by the need to improve the quality of cognitive activity, including a mnemic one, which provides successful realization of a personality subjective potential. Especially significant is the connection of the mnemic activity (MA) with children’s psychophysiological qualities.

Objectives. To reveal MA specificity in 5-6 and 6-7 year-old children with different profiles of motor and sensor functional asymmetry (MSFA).

Methods. This research covered 100 children of both sexes (40 of 5-6 years old and 60 of 6-7 years old). The methods used were: “10 words” (Luria), “10 objects” (Martsinovskaia), studying memory during the game, work and communication (Istomina), “Sense correlation” (Leontiev), “Pictogram” (Luria), “Classification” in two series (Zinchenko). To detect a MSFA profile we applied the tests that define a dominant hand, leg, eye, and ear (Bragina, Dobrohotova, et. al.). Kruskal-Wallis test was used for statistical estimation of the differences.

Results. MSFA profile distribution showed that “right-handers” constitute 50.0% of the 5-6-year-olds and 55.0% of the 6-7-year-olds; 27.5% of the 5-6-year-olds and 20.0% of the 6-7-year-olds were “ambidexterous children”; 15.0% in each sample age group demonstrated “absolute right-handedness”, 7.5% of the 5-6-year-olds and 10.0% of the 6-7-year-olds demonstrated “left-handedness”. The highest rate of 6-7-year-olds with MA high level was detected concerning “ambidexterity” profile (33.3%); high level was also characteristic of 11.1% of the “absolute right-handers” and 6.1% of the “right-handers”. “Left-handers” were not revealed among those having this level. The majority of the children regardless of
their age showed the middle MA level. This level was characteristic of all the “left-handers” in both groups; it was typical of 75.0% of 5-6-year-olds and 87.8% of 6-7-year-old “right-handers”, 83.3% and 77.8% of children aged 5-6 and 6-7 years old in the “absolute right-handers” group; 81.8% and 66.7% among “ambidexters” of both age groups. The highest rate of children having a low MA level among the 5-6-year-olds was found in the “right-handers” (25.0%), among 6-7-year-olds – in the “absolute right-handers” group (11.1%).

Conclusions. Based on the MA motivation component, we revealed dominance of girls over boys, “ambidexterous children” over representatives of other MSFA profiles. High level of MA motivation component was demonstrated by “right-handers” and “ambidexters”. Low indices of MA operation-and-technical component were characteristic of the representatives of all the MSFA profiles.

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Taller students are less happy: the relationship between somatometric parameters and self-esteem

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Introduction

According to modern studies conducted in various countries, there is a relationship between height and happiness (Beaton et al., 2009; Sohn, 2016). Similar relationships have also been described for Body mass index (BMI) (Blanchflower & Oswald, 2008). The purpose of this work was to determine based on a sample of Russian universities students if there are psychophysiological interrelationships among height, weight, BMI and several parameters of self-esteem.

Methods

The study involved 318 students of both sexes, who were enrolled in junior courses in four different Russian universities (mean age 20.0±2.1). Concerning somatometric indicators, body height and weight were measured. BMI was calculated based on the obtained data. The students’ self-esteem was defined by 11 parameters of self-evaluation (health, sportiness, attractiveness, confidence, sociability, cheerfulness, success, intelligence, happiness, faith, prosperity) with the help of a modified variant of the Dembo-Rubinstein method of self-esteem measurement. The obtained somatometric and psychological data were analyzed with variation statistics methods, and were also subjected to correlation analysis. With a significance level of p<0.05, there were found statistically significant correlations among the measured parameters, the characteristics of which formed substantial relationships.

Results

The results of the study showed that the average weight of the surveyed students was 60.1±11.1 kg, height - 169.5±9.2 cm, BMI - 20.8±2.7, which, in general, characterized the sample as normative concerning somatometric indicators. Correlation analysis revealed that BMI correlated more with weight (r=0.79), but not with height (r=0.13). It was also found that heavier students gave a higher estimate to their confidence (r=0.13) and mind (r=0.12). Taller students proved to be less religious (r=-0.13) and healthier (r=0.11). Taller students turned to be sportier (r=0.14) and more confident (r=0.13) in self-perception. At the same time, taller students felt less happy (r=-0.13). The study also showed lack of significant correlations between somatometric parameters and such indicators of self-esteem as attractiveness, sociability, cheerfulness, success, well-being (p>0.05).

Conclusions

This work revealed new psychophysiological interrelations – taller students tend to be much healthier, sportier and more self-confident. This is still not enough for them to feel happy. More religious students, who are shorter, consider themselves happier. Having greater body weight, students consider themselves as more confident and intelligent. It was also revealed that people of different height, body weight and BMI may be equally attractive, sociable and cheerful, prosperous and successful. The results can be specified in the context of different age groups and gender differences.

The connections between intelligence, creativity and the sensorimotor integration in children of different ages

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The results of further studies on the connection between creativity and intelligence have been extremely contradictory. On the one hand, there are findings that show a significant correlation between these two parameters (Hennessey, Amabile, 2010); on the other, there is data that proves such a link to be insignificant. There is an opinion that any and all combinations of intelligence and creativity are possible (Deary, 2012), which is why there are individuals with high levels of both parameters and low test scores, as well as people with a high level of one parameter and a low level of the other. It can be assumed that the particular nature of the interplay between creativity and intelligence is determined not only by the conditions in which a person develops and their personality traits (Haier, 2009), but also their age.

The purpose of the report was to compare the interactions between creativity level and intelligence level of the 7-8-year-old children and 12-13 year-old teenagers and to study how 7-8-year-old children and young teenagers (12-13 years old) with different levels of intelligence and creativity assimilate stochastic signals. In all, 160 children took part in the study, 80 first- and second-graders who were 7-8 years old (37 boys and 43 girls), and 80 fifth-graders, aged 12-13 (40 boys and 40 girls). We used the following procedures Raven’s Progressive Matrices; A battery of creative thinking tests, amounting to a
modification of Guilford and Torrance’s tests, in a Russian adaptation created by E. Tunik, the computer reflexometric method. Our findings show that the relationship between the level of intelligence and the level of creativity is different in the two age groups. With the 7-8-year-olds, they are independent of each other, whereas with the 12-13-year-olds there is a weak but significant link between them. With the 7-8-year-old children, the level of creativity predetermines the ability to detect the structure of a sensory stream that is organized in a complex way. At the ages of 12-13, neither the level of creativity nor the level of intelligence is connected with the parameters of sensorimotor integration, but they are interconnected. The study is founded by Russian Foundation of Fundamental Research, project #18-013-00323

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The perception of advertising images by children of 5 years old
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Introduction. The purpose of the research was to analyze how a child chooses the products in the markets and later to compare the results with the choice of his/her parents.

In view of the age-related features of child development, at the preschool age the greatest influence is exerted by the phenomena of psychological contamination (affecting the emotional sphere of the personality), imitation (involving the appropriation of behavior models that have been observed) and indoctrination.

Children compel their parents to buy attractive products, which are far too often inferior, and this sometimes leads to friction with the parents, who refuse to do so. When parents explain that these products are deleterious to their health, 23 percent of children agree with them, but 60 percent actively protest and become upset (Strasburger et al., 2009).

It has already been shown that the extent to which a child has formed the theory of mind plays a significant role in their understanding of the purpose behind advertisement (Sergienko et al., 2013).

Investigations into children’s perception of a package by using an eye-tracking device are rarely found in the research of child psychologists. Sequential presentation of visual patterns on a computer screen and documentation of children’s eye movements using an eye tracker will make it possible to analyze in greater detail their areas of interest and prove what advertising material has a special effect on children’s preferences.

Methods. The participants were 25 children between the ages of 3 and 7 (12 boys and 13 girls) and their 50 parents. In order to achieve our objectives, we used several psychodiagnostic procedures: a survey for children about their knowledge of the products, Theory of mind analyzing and eye tracking. For the subsequent statistical analysis, the following facts were used: the number of fixations, the total gaze duration, the percentage of the time on the areas of interest and the length of the saccades. Child could fix the eye on the fairytale characters on a package of cottage cheese, or information about taste, or the name of the brand. Results and conclusion. The gaze duration on the advertising image of a fairytale character is substantially longer than those for the taste and the brand. Food selection for preschool children is based predominantly on good feelings to a character depicted on a package. The study is founded by Russian Foundation of Fundamental Research, project #18-013-00323a, by Russian Scientific fund #14-18-02135.

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Relationship between psychophysiological measures during an imitation-inhibition task and personal traits
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Automatic unconscious mimicry occurs during social interactions. It contributes to the formation of society by increasing positive feelings and successful communication. When we observe the actions of the other people, an observed motor representation is created by the putative human mirror system (hMS). However, for successful communication, inhibition of such automatic imitation is also important. Since there has been little work on the relationship between personal social traits and activity of the social brain, we tested the correlations between psychophysiological measures during an adaptive imitation-inhibition task and self-report personal traits.

Participants repeatedly observed a short video of finger lifting and were asked to respond by lifting their index finger as soon as possible according to a congruent indicator presented simultaneously. Event-related EEG mu wave desynchronization (ERD) was recorded to measure hMS activity. In addition to reaction time (RT), d-prime and C from signal detection theory were calculated from the behavioral data. D-prime reflects task accuracy and C reflects response bias. Empathy and systemizing quotient (EQ/SQ) to evaluate personal traits on social-cognition were provided by participants. Congruency effects for RT and mu ERD were calculated by subtracting congruent trials from incongruent trials. The congruency effect of RT was negatively correlated with EQ but not with SQ (\(<\rho_p\rangle = -.429, \langle\rho\rangle = .032; \langle\rho\rangle = .071, \langle\rho_p\rangle = .738; \) respectively), indicating that those who scored low EQ showed a greater congruency effect. D-prime was negatively correlated with EQ but not with SQ (\(<\rho\rangle = -.432, \langle\rho\rangle = .31; \langle\rho\rangle = -.250, \langle\rho\rangle = .738; \) respectively), indicating that those with lower EQ showed lower task accuracy. No significant correlation was found for response bias C. The correlation between the congruency effect of mu wave ERD and EQ did not reach significance. On the other hand, a positive correlation with SQ (\(<\rho\rangle = .457, \langle\rho\rangle = .022\)) was found. The correlations of mu ERD and RT during the task with personal empathy and systemizing traits were tested. As a result, EQ was correlated with behavioral data and SQ was correlated with the congruency effect of EEG data. Thus, we conclude that, during the task we used, not only empathic ability but also systemizing ability of social cognition plays an important
Spatial processing in highly math-anxious individuals: an event-related brain potential study
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Introduction: Recent studies have reported that highly math-anxious (HMA) individuals tend to perform worse than their low math-anxious (LMA) peers on spatial processing tasks, and this poor spatial skill could be a contributing factor in developing their math anxiety. The aim of the present study was to examine further HMA’s low spatial ability by recording their brain activity during a mental rotation task. The event-related potential (ERP) technique has proven to be useful for studying spatial processing. Concretely, a slow posterior negative deflection (the rotation-related negativity-RRN), that is superimposed on a broad late positive component (P3), is considered a direct electrophysiological correlate of the mental rotation process.

Methods: Twenty HMA and 20 LMA individuals were presented with letters in their normal or mirror-reversed version in six orientations (0, 50, 100, 150 210, 260 and 310 degrees) and were asked to make mirror-normal discriminations. Results: A mental rotation effect was found for both groups, with response time and error rate increasing with angular deviation from upright. This effect did not differ across groups, but HMA individuals were in general slower than their LMA counterparts. As for ERPs, the amplitude in the 450-550 ms window became more negative at parietal sites the greater the degree to be rotated, showing the expected ERP mental rotation effect (RRN) in both groups. Interestingly, amplitude was more positive for the HMA group than for the LMA group in greater deviations from upright in this time window, suggesting a larger role. Moreover, hMS activity seems to be related to the cognition of low-order physical aspects of movement that is then passed to high-order processes.

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Self-reflection and self-esteem: ERP study of explicit self vs. other evaluation
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Introduction
Self-esteem is one of the oldest and most widely studied constructs in psychology. It refers to the degree to which one values and accepts himself or herself, and reflects one’s attitude towards his or her own person. Majority of studies on the neural basis of the self-referential processing in individuals with low (LSE) and high self-esteem (HSE) investigated processing of the self-relevant information in the social functioning context, i.e. in relation to rejection cues and a negative feedback from others. Self-referential processing in those individuals was also studied ‘in isolation’, without any social context. Findings of those studies suggest that self-esteem modulates brain activity associated with self-reflection. To provide further evidence in support of this notion we investigated ERP correlates of explicit self-evaluation of personality-trait adjectives in individuals with HSE and LSE. Control conditions involved performing the same task with respect to a close-other and a famous person.

Method
Participants (mean age: 27.76) were selected based on their self-esteem score measured by the Rosenberg questionnaire: LSE group (n = 18; SES = 21.39) and HSE group (n = 20; SES = 37.70). The set of stimuli consisted of 150 adjectives representing personality traits, divided into 3 lists (SELF, CLOSE, FAMOUS). EEG was recorded from 62 electrically shielded scalp electrodes and 2 electrodes placed on the left and right earlobes. Electrodes impedance was kept below 5 kΩ. The sampling rate was 500 Hz.

Results
Repeated measures ANOVA performed on mean amplitudes in the 650-700 ms time window yielded significant main effect of only one factor ‘condition’ (F(2,72)=4.976, P=0.009). LPC amplitudes in SELF condition were higher than in CLOSE condition (P=0.009) and FAMOUS condition (P=0.044). The significance of the ‘group’ x ‘condition’ interaction (F(2,72)=3.813, P=0.027) was driven by higher LPC in the HSE group than in the LSE group for SELF condition (P=0.014). ANOVA computed on two measures of the self-preferences effects (mean amplitudes of difference waves SELF-CLOSE and SELF-FAMOUS) showed a significant main effect of ‘group’ factor (F(1,36)=9.863; P=0.003): self-preference effects were enhanced in HSE group.

Conclusion
We found that in individuals with HSE process of self-evaluation was associated with substantially increased amplitudes of LPC in comparison to individuals with LSE. Moreover, the self-preference effect was significantly stronger in HSE group than in LSE group. Thus, our findings suggest that the higher level of self-esteem the higher activity associated with explicit self-reflection.
**Increased inter-site phase-coupling reflects post-feedback adaptations of decision-making systems**

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Response commission in cognitive tasks comprises a complex set of mechanisms including decision making and action execution. Decision-making processes in multi-choice tasks involve sensory evidence integration and action selection, that are strongly related to the activity of the intraparietal cortical areas. Action execution is regulated within motor areas that may implement response initiation and inhibition. Failures within one or the other of the two systems may lead to qualitatively different kinds of errors that differ in the response time. Presumably, fast errors, with response latency shorter than average response latency on correct trials, are caused by inability to inhibit irrelevant prepotent responses, while slow errors, with response latency longer than average response latency on correct trials, result from disruptions forming the decision variable.

Errors can be detected and appropriate corrective adaptations can be initiated in top-down fashion by performance monitoring systems, with errors detected either internally (following error commission), or externally (following negative feedback presentation).

We recorded EEG while participants performed the auditory version of the condensation task with high cognitive demand. In order to detect modulations of oscillatory activity and functional connectivity patterns between areas, we used spectral power measures and weighted phase-locking index, which is a measure of stability of phase difference between signals recorded from two electrodes.

We observed alpha power suppression in the pre-response time window with the minimum at the left parietal electrodes, which presumably reflects generation of a decision variable after sensory evidence integration. Midfrontal theta power and phase coupling between midfrontal and left parietal regions increased after negative feedback presentation, associated with performance monitoring and top-down adjustments of the decision variable in the intraparietal cortical areas. Moreover, functional coupling was more pronounced for subjects who tended to commit slower errors, compared to correct responses. This finding suggests that functional connectivity patterns differ depending on the type of error committed. That is, in the case of slow errors, which resulted from failures in decision-making processes, negative feedback elicited robust functional connectivity, that might be used in top-down influence on decision-making systems.

The study was implemented in the framework of the Basic Research Program at the National Research University Higher School of Economics (HSE) in 2018.

**Effects of induced mood on single-word imagery processing: An ERP study**

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**Background:** The effect of emotional states (moods) on semantic memory access has been examined in behavioral and event-related potential (ERP) studies. Although these studies have shown that moods influence the context integration process in a sentence, it is unclear whether moods affect single-word imagery processing. In this study, we recorded ERPs to investigate the effects of word imageability on the N400 and N700 components in a reaction-time task, in which participants judged whether a word was easily imaginable or not.

**Method:** Thirty right-handed university students performed an imageability judgment task under three different moods (neutral, positive and negative) in a counterbalanced order. To induce a specific mood state, participants were first asked to recall and write in detail about a happy or sad episode in their past. In the neutral condition, they were simply asked to describe the area where they live. They described these episodes on a sheet of paper in seven minutes. After the mood induction procedure, participants performed a reaction-time task, in which they were instructed to decide if a word evoked visual imagery easily or not. One hundred thirty-five high imagery words (e.g., <i>baseball</i>) and 135 low imagery words (e.g., <i>psychology</i>), each consisting of two kanji characters, were selected according to normative values. In each mood session, 45 high imagery and 45 low imagery words were presented in a random order.

**Results:** Imageability judgment was faster for high imagery words (<i>M</i> = 736 ms) than for low imagery words (<i>M</i> = 793 ms). Neither the main effect of mood nor the interaction effects including mood were significant. At centroparietal sites, high imagery words elicited a larger N400 (<i>M</i> = −3.1 µV) than did low imagery words (<i>M</i> = −2.2 µV), in the 300–400 ms period following stimulus onset. At frontal sites, high imagery words elicited a larger (more negative) N700 (<i>M</i> = 0.8 µV) than did low imagery words (<i>M</i> = 2.9 µV), in the 600–800 ms poststimulus period. A significant main effect of mood on N400 was obtained. The amplitude of N400 was larger under positive mood (<i>M</i> = −2.8 µV) than under negative mood (<i>M</i> = −2.0 µV). The interaction effect of mood and word imageability was not significant.

**Conclusion:** The results suggest that, compared to negative mood, positive mood facilitates an activation of semantic memory that calls on the visualizability of a word in the imagery task.

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Functional connectivity between midbrain and cortex during the consciousness recovery: Granger causality calculation
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The role of midbrain-cortex functional interaction in consciousness has been controversial for several years. The present study aimed to calculate functional connectivity between cortex and midbrain area (periaqueductual grey, PAG) in consciousness recovery.

The shunt combined with deep electrode was implanted in 5 patients with tumor of pineal area at the final stage of oncopathy to prevent occusal hydrocephaly and to record brain activity. ERPs were recorded simultaneously from deep electrodes located close to intact PAG area and scalp electrodes using auditory two-tone oddball paradigm. Brain signals were analyzed with matlab Brainstorm toolbox. The selection of peaks was made in N100 (55 to 120 ms), N200 (150 to 300 ms) and P300 (200 to 400 ms) time windows. Functional connectivity was calculated in time windows including 65 ms before and after peak latency on deep electrode by the Granger causality test (value of model order n=10) to explore causal interactions between brainstem and different areas of cerebral cortex.

Peaks recorded on deep electrodes we identified under the same names (N100, N200 and P300) for convenience of description and comparison with those recorded on scalp sites. In post-anesthesia disorders of consciousness, the peaks were more illicit in deep electrodes and waveform compared to those in scalp. On scalp electrodes ERP was clearly detected on right-side sites. In obnubilation the detection of peaks was complicated. Only N100 was clearly detected on deep and left-side scalp electrodes during the listening to tones. None of those was revealed on deep electrodes. In clear consciousness ERP was clearly detected on scalp electrodes, with illicit peaks on deep electrodes.

In post-anesthesia disorders of consciousness, the directed Granger connectivity from frontal area to other cortex regions was detected; in obnubilation, the directed links from left cortex area to brainstem and from the brainstem to left cortex area; in clear consciousness, bi-polar links between deep electrodes and left frontal sites.

The data obtained supposes that midbrain is involved in consciousness recovery by the establishment of functional connectivity with cortex and other upper subcortex structures. The changes in direction of functional connectivity were detected during consciousness recovery: the direct connectivity from frontal area to brainstem in post-anesthesia disorders of consciousness and obnubilation and from the brainstem to left cortex area in clear consciousness.

Early perceptual representations of visual words are manifested differently by task demands: Evidence from ERP measures of spatial attention
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Introduction
Although attention has been indicated to play important role in reading words, not much is known about how attention selects them. In our previous study (Okumura et al., 2016), spatial attention towards the left end of Japanese Hiragana words and nonwords remained focal during early sensory/perceptual processing but was indicated to spread over reversed words (i.e., words written from right to left), as indexed by the modulation of P1 spatial attention effect in event-related potentials (ERPs). While these results suggest that initial-letter position may guide attention to visual words, the study used visual feature detection that required participants to see rather than to read the stimuli. Therefore, the present study aimed to further examine the interaction between attention and visual word processing by using a phonological task that involves higher-order information of words.

Methods
ERPs were recorded from 14 native Japanese adults. Words, nonwords, and reversed words consisted of four Hiragana letters aligned horizontally across the left and right hemifields. Participants attended to either the left (attend-left) or right end (attend-right) of the rapidly and randomly presented stimuli, and detected letters that represent a particular vowel sound when they appeared at the attended hemifield (i.e., targets). ERPs at the bilateral occipito-temporal electrodes (PO7, PO8) were quantified as peak amplitudes within designated intervals.

Results
In ERPs elicited by the standard stimuli (i.e., without target), P1 (100-150 ms) at both PO7 and PO8 was more positive when attending to the contralateral end of the stimuli, regardless of type (all ps < .04). N1 (150-210 ms) at PO7 for nonwords was more negative in the attend-right than in the attend-left condition (p < .02), but no attention effects were indicated for words and reversed words.

Discussion
In contrast to our previous study, P1 attention effect was present for all stimulus types and in both attention conditions, which may reflect increased focal attention due to higher task demand (simple visual feature vs. phonology). Moreover, attention effect was found in N1 for nonwords, but not for words and reversed words. This attention-spreading effect
suggests that letter strings with lexical knowledge are represented as abstract integrated percepts at N1 level, since the spatial arrangement of constituent letters (normal vs. reversed) was not concerned. In summary, the present study suggests qualitatively different spatial representations of visual words at P1 and N1 level, and that the emergence of them depends on the words' dimension(s) to be processed.

EMOTION-MODULATED STARTLE REFLEX AND HEART RATE IN WOMEN WITH DIFFERENT RESILIENCE SCORES
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Introduction: The study of psychophysiological factors is essential to understand the processes of resilience adaptation to face successfully from adverse situations. Currently, little is known about the psychophysiological resilience being important how those people regulate their emotions. The main objective of this research was to know the differences between people with different levels of resilience (high, medium and low scores) in psychophysiological variables using the modulating effect of the Affective Image Visualization Paradigm (IAPS). Method: The sample was composed of 39 female psychology students from the University of Granada, aged from 18 to 28 years (Mean = 19.76; Standard deviation: 2.72), selected from an initial sample of 317 students based on their scores on two resilience questionnaires: The CD-RISC 25 Resilience Scale (Connor & Davidson, 2003) and the Wagnild & Young Resilience Scale (1993). The participants viewed 72 emotional pictures (unpleasant, pleasant, neutral) in a block design. Results: Our results showed that the magnitude of the startle response was greater when participants were viewing the unpleasant pictures than pleasant ones, with the neutral pictures producing an intermediate magnitude. On the other hand, it was the unpleasant pictures which had faster heart rate in comparison with pleasant and neutral ones for both groups. The startle after the pictures onset enhanced the emotional response showing a high accelerative component in unpleasant images. Conclusions: The study of psychophysiological mechanisms is considered important for the understanding of emotional regulation and rigorous studies in the present field are needed to design effective intervention strategies in clinical and non-clinical population.
Keywords: Resilience, emotion modulation, startle reflex, heart rate

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Relationship between body mass index and latent period of simple sensorimotor reaction to a light stimulus in individuals of different ages and different sexes
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Introduction. In recent years, attempts were undertaken to link the value of latent periods (LP) of sensorimotor reactions with functional state of not only the brain, but also whole organism, in particular, with body mass index (BMI). The aim of this study was to detect possible correlations between simple sensorimotor response to a light stimulus and BMI in 7-8-year-old children (n=627), 15-17-year-old adolescents (n=638), and 30-60-year-old adults (n=507) of both sexes.

Methods. In each sex and age group, subgroups by the level of BMI were formed as follows: medium BMI (Me±1SD), low BMI (below Me−1SD), and high BMI (above Me+1SD). LP was evaluated in the forearm movement test in each group independently. Spearman nonparametric correlation coefficients for the two parameters were calculated.

Results. At the age of 7-8 years, no gender differences in both parameters were revealed; BMI: Me=16.3, SD=1.3; LP: Me=0.27 C, SD=0.05. However, it was found that children with lower BMI values had longer LP. The differences between children with different BMI were statistically significant only for the left hand. As children with different BMI differed not only by body weight, but also by length, we hypothesized that LP can correlate with general physical fitness, rather than BMI. At the age of 15-17, no significant gender differences and age dynamics of BMI were found (Me=20.0, SD=1.5). In all age groups, adolescents with different BMI responded to the light stimulus with the same LP, but boys responded faster: Me=0.15 s, SD=0.03 vs. Me=0.17 s, SD=0.03 in girls (p=0.028). In some cases, correlations between BMI and LP were revealed: in 16-year-old girls and 17-year-old boys, a negative correlation between LP and body length was revealed (tall adolescents faster responded to the stimulus); in 16-year-old boys, LP negatively correlated with body weight and BMI (stout boys responded faster).

At the age of 30-60 years, the proportion of people with high BMI increased with age, and more quickly and significantly in women. LP did not change in men and decreased with age in women. However, analysis of correlations showed that alimentary obesity developing with age had no negative impact on neurophysiological parameters of the sensorimotor reactivity.

Conclusion. These findings confirm centuries-old experience of combat sports and the data of sports physicians and physiologists attesting to the absence of correlations between BMI and LP.
Heart-Rate Variability and Stress in Simultaneous Interpreter Trainees

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Experimental research on simultaneous interpreting has been conducted since the 1960s. Methods used vary from EEG, PET or fMRI to blood pressure or pupil dilation measurement. Within our study, we suggest a different approach: investigation of heart rate variability, which is considered to be a measure reflecting autonomic nervous system dynamics. With unobtrusive wireless heart rate sensors, HRV can be recorded in natural settings.

Within the experimental setting, 12 students trained to become simultaneous interpreters (9 females, 3 males; aged 23-28) worked in pairs in an interpreter booth. In turn, they performed four consecutive tasks on authentic speeches shown on video: shadowing in a foreign language - German (n=11) or Russian (n=1); interpreting from a foreign language, shadowing in the mother tongue, and interpreting from the mother tongue into a foreign language. The length of each task ranged between 6 and 8 minutes. The heart rate variability was measured using Zephyr HxM Smart Heart Rate Monitor. It was evaluated via spectral analysis using software which automatically marked instances of a significant decrease in the total power (TP) and a simultaneous increase in the LF/HF ratio, considered to be a manifestation of acute stress, on the heart rate tachogram.

The study revealed significant individual differences as to the duration of stress episodes. The average proportion of stress episodes in the course of all tasks came up to 37 percent. Translation from the foreign language into the mother tongue appeared to be the least stressful and the task of shadowing in the foreign language - the most stressful in average. A slight increase in the duration of stress episodes corresponding to the increase in interpretation quality could be observed. The performance of the other interpreter in the booth caused stress in all participants, irrespective of whether they were the first or the second to fulfill the tasks. In general, more successful interpreters tended to be more stressed during task completion by their neighbors than less successful interpreters.

Dynamic of autonomic mode for acute stress in the experimental modeling of the process of simultaneous interpretation

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Introduction. Various approaches are used to study simultaneous interpretation. We have used the analysis of heart rate variability, which has already proved itself as a way of measuring the level of stress in the contexts of natural activity. The purpose of this study was to determine the possible causes of stress-related simultaneous interpretation.

Methods. In the experiments, 40 simultaneous interpreters (35 women and 5 men, age 20-34 years) took part in the interpreting booth. They performed four tasks: repetition in the native language and foreign, interpretation from a foreign language to the native language and back. To assess the dynamics of autonomous functions, the technology of event-related telemetry of the heart rate was used. In addition, before and after professional work, the interpreters passed a bilingual Stroop test. ANOVA (the method of repeated measurements) and correlation analysis were used for the statistical analysis.

Results. A high level of stress during interpretation was manifested in decrease in native RR-intervals, and in characteristic changes in the parameters of autonomic regulation: a decrease in the overall power of the spectrum of heart rate variability against a background of a sharp increase in the level of dominance of sympathetic activity over parasympathetic activity. It is characteristic that the voltage in the case of simultaneous translation was statistically significantly higher (p <0.05) compared to repetition only in the first 100 seconds of the task, and then the differences became unreliable. To assess the mechanisms of the impact of the type of tasks on the level of energy consumption during the simultaneous translation, a bilingual Stroop test was used. It reproduces both the mutual activation of images through consolidation, and their mutual suppression through competition. With a personalized analysis of the relationship between the rhythm of the heart and the reaction time for different variants of the interaction of information images (consolidation-competition), a statistically significant (p <0.05) rate increase was observed in the String's bilingual test with an increase in the response time of the subjects, as confirmed by correlation analysis. The greatest expenditure of energy and the greatest time required problems with pronounced competition of color and semantic images, and not with their consolidation.

Conclusions. Thus, the main reason for the stressogenic nature of simultaneous interpretation is the competition of information images of native and foreign languages.

With the support of RFBR grants 16-06-00501, 18-013-01225

Current trends of neuropharmacology in EEG and ERP studies

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Neurotransmitters play a key role in brain functioning across all stages of human life. Overwhelming majority of studies explore neurochemicals’ influence on brain tissue of lab animals. As a result of many decades of research, main nuclei, which synthesize these neurotransmitters, were carefully investigated and described. However, disproportionately fewer studies aim at scrutinizing the same neurotransmitters in healthy humans, using indirect approaches to detect any changes in their level (for example, dynamics of pupil diameter as a proxy for norepinephrine system). To investigate how alterations in neurotransmitter level may affect human behavior in particular cognitive or emotional task, researchers frequently employ neurotransmitter depletion paradigms or particular neurotransmitter agonist-antagonist consumption (for example, reboxetine and clonidine for norepinephrine signaling, respectively). Electrophysiological methods are widely used in neuroscience, including clinical settings. Being non-invasive technique for registration of summarized activity of neocortical neurons’ post-synaptic potentials, EEG has several apparent advantages such as its high temporal resolution, relatively low cost, mobility. To date, EEG or ERP studies in the field of neuropharmacology are scarce. Additionally, there are many inconsistencies between findings obtained in these studies. A great degree of variability in using different tasks or ERP components may lead to the absence of conclusive and reliable results.

In the current comprehensive review, we strive to systematize major findings of these disparate studies and outline several prospects for integration of electrophysiology with neuropharmacology that might be undertaken in near future. The main directions are presented as follows: 1) embedding of the extant data into predictive coding framework, which can be suitable for bringing together heterogeneous empirical facts in the field of electrophysiology and pharmacology; 2) complementing of current understanding of cortex laminar hierarchy and the laminar specificity (regarding to prediction generation/precision weighting operations) with receptor distribution maps to gain more sophisticated framework; 3) utilization of transcranial magnetic stimulation methods in conjunction with conventional neuropharmacological approaches; 4) connecting of behavioral data with underlying neural processes through lens of computational cognitive modeling (for example, reinforcement learning); 5) employment of advanced EEG-ERP processing methods. It will also be of huge importance to reveal key mechanisms of side effects occurrence and to find out neural computations underpinning placebo response.

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Effects of mental fatigue on attentional processing during the attention network test: an event-related potential study
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Introduction: Mental fatigue refers to a component of central fatigue, defined as a failure to initiate and maintain attentional tasks that require self-motivation, and it is frequently experienced during and following prolonged periods of cognitive activity that demands work efficiency. It may influence performances and lead to temporary deterioration of attentional functioning and response readiness. The aim of the study was to investigate the effects of mental fatigue on attentional processing during the Attentional Network Test (ANT): a task that examines simultaneously alerting, orienting and executive attention. ERP components associated with ANT were acquired in order to highlight the neural correlates of attentional mechanisms engaged during this test.

Methods: Thirty healthy subjects were enrolled and randomly assigned to two groups: the fatigue group (15 subjects) that performed 1h of a continuous performance of mental arithmetic task, and the control group (15 subjects) that performed 1h of leisure activity; prior and after, subjects performed the ANT, while ERPs were recorded. RTs were analysed according to the subtraction method requested by ANT; CNV, N1, and P3 components were analysed according to cue-types in order to evaluate the ERPs related to the alerting and the orienting networks; N2 and P3 were analysed according to the target-types, in order to evaluate the ERP response to the executive network.

Results: Alerting, orienting and executive networks’ efficiencies were comparable between groups, while accuracy declined only after mental effort (p=0.017); mean overall RT shortened after ANT repetition only in the control group (p<0.001), while in the fatigue group it tended to be prolonged (p=0.08). Mental fatigue did not exert any effect on CNV, N1 and P3 parameters. Instead, in the fatigue group, N2 and P3 amplitudes to the incongruent stimuli were significantly reduced after mental effort (respectively p<0.001 and p<0.001), while remaining stable in the control group; moreover, while P3 amplitude to the congruent targets was higher in the control group after ANT repetition (p=0.023), in the fatigue group it was not (p=0.30).

Conclusions: Mental fatigue seems to generically affect the behavioural performances to the task (RT and accuracy). Even if executive network efficiency seems to be preserved, mental fatigue appears to influence the ERPs related to this network, especially the responses to incongruent targets. Alerting and orienting are not affected by mental fatigue. The results fit in well with the theoretical model implicating the striato-thalamo-frontal circuitry as the core substrate of mental fatigue.

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N3 Event-Related Potential Component in Passive Oddball Tasks: An exploratory study
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More than half a century has passed since we first learned that low-frequent stimuli, presented among highly frequent ones, elicit in the EEG a slow late positive wave with a typical peak latency slightly longer than 300 ms. Many passive oddball experiments show a negative deflection at N3 peaking between 400 and 500 ms, but this wave has never been analyzed properly. To our best knowledge, the present study is the first ERP report explicitly devoted to N3. For this reason, the study is largely exploratory.

We conducted five passive oddball experiments, in which the number of deviants (i.e., one or two), their alleged meaning and their distinctiveness varied. Mastoid- or common-referenced waveforms showed a fronto-central N3 in all experiments. The data were CSD (Current Source Density) transformed and underwent a Principal Component Analysis (PCA). The PCA revealed N3 containing two subcomponents with very stable peak latencies of about 415 and 455 ms, respectively. The two N3 CSD-subcomponents were maximally negative over midfrontal areas but positive over the posterior temporal cortex. N3 was not positive at any electrode when measured with mastoid reference, obviously because its source is close to the mastoids. Direct comparative analysis of N1 and N3 demonstrated substantial differences. The negative-to-positive transition was much more anterior for N3 than for N1. The maximum of frontal negativity was more lateralized for N1 than N3. The distribution of N1 CSD is compatible with a fronto-temporal sink, whereas the distribution of N3 CSD is rather in line with a midfrontal sink. Both frontal negativity and posterior positivity exhibited clear oddball effects, i.e., they were larger to deviants than to standards. Positive components P3a and P3b were also analyzed, which replicated the previously known effects.

Summarizing, several conclusions can be made: (1) N3 followed the complex P3a/P3b having a peak latency 400-500 ms (2) The spatial distribution of N3 is characterized by a tempo-parietal source and a fronto-central sink (3) N3 is not a mismatch negativity (4) N3 is probably related to attention.

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Brain Lateralization of Emotional Processing of Clinically Diagnosed Anxious and Depressed Male Patients
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Lateralization is the idea that the two halves of the brain’s cerebral cortex, left and right hemispheres, execute different functions. This study employed quasi-experimental design specifically the small-N design involving 4 male patients (2 anxious with left and right dominance) and (2 depressed with left and right dominance) who were clinically diagnosed in mental facilities. The brain lateralization was assessed using the Luria-Nebraska Neuropsychological Battery specifically focusing only on the brain dominance of the participants. The psychological disorders of the participants were diagnosed by clinical psychologist or psychiatrist from the mental facilities they were recruited. The emotional processing was done during the PET scan where the framed pictures were mounted at the PET machine above the head region of the patient. The PET images were acquired with a Philips Gemini TF 64 PET_CT scanner at 1 bed position for 10 minutes, 34 minutes after intavenous administration of 201 MBq (5.4 mCi) of 2-[18F] of Fluoro-2-deoxy-D-glucose. A post-inquiry was conducted using the Self-Assessment Manikin (SAM) of Bradley and Lang (2007). With the assistance of the nuclear medicine doctor, analysis of PET images revealed that both the anxious left and right hemispheres dominant participants had hypermetabolism in the right sensorimotor cortex during the emotional processing. The depressed left hemisphere dominant patient revealed hypermetabolism in the left midfrontal cortex and left associative visual cortex while the depressed right hemisphere dominant patient revealed hypermetabolism in the right primary visual cortex. Using the SAM, anxious right hemisphere patient revealed happy emotion with the pleasant picture and felt in control with the unpleasant picture while the anxious left hemisphere dominant revealed neither happy nor unhappy with the pleasant picture but felt dominated with the unpleasant picture. On the other hand, both left and right hemispheres dominant depressed patients revealed happy feelings with pleasant picture and felt dominated with the unpleasant picture. Considering the brain dominance of the patients, it implied that anxious patients processed emotions in the right hemisphere of the brain regardless of their dominance implicating that the right hemisphere processed emotions regardless of valence. This supports also the right hypothesis theory of emotion. On the other hand, depressed patients processed their emotions based on brain dominance such that the left hemisphere dominant depressed processed in the left hemisphere and the right hemisphere dominant depressed processed emotion in the right hemisphere.

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Neurometric Results of a Case Series Using live Z-Scores Neurofeedback
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Introduction: Live Z-Score Training (LZT) is a new paradigm of Neurofeedback, it was developed in the last 15 years and allows to compute, review and process the deviations of z-scores in real time. Only few Neurofeedback studies have used LZT training as an intervention to measure its effects. The aim of this work is to present the neurometric (pre/post QEEG) changes of a case series using LZT- PZOKUL in despite of the treated condition. Method: 6 different patients with insomnia and/or learning disorders from Nepsa Clinic between 16 and 30 years old were randomly selected (ex post facto) to use
Muscular tension regulation amongst patients with chronic tic disorders and body-focused repetitive behaviors during a Stimulus-Response Compatibility Inhibition Task: a surface electromyographic study

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Background: Chronic tic disorders (CTD) and body-focused repetitive behaviors (BFRB) are both psychiatric affections with similar phenotypes such as repetitive motor movements and heightened sensorimotor activation. CTD are characterized by involuntary motor and phonic tics, which can range from mild to severe. The term BFRB, comprising trichotillomania, onychophagia as well as skin picking, refers to a cluster of destructive impulsive habits directed toward the body and lead to both physical and psychological health issues. Neurophysiological evidence suggests that both CTD and BFRB involve difficulties to modulate cortical activation optimally in planning and executing responses. However, the differences in motor overactivation regarding the level of muscular modulation remain unexplored. Therefore, the principal aim of the current study was to investigate the differences in muscular tension activation and inhibition on surface electromyography (sEMG) between clinical groups affected with either CTD or BFRB compared with a healthy control group.

Methods: This current study compared 22 CTD patients, 21 BFRB patients and 20 healthy control participants matched on age, education, laterality and intelligence, during a Stimulus-Response Compatibility Inhibition Task. The sEMG was recorded from two active electrodes at 500 Hz placed on the extensor digitorum muscle of the posterior forearm. The area under the curve recorded from sEMG represents the level of muscular tension activation and was quantified as the mean amplitude during the -200 to 200 ms interval from the response.

Results: A repeated measures ANOVA revealed that the main difference was present during the incompatible condition, where CTD group had significantly higher level of muscular activation compared to BFRB and control group [Group by condition interaction; F(2,60)=4.04, p<0.05]. Furthermore, Independent Samples t Test showed that CTD group had higher Stimulus-Response Compatibility effect causing an muscular activation of their hands to which no activation and no response is expected compared to BFRB [t(41)=2.24, p=0.05] and control group [t(40)=2.79, p=0.01].

Discussion: The EMG showed that CTD has a higher muscular tension than the BFRB and the control group, which might reflect the chronic over-a arousal of both hemispheres motor cortex in planning and executing responses. Furthermore, patients with CTD manifested some difficulties to inhibit muscular activation of the contralateral hand, more specifically in the incompatible condition, which indicate a motor inhibition deficit suspected in this clinical group. Accordingly, the consequences of tic symptoms in CTD patients may be a tension reduction caused by an accumulation of muscular tension in the body.

Magnesium Deficiency Effect on the Severity of Autonomic Dysfunction in Mitral Valve Prolapse Patients with Emotional Tension

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Background. The author’s analysis suggests that the clinical manifestations of mitral valve prolapse (MVP) and magnesium (Mg) deficiency are highly associated [Durlach, 1998; Nechaeva, Martynov, 2017]. To test this hypothesis we conducted study in which they measured severity of autonomic dysfunction (AD) and emotional tension (ET) in MVP patients before and after the treatment with magnesium orotate.

Methods. The study involved 43 MVP patients with AD (the average age was 26.7±2.6) and 73 healthy subjects (the average age was 27.5±1.3). All of MVP patients have received treatment with magnesium orotate at a dose of 3000 mg per day (a 6-months course). Psychological testing was carried out using the MMPI, the Cattell’s 16 PF Questionnaire, and the Spielberger State-Trait Anxiety Inventory. The AD severity was detected with ‘Questionnaire for AD signs diagnostics’ (Vein, 2003). Quantification
of Mg in hair was carried out on Laser-Induced Breakdown Spectrometer “LIBS-ELITE” (GMB, Australia).

Results.
The MMPI midrange profile for MVP patients is characterized by significant ($p<0.001$) differences with healthy participants for the 1, 2, 3, 6, 7, 8, and 0 scales. We obtained lower ($p<0.05$) values for the A, C, E, F, and H factors and higher ($p<0.05$) values for the O, Q2, and Q4 scales for MVP patients in 16 PF. These data demonstrated that most MVP patients distinguished from healthy participants. They differ in anxiety level, emotional lability, self-distrust, increased sensitivity to one’s failures, and a tendency to lose control over emotions. This set of features testify to an enduring state of ET. Before the treatment, mild case of AD was diagnosed in 11.1% of patients; medium severity - in 37.0% of patients, severe AD - in 51.9% of patients. A significant correlation ($p<0.01$) was found between the height of trait anxiety and AD severity. After the treatment, a significant decrease ($p<0.01$) in AD severity was noted. Severe AD was not detected in any patient. Mild AD was diagnosed in 59.3% of cases. Mg concentration was decreased in 72.7% of patients before the treatment. Mg concentration averaged for the MVP group was $59.4+9.25$ µg/g. After a 6-month course of therapy Mg level compared to the baseline increased ($p<0.01$) and reached the lower limit of normal in 62.5% of patients. These patients had significant clinical reduction the of AD and ET severity.

Conclusion.
The results confirmed the hypothesis of a relationship between the severity of AD and ET with Mg deficiency in MVP patients.

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On the efficiency of neurofeedback in the brain-computer interface
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The brain-computer interface is considered one of the most promising technologies in the treatment of neurological diseases and injuries, and their consequences. In this work, the same subjects compared the effects of two bioelectric control procedures on the EEG, in which the feedback signals controlling the photostimulation process were given with a short and long delay. In the first series 15 volunteer subjects were exposed to light effects obtained in real time by direct transformation of the EEG (active electrode in the lead Cz, reference and grounding in the ears of the ears, EEG filtering range 2–32 Hz and the sampling frequency of the signals 100 Hz) flickering. This was achieved by normalizing the digitized values “” of the EEG in real time, in which the largest negative value of the signal corresponded to the minimum, and the largest positive value to the maximum illumination of the LEDs (power less than 100 µW). In this case, the feedback delay was the minimum possible (approximately 0.01 sec) and was due to hardware EEG transformations into light signals. In the second series, in the same subjects, the normalization and conversion of the EEG into LED flashes occurred with a delay equal to 2.56 sec. The experiment began with a 30-second recording of the background electric activity, then for 10 minutes the operating mode was switched on, where the subjects were exposed to varying intensity LED effects. The statistical processing of the results was carried out using the Origin 6.0 software package.
The analysis showed that only with a minimal delay of the control signals is there a reliable increase in the severity of the main EEG rhythms during the exposures. The corresponding shifts in the power of theta, alpha and beta rhythms of the EEG relative to the background were 7.0 ± 2.6%, 8.7 ± 3.3%, and 13.5 ± 3.8%. At maximum feedback delays during the actions, the power shifts of the EEG rhythms were unreliable and amounted to 2.5 ± 1.8%, 4.5 ± 3.3% and 6.9 ± 3.5%, respectively. It is important that, with minimal delays after the cessation of photostimulation, the power of the EEG rhythms maintained values, higher than the baseline level, whereas in the case of long feedback lags (by 2.56 sec), after the stimulation was canceled, the EEG power decreased to below or below the initial level. Supported by grants from RFBR 16-06-00133, 18-013-01225

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Primary psychopathic traits are associated with reduced subjective and cortical reactivity to unpleasant emotional movies
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The present study investigated the relationship between high trait levels of primary psychopathy, subjective emotional experience and cortical activity in the Gamma band (30 – 49 Hz) during different affective states elicited with ecological emotional stimuli. 58 male participants were divided in two groups, High (28) and Low (30) primary psychopathy, using the Factor 1 of the Levenson Self-Report Psychopathy Scale. Participants watched 15 two-min clips, divided in five categories (Erotic, Neutral, Scenery, Compassion and Fear) while their EEG activity was recorded from 36 scalp electrodes. Participants reported their emotional experience by evaluating movies on Valence and Arousal dimensions and quantifying how much they felt sad, anxious and touched. Cortical activity included the analysis of normalized EEG Gamma power recorded during the last 30 seconds of each clip. Analysis of the self-report measures was carried out with a series of linear mixed-effects models including Film Category and Group as predictors, whose significance was evaluated with an F test.
Film by Group interaction for Valence ($F_{(4,832)}=2.60$, $p < 0.05$) and Arousal ($F_{(4,832)}=3.04$, $p<0.05$) variables, revealed that participants in the high compared to low psychopathy group rated negative movies less arousing than the positive ones. Instead, the low psychopathy group judged Compassion clips more pleasant. In addition, the significant Film by Group interactions observed for the adjectives Anxious ($F_{(4,832)}=9.05$, $p<0.05$), Sad ($F_{(4,832)}=9.45$, $p<0.05$) and Touched ($F_{(4,832)}=13.71$, $p<0.05$) showed that the high psychopathy group felt less anxious in response to Fear clips and less sad and touched by Compassion excerpts. EEG Gamma activity was analyzed using multilevel modeling and adopting a model selection strategy based on AIC values. First we identified the model that best fitted the data and then we carried out an F test to evaluate the significance of each predictor. The Film by Group interaction ($F_{(4,267)}=2.39$, $p < 0.05$) showed that negative clips induced larger Gamma power in both groups compared to neutral and positive movies, and that, in the high vs. low psychopathy group, Gamma power in response to Fear movies was reduced. Taken together the present results show that high traits in primary psychopathy are associated to a reduced sensitivity to unpleasant emotional stimuli, which is observed at both the subjective and physiological level. The consistence observed across different response domains highlights the advantages of using strong and ecological emotional stimuli, like movies, to uncover the distinctive psychophysiological markers of the emotional alterations associated to primary psychopathy.

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EEG correlates of creative thinking process associated with originality in young and elderly adults

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Introduction. Psychological research of the past decade provided evidence, that successful aging is accompanied by long-term preservation of creative potential. However neurophysiological mechanisms that ensure the maintenance of this ability are not studied. Based on age difference in speed of mental processes we proposed difference in temporal organization and strategies of successful creative thinking. The aim of the study was to investigate the association of originality of creative ideas given during the performance of divergent thinking test with time course of task induced changes of electrical activity (ERSP) in young and elderly participants. So, we studied the initial, middle and final stages of divergent problem solving (so-called generative and evaluation/exploration phases).

Methods. Young (N=80, 22.6 ±3 years) and elderly (N=80, 63.4 ±6.7 years) adults participated in the study. Continuous EEG data were recorded from 52 electrodes during the performance of “alternate uses task”. Reactivity was calculated in theta, alpha 1,2,3 and beta1,2 EEG frequency ranges as log (poststimulus) – log (prestimulus) values. ERSP and sLORETA reactivity were analyzed for initial (200-800 ms after stimulus presentation), middle time interval and final stages (600 ms before preparation of press the response button). STATISTICA and sLORETA were used for ANOVA and correlation analysis.

Results. Elderly as compared to young adults performed a task faster and evaluated it as more simple. Age groups did not differ in originality and task interest. For the initial stage of task performance, there were no associations between age and originality with respect to EEG reactivity. For the middle stage, task induced alpha1 synchronization was higher in the original elderly than in other subjects (Fig.1). For the final stage, originality scores were positively correlated with task induced changes of beta2 current source density estimates in precuneus in young adults only (Fig. 2).

Conclusions. Difference in temporal and frequency of EEG indices associated with originality in young and elderly subjects let suggest specific strategies in successful creative task solving; importance of retrieval from long-term memory in the elderly, internal attention and final information integration - in young adults.

The reported study was funded by RFBR and Government of the Novosibirsk region according to the research project 17-46-540705.

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Distinguishing patients with schizophrenia and obsessive-compulsive disorder by beta-band event-related EEG synchronization/desynchronization in Go/NoGo task

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The spectral power of different EEG frequency bands can vary under the influence of incoming stimuli or motor activity. It is supposed that the event-related synchronization/desynchronization (ERS / ERD) reflects changes in the activity of the corresponding areas of the cortex and provide information about brain functioning during execution of some tasks, for example tests in Go/NoGo paradigm, which require performing of some action after the certain stimulus, and are widely used for studying cognitive control processes. Mental disorders are known to be accompanied by impairment in cognitive control functions but on the basis of differences in symptoms it can be assumed that different processes are violated. The aim of the study was to examine changes in ERS/ERD magnitude during Go/NoGo test execution in patients with schizophrenia and obsessive-compulsive disorder (OCD) compared to healthy control. In our study 19-channel EEG was recorded during the execution of cued visual Go/NoGo test with equal probability for Go and NoGo probes. Subjects were 97 schizophrenia patients, 64 OCD patients, and 327 healthy participants 18-50 years old. For evaluating of reaction time and amount of mistakes button signal was registered during test execution. The EEG recordings were transformed into current sources density estimates. The ERD/ERS was calculated by means of a complex Morlet's wavelet transform. ERS/ERD magnitude was averaged over groups and compared between them. Comparative analysis of behavioral parameters revealed increase in amount of omission mistakes in patients with schizophrenia and decrease in reaction time in OCD group. The analysis of ERS/ERD magnitude showed decrease in power of beta-band ERD in the occipital area for both groups of patients most pronounced for schizophrenia group. In addition, we found decrease in magnitude of beta-band ERS in Go probes and ERD in NoGo probes in the left central area for schizophrenia patients. OCD group differed from healthy control by increased magnitude of beta-band ERS in the frontal area in NoGo probes. Generally, as was expected we observed different patterns of ERS/ERD changes in two groups of patients. Differences in magnitude of ERS/ERD in schizophrenia patients might reflect low activation of the visual cortex during stimulus processing and poor updating of task-related forward model caused by decrease in attention level. On contrary, increase in magnitude of ERS in OCD patients together with smaller reaction time might be the consequence of increased attention level. Study supported by grant of Russian Science Foundation 1'-16-15-10213.

**Working memory processing of emotional stimuli in individuals at high risk of schizophrenia. A preliminary report of anatomic and neurofunctional correlates**

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**Introduction:** It has been proposed that family members with genetic risk of schizophrenia usually share behavioral, anatomic and brain functional characteristics with their relatives suffering this illness. **Methods:** With the aim to further explore such intrinsic relationships we evaluated 16 first-degree relatives of patients diagnosed with schizophrenia and 16 healthy control subjects with MRI and fMRI tools while performing typical 1 and 2-back tasks using faces with emotional content (happy, angry and neutral) as stimuli. Participants at risk and healthy controls were matched according to age, sex, and educational level. Due to the nature of the task, the analysis focused on behavioral responses, anatomic measurements and functional activations at prefrontal dorsolateral cortex (PFDLC), hippocampus (H), and amygdala (A). **Results:** Preliminary analysis of the data showed that regarding the behavioral responses, there were not significant differences between the groups. The structural analysis of the selected ROIs (cortical thickness for PFDLC, hippocampal and amygdalal volumes) showed an important increase in the hippocampal volume in subjects at risk of schizophrenia as compared with controls. However, the comparison of BOLD functional activation at these locations while performing the n-back tasks, failed to show significant differences between groups. **Discussion:** Our results do not coincide with most of the reports in the literature about the common behavior of individuals at genetic risk of schizophrenia. We assume that these preliminary results might be explained due to the fact that the individuals selected as having a high genetic risk of schizophrenia were completely functional, socially adapted, and none of them referred symptoms associated with schizophrenia, thus probably representing just the better functioning individuals among those usually evaluated as in risk of illness development. **Conclusions:** In spite of a latent genetic risk, the participants evaluated in the current study might probably develop compensatory strategies to deal successfully with daily life demands, particularly with facial emotional stimuli, and changes in hippocampal volume might be reflections of these adaptive adjustments. However, further analysis should be performed to better explore these relationships.

**An ERP study of P600 and N200 effects elicited by distance of tonal modulation**

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**Background**
Increasingly, music is used as a therapeutic instrument in the field of rehabilitation medicine and psychophysiology. Tonal modulation is one of the main structural and expressive aspects of music.

**Aims**
The aim of present study is to investigate neuronal correlates of the cognitive processing of distance of tonal modulation with event-related brain potentials

**Method**
EEG measurements were recorded from 70 participants while they listened a set of harmonic progressions with unprepared tonal modulation to the subdominant (a near modulation, replacement of 1 tone), the diminished sixth (a distant modulation, replacement of 4 tones) and the tritone (a distant modulation, replacement of 6 tones). We also included a non-modulating progression into the set of stimuli to establish a baseline for comparison of responses to modulation. The progressions prepared in such a way that 4 mode conditions were obtained: major (20 participants, 6 males, age M=19.7, SD=2), minor (20 participants, 2 males, age M=20.9, SD=2.1), major-minor (15 participants, 2 males, age M=18, SD=1) minor-major (15 participants, 4 males, age M=18, SD=2.3). The progressions were each eight-chord long, similar in rhythm, tempo, duration, sound intensity. The EEG was recorded from 19 electrodes located according to the standard “10-20” scheme. Event-related potentials were averaged on modulating chords. We conducted a ANOVA for the following factors: distance of modulation, anteriority and laterality.

**Results**
The results of the ANOVA for the 150-250 ms time interval revealed a significant interaction Distance of modulation X Laterality for major (F (12,810) =3.5037, p ≤ 0.001) and minor ((F (12,855) =2.8627, p ≤ 0.001) conditions. There was an increase in amplitude of N200 during listening non-modulating progression in major condition and during tritone in minor condition.

Results for the 550-650 ms time interval revealed a significant interaction tonal Distance of modulation X Anteriority (F (6,720) = 18.463, p ≤ 0.001) for major condition and Distance of modulation X Laterality (F (12,855) =2.1169, p ≤ 0.05) for minor condition. In both conditions the amplitude of P600 increased in response to increase in tonal distance during modulation.

**Conclusions**
The results of this study showed that N200 is related to processing the tonal harmony. These results agree with the previous investigations demonstrating that N200 is involved in processing the tonal syntax. The found increase in the amplitude of P600 in response to an increase in tonal distance suggests that the amplitude of P600 corresponds to the degree of violation of tonal expectations.

**EEG-BASED BRAIN CONNECTIVITY ANALYSIS DISTINGUISHES CHILDREN WITH LOW MATH ACHIEVEMENTS FROM THEIR SCHOOLMATES.**

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A close relationship between the performance on symbolic numerical comparison tasks and math achievements in children, adolescents and young adults has been reiteratively reported. Moreover, several studies have consistently shown that children with math difficulties have an impaired ability to process numerical representations. In this context, we aimed to use a high temporal resolution tool as EEG, to evaluate the possibility to identify children with low math achievements, as well as to explore the neurofunctional substrates underlying this difficulty.

According to their performance in the math subsection of the Wide Range Achievement Test, 4th edition (WRAT-4), fifty-seven 8-to-10-year-old children were equally divided into three groups: Low Achievement (LA), Average Achievement (AA), and High Achievement (HA). They all performed a symbolic numerical comparison task with simultaneous EEG recording from all of the 10/20 scalp locations. Based on the classification of datasets built on invariant measures such as degree of each electrode (Gio), clustering coefficient (C), and the number of edges between the neighbors of each electrode (E), all derived from EEG coherence matrices in the typical frequency bands (delta, theta, alpha, beta, and gamma), we propose a methodology to distinguish the brain regions probably underlying the EEG characteristics of LA children.

Multiple data sets were built by frequency band and metric, and they were used to create a classification model using a decision tree algorithm. In order to test the accuracy of each model, a stratified 10-fold cross-validation was performed. The classification of LA children showed an accuracy above 75%, but it varied depending on the variables tested. Moreover, the model could achieve an accurate classification by only considering three electrodes (O1, P4, and T4), corresponding to occipital, right parietal and right temporal locations, respectively.

The analysis of EEG parameters allow the distinction of children with low-math achievements with respect to their classmates, along with the identification of several brain regions operationally involved in LA children performance, as well as to explore their functional relationships with other cerebral areas while numeric-comparison tasks are performed. These methods might be useful to early evaluate the math skills acquisition, and to adjust interventional therapies design in order to deal with potential difficulties in this area.

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(Almost) before your eyes: Preference for face-like configurations in the prenatal life
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Introduction
Previous behavioral evidence indicated that newborns preferentially gaze at face-representing stimuli, including schematic face-like configurations (i.e., three dots composing a downward pointing triangle), as compared to neutral ones. Reid and colleagues (2017, <i>Current Bio</i>) recently demonstrated that even fetuses in the third trimester of pregnancy, when exposed to light stimuli projected through the uterine wall, preferentially oriented their heads toward face-like configurations (F) rather than toward the same stimulus presented in the inverted configuration (I). Although overall fetuses’ response rate was extremely low (less than 20%), thus limiting protocol applicability, this finding opens the possibility to explore the physiological correlates of F preference in human fetuses. With the final aim of defining a paradigm for fetal-MEG, here we present two preliminary studies. In Experiment 1, in order to increase fetuses’ response rate, we tested a novel protocol directly monitoring fetuses’ gaze behavior. In Experiment 2, by investigating F-related visual evoked potentials (VEPs), we verified that F elicited similar brain responses as compared to other previously-tested face-like configurations.

Methods
<p>Experiment 1</p>
We replicated Reid et al. 2017 experiment in a population of 10 normal fetuses, with a gestational age between 259 and 275 days. Visual stimuli (5 per condition) were moved across maternal abdomen, from one side of the fetus’ visual field to the other, for approximately 10 s. Fetal gaze behavior was monitored with 2D sonographies, by focusing on lens movement orientation.

<p>Experiment 2</p>
In a population of 10 young healthy subject, we compared F and I-related VEPs through a point-by-point paired-sample t-test.

Results
<p>Experiment 1</p>
Results confirmed Reid et al. 2017 findings, with fetuses preferentially directing their gaze toward F rather than I (paired-sample t-test: p=0.02). Importantly response rate, directly based on gaze orienting, appeared much higher (numbers of lens movements: F, 4.3±0.7; I, 3±1.4; mean±SD).

<p>Experiment 2</p>
VEPs elicited by F and I resulted to be significantly different in P1 (with F eliciting a smaller positive deflection) and P300 time windows (with F eliciting a larger positive deflection). In I-related VEPs, the N170 showed a greater amplitude. These results suggest that F elicited similar neurophysiological responses as compared to other face-representing stimuli.

Conclusions
Our preliminary results seem promising in indicating a possible more sensitive methodology to track fetuses’ gaze behavior and in demonstrating the validity of F in eliciting a genuine face-like configuration, thus representing an encouraging start to investigate fetuses’ physiological responses to face configurations.

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Effects of practice on Lukacs’ (2016) countermeasures (CMs) to the P300-based Complex Trial Protocol (CTP) for detection of concealed episodic information from a mock crime
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Authors: P. Rosenfeld, J. M. Olson, E. J. Sitar, & A.C. Ward The CTP (Rosenfeld et al., 2008) has proven a robust CIT in forensic analogs, with good accuracy and resistance to the CMs typically applied in CITs, which involve subject-generated secret responses to irrelevant stimuli. Meixner & Rosenfeld (2011) also reported the utility of the CTP in anti-terrorist situations in which planned but undeceived crime specifics are unknown. In this situation, investigators compare the largest with the next largest P300 response, (the “blind I-max test”) assuming the former to represent response to the (crime-relevant) probe item, and the latter to represent the response to the most salient irrelevant, the “I-max.” Lukacs et al. (2016), while replicating the major findings of the CTP in forensic situations in which the probe is known, developed a CM technique which foiled the I-max test in anti-terror scenarios. This technique appeared to our lab as challenging for the subject and requiring considerable practice, as reported by Lukacs et al. Thus in the present study we compared 2 groups, a practice (P) group in which we tried to approximate the practice CM training as in Lukacs et al (2016) vs. a non-practice (NP) group. The concealed information was episodic: the stolen items in a mock crime (watch, bracelet, randomly assigned). At the time of this abstract submission, 9 P and 7 NP subjects have been run. Using the bootstrap method (Rosenfeld et al., 2013) to determine stimulus knowledge, 6/9 P and 4/7 NP subjects were detected as recognizing birth dates. By the time of the conference, we will have results for 15 P and 15 NP subjects.

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How age and meta-linguistic abilities modulate ERP patterns in French-speaking children
In French, many adjectives are marked for masculine and feminine gender, which has to agree with the gender of the noun they modify, however gender marking is not transparent: there is no regular inflectional suffix (e.g. the final /l/ in <i>verte</i>/*<i>vert</i> (masculine) vs. <i>ver</i>/*<i>ver</i> (feminine)).

There is some controversy about when children learn to master this agreement, and if they rely on mechanisms distinct from adults. Previous elicitation tasks and corpus studies provided insufficient data as children use very limited adjective vocabularies. Our study used event-related potentials (ERPs) and aimed to establish (a) at what age native French children start to show adult-like neurocognitive patterns for adjective agreement, and (b) if ERP patterns are driven by age or linguistic proficiency (LP). French adults show typical ERP patterns for gender errors (a LAN followed by a small P600), while semantic errors elicit a semantic N400 followed by a P600 [1].

Methods. While their EEG was recorded, 40 French children aged 4:05–8:11 listened to sentences containing high-frequency and early-acquired words as in (3), presented conjointly with pictures. Half of the sentences contained agreement errors on the adjective (wrong gender) or semantic errors (showing the wrong object).

<i>Je vois une cuillère <u>verte</u>/<i>ver</i> (<i>vert</i>/<u>verte</u>) sur la table</i>... green spoon on the table

Both the children’s age and their performance in meta-linguistic tasks (e.g., acceptability judgments and error correction) were used as predictors for ERP patterns.

Results. In children, agreement errors and semantic violations showed ERP timing differences, with semantic processing occurring more rapidly than agreement, while adults showed similar timing for both. Age and LP modulated semantic processing in that younger children showed more broadly distributed N400s than older participants, who exhibited N400+P600 patterns, high LP scores also correlated with larger P600s. Importantly LP abilities, but not age, correlated with adjective error processing: children with better performance showed a distributed N400 and a reduced frontal or posterior positivities in comparison to those with lower performance (Figure 1).

Conclusions. Our data establish that French children processing gender errors undergo changes, but do not yet converge on the adult ERP pattern (LAN + small P600). Data suggest that children may process agreement errors as lexical errors (N400s). It thus seems that acquisition of agreement checking for French adjectives can be protracted, which could be linked to agreement marking’s lack of transparency in French adjectives.

[1] Royle et al. (2013) &lt;i&gt;Mental Lexicon, 8&lt;i&gt;(2), 216-44.

Picture 1: https://www.eventure-online.com/parthen-uploads/175/18001/add_1_426990_28ba395d-ccf3-44c7-8bc8-d0fdceb11a0.png
Caption 1: Figure 1. Effects of meta-linguistic abilities on component amplitudes and distributions found in children: N400 (400-750 ms) and later positivities.

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Feeling Word Vibrations: Neurofunctional activation differences in profoundly deaf individuals and normal-hearing controls
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&lt;b&gt;Introduction:&lt;/b&gt; The rationale that auditory deprivation could benefit sensory modalities that remain intact, underlies the exploration of vibrotactile stimulation as an alternative sound perception method for the population with profound bilateral deafness allowing discrimination of sound, and furthermore, of spoken language. Therefore, the search for alternate communication methods is necessary primarily because early oral language acquisition is a challenge for profoundly deaf individuals having important implications in neurodevelopment, and consequently in cognition.

&lt;b&gt;Methods:&lt;/b&gt; We studied the neurofunctional activation patterns -BOLD signal- in 12 profoundly deaf subjects and 12 normal-hearing (NH) controls, as they performed 2 different vibrotactile sound discrimination tasks wearing a small portable stimulator device on the left index finger. The fMRI block-design paradigm consisted of two Go/NoGo tasks. The word task involved semantic discrimination (T: Mexican flag colors; NT: other colors), and the tone task required the discrimination between two pure tones with different duration (T: 500 ms; NT: 250 ms). Both groups were scanned at a baseline condition, and only the profoundly deaf participants were scanned again, after having completed a 10 to 12-week training program aimed at vibrotactile word recognition, specifically the names of colors.

&lt;b&gt;Results:&lt;/b&gt; The most significant group differences were observed in the word &gt; tone contrast at the baseline condition. Prior to training, the areas recruited during vibrotactile word discrimination in the deaf were the visual cortices, whereas in the NH group the main metabolic activations were left frontal and parietal regions including the angular and supramarginal gyrus.

&lt;b&gt;Conclusions:&lt;/b&gt; These findings suggest that the neural organization associated with oral language development underlies linguistic stimuli processing even when the pathway involved is somatosensory. What is most surprising is that the neurofunctional activation pattern in the profoundly deaf group, after having learned the somatosensory representation of each word, strongly resembles the NH baseline activations. Some important clinical implications of our findings are that the implementation of novel technologies and training programs that facilitate vibrotactile perception, and discrimination of
sounds within the language spectrum, might have an advantageous impact on oral language development.

Key words: profound deafness, vibrotactile discrimination, linguistic stimuli, fMRI.

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Resting-state EEG microstates in children with Autism Spectrum Disorder
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Autism spectrum disorders are characterized by several specific EEG biomarkers that distinguish the brain activity between the neurotypical development and ASD population. Resting state analysis may be of interest in understanding functional networks of the brain as it is not related to performing specific tasks, thus enabling a wider collection of data from ASD children. In particular, the study of the temporal characteristics of the network’s activation can unveil crucial information about brain functions as the presence of inadequate brain state at rest can affect the subsequent processing of incoming stimuli leading to dysfunctional information processing and behaviour. Within the resting state analysis, it is possible to study brief quasi-stable brain states, defined as ‘microstates’, with a duration around 100 ms. The temporal parameters of the microstates are usually the duration, the frequency and the transition of a given microstate to another. The analysis of these microstates parameters has been found to be altered in a number of neuropsychiatric disorders even though the characteristics of microstates in ASD are not well explored yet. We compared recordings from neurotypical and ASD children, matched by age and sex, and used a modified hierarchical clustering algorithm, known as the <i>topographic atomize and agglomerate hierarchical clustering</i> (TAAHC) method, to identify the microstate classes. Preliminary results of the temporal features revealed significant differences in the duration, occurrence as well as in the transitions of microstate topographical maps. The aim of the present work is to expand the range of diagnostic biomarkers in the ASD.

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Investigation of visual-motor and cognitive functions state in pediatric posterior fossa tumor survivors, acute lymphoblastic leukemia survivors, and health controls
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Introduction
Posterior fossa tumors (PFT) and acute lymphoblastic leukemia (ALL) are frequently observed oncological diagnoses among children and adolescents. Current treatment of cancer has led to a significant increase in patients’ survival rates. However, treatment factors cause the impairment of motor and cognitive functions. Such an outcome can be induced by tumor growth process as well. The purpose of this investigation was to compare visual-motor and cognitive functions in groups of PFT survivors, ALL survivors, and healthy controls.

Methods
Berry VMI is aimed to assess visual-motor integration, motor co-ordination and visual perception. CANTAB is Cambridge Neuropsychological Test Automated Battery, which consists of several tests for evaluating the following cognitive functions: short-term memory, spatial working memory, and attention.

Participants
The following groups participated in the trial: 76 PFT survivors (29 females, 47 males, mean age was 11.72±3.28), 40 ALL survivors (20 females, 20 males, mean age was 10.75±3.5), 20 healthy controls (9 females, 11 males, mean age was 11.5±2.8).

Results.
The findings have revealed that visual-motor integration, motor co-ordination and visual perception are significantly worse in PFT survivors comparatively to ALL survivors. Comparison of patients’ groups with healthy controls has demonstrated the impairment of short-term and working memory in PFT survivors, while ALL survivors have showed only short-term memory decrease. The results reveal negative effects of the cerebellum pathology in children who survived posterior fossa tumors. It is coherent with findings about the cerebellum involvement in cognitive functions. The patients after ALL do not have topical lesion but they demonstrate cognitive and motor deficits by reason of chemotherapy toxicity.

Conclusion
Children and adolescents who survived PFT and ALL show deficits of motor and cognitive functions. Furthermore, PFT survivors have stronger deficiency comparatively to ALL ones. It can be connected with the pathology of cerebellum, which controls both motor and cognitive functions through feedbacks with frontal lobes. Therewith chemotherapy and radiotherapy can cause adverse effects as well.

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Psychophysiological correlates of color function in children with Attention Deficit Hyperactivity Disorder
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Introduction
ADHD is one of the most common disorders in children and adolescents. It occurs in about 5% of the child population. This makes research of psychophysiological correlates of ADHD very important. Objective physiological indices of ADHD can be applied not only for preclinical diagnostics, but also for monitoring the dynamics of the state with ADHD.

Methods
In our work, to assess selective attention and activity level, the Toulouse-Pieron test was applied. It represents a variant of the proof test — a nonverbal test which reveals ability of the respondent to voluntary concentrate the attention. The test took 10 minutes per volunteer. Processing of the results was manual, with the use of special keys. Instrumental quantitative assessment of emotiogenic changes of function of color discrimination was performed. To assess color discrimination thresholds in the framework of HLS color model the computer campimetry test was applied. The test took 5 minutes for each participant, and the assessment was performed automatically.

Results
A total of 41 subjects between 7 to 12 years of age participated in the study: 18 children with ADHD and 23 children without diagnosis.

In hyperactive children the color discrimination thresholds in all shades are significantly higher than in healthy children (p<0.001, t-tests). In 91% of healthy children the function of color discrimination with the maximum differential threshold in green shades range prevails, in 70% of children with ADHD – in blue shades range. The indices of computer campimetry which are closely related to indices of accuracy (r = -0.87; p < 0.05) and speed (r = -0.93; p < 0.05) according to the Toulouse-Pieron test are revealed. The regression analysis was performed to calculate parameters of selective attention and speed: K = -0.0118 * dH190 + 0.9083 (R² = 0.79) V = -3.656 * dH160 + 57.562 (R² = 0.6), where K — accuracy according to the Toulouse-Pieron test, dH190 - differential threshold for shade 190; V - speed according to the Toulouse-Piron test, dH160 - differential threshold for shade of 160.

Conclusions
Deterioration of color discrimination in shades of blue can be considered as possible markers of the increased risk of clinical ADHD development in children aged 7-12. Computer campimetry can be used as a simple and reliable method to aid ADHD assessment along with the classical proof test for preclinical diagnosis. It can also be useful for monitoring of the dynamics of ADHD in children.

Effects of 5-HTTLPR on resting state EEG networks in the people from different ethnic groups in Siberia.
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Introduction:
Serotonin transporter is one of the most widely investigated genetic markers of individual variation in serotonergic function. The promoter region of the serotonin transporter gene (5-HTTLPR) contains long (L) and short (S) variants. The effect of 5-HTTLPR to the risk of depression and other mental health problems is highly variable in different ethnic groups. According to the most of reports, the S allele has been found to increase the risk of mental health problems in the Caucasoids, but also the same allele has an opposite effect or no effect on the different Mongoloid groups.

Methods:
This study comparatively investigated the effect of 5-HTTLPR polymorphism on EEG current source density, connectivity, and topological properties of resting state networks in the groups of Caucasian Russians (210 persons) and Siberian Mongoloids – Tuvinians, Yakuts and Evenks (173 persons).

Results:
As compared to L-carriers, S homozygotes from the Caucasian group showed lower current source density and connectivity in most frequency bands in areas overlapping with the default mode and emotion regulation regions. However, the opposite effect of the S allele revealed in the Mongoloid group, i.e. the Mongoloid S homozygotes showed higher current source density and connectivity in the same brain areas and frequency bands in comparison with the Mongoloid L-carriers. In addition, the trait anxiety level, the neuroticism scores and the emotional intelligence scores were measured in all participants by means of different self-report inventories. SS homozygotes showed higher scores of anxiety and neuroticism and lower scores of the emotional intelligence in comparison with the L-allele carriers among all ethnic groups. However, the associations between resting-state EEG and these psychological measures were different among ethnic groups.

Conclusion:
The effect of 5-HTTLPR polymorphism on EEG and on association of resting-state EEG networks with psychometric measures looks unstable and depends on many additional climatic and cultural parameters. The study was supported by the Russian Science Foundation (RSF) under Grant 17-18-01019.
The Influence of Catechol-O-Methyltransferase (COMT) Val158Met Gene Polymorphism, Persistence, and Attentional Characteristics on Novelty Seeking

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Over the last five decades, a number of biological oriented personality theories have been proposed to explain how anatomical and functional differences in the human brain are responsible for individual differences in personality. Catechol-O-methyltransferase (COMT) gene for the Val158Met single nucleotide polymorphism (rs4680) is known to influence the activity of the enzyme responsible for dopamine metabolism and has been linked with various aspects of personality dimensions and cognitive processes. In the present study, non-clinical participants (201 women and 53 men) were administered the Temperament and Character Inventory-Revised, Tellegen Absorption Scale, Differential Attentional Processes Inventory, and Waterloo-Stanford Group Scale of Hypnotic Suggestibility, Form C. Among these participants, COMT polymorphism (parameterized as a 3-level variable: 0 = Met/Met, 1 = Val/Met, 2 = Val/Val) was assessed in 117 women and 51 men. Hypnotic Suggestibility scores were significantly correlated with scores from the Absorption, Extremely Focused Attention, and Dual Attention for Physical-Cognitive task. We failed to find the expected significant association between COMT and Hypnotic Suggestibility scores. In contrast, COMT scores were significantly correlated with scores from Novelty Seeking (r = -.15, p = .049) and its Disorderliness subscale (r = .21, p = .008). A principal component analysis (with varimax rotation), performed on personality and attention measures, yielded a four-factor solution: Factor-1 (Moderately Focused Attention, Dual Attention Cognitive-Cognitive, and Dual Attention Physical-Cognitive), Factor-2 (Novelty Seeking, Reward Dependence, and Harm Avoidance), Factor-3 (Hypnotic Suggestibility, Absorption, and Extremely Focused Attention), and Factor-4 (Persistence). These factors accounted for 18.4%, 16.3%, 16.2%, and 12.3% of the total variance, respectively. These findings guided us in the choice of the COMT, Persistence, Extremely Focused Attention, and Absorption scores as predictors of Disorderliness scores in separate multivariate regression analyses. Lower COMT activity, higher Absorption scores, and lower Persistence scores accounted for 18% of the total variance in the whole sample, and 10.6% in female sample. In male sample, higher Absorption and lower Persistence scores significantly predicted Disorderliness scores accounting for 22% of the total variance. Since our male sample was relatively small, further research is needed to understand gender differences, if any, using a larger male sample.

Interceptive awareness, conditioned emotion and hypnotizability

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Interceptive awareness, conditioned emotion and hypnotizability
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Interception and emotion are closely related to each other. Emotion sustained by the activity of the Behavioral Inhibition/Activation System (BIS/BAS, which regulates withdrawal or approach behavior) is known to interact with hypnotizability in pain imagery and control. Hypnotizability-related differences in interception may be explained by the structural and functional brain differences observed between subjects with high and low hypnotizability scores. Thus, the aim of the study was to measure hypnotizability-related differences in interceptive awareness and BIS/BAS activity and to find out possible relations between them in participants with high (>highs<<), medium (>mediums<<) and low (<lows<<) hypnotizability levels. Participants of both genders (n=284) completed the Italian version of the Multidimensional Assessment of Interceptive Awareness (MAIA) questionnaire and the Carver scales (which relate to the activity of BISBAS). Separate multivariate ANOVAs were applied to MAIA and Carver scales scores and correlational analysis between them was conducted. Significantly higher interceptive awareness was found in (>highs<<) with respect to (>mediums<<) and (>lows<<), whereas significantly lower BIS scores were found in (>highs<<) and (>lows<<) with respect to (>mediums<<). In addition, significant correlations between MAIA and Carver scales were found in (>mediums<<) (who better represent the general population), but not in (>highs<<) and (<lows<<). The (>highs<<) and (<lows<<) few significant correlations between MAIA and BISBAS differed between each other, which can be accounted for by not studied traits as well as by the hypnotizability-related structural and functional brain differences in the insula and cerebellum which are relevant to both interception and emotion.

The importance of fMRI functional connectivity analysis of a motor network in patients with movement disorders after severe traumatic brain injury

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An unbiased assessment of motor function in patients with severe traumatic brain injury (STBI), followed by movement disorders in 2 out of 3, is of current interest.

Objective: to evaluate the functional activity of a corticospinal motor network after STBI, comparing fMRI connectivity in resting state (RS) and passive movement.

Methods: The experimental group consisted of 20 patients with right-sided hemiparesis after STBI; the control group, of 15 healthy volunteers. The degree of hemiparesis was evaluated on the muscle strength scale.

Each examination included fMR and DTI 3T.

fMRI was recorded in RS with closed eyes and with passive right fist clenching (by experimenter). There was conducted a comparative group analysis of the functional connectivity (FC) of a corticospinal tract’s motor network in RS and movement by the CONN program. The network included areas involved in right arm’s fMRI responses, such as the left motor cortex, additional motor cortex, right cerebellum hemisphere, and also the right motor cortex. FC intensity between the selected points and their significance was assessed.

DTI estimated a state of the corpus callosum (CC), calculating fractional anisotropy (FA) in 7 topographic zones in the occipital-frontal direction. The Spearman correlation coefficients between the regional FA of the CC and hemiparesis severity were calculated.

Results: FC intensity for homologous pairs of ROI within a given motor network in RS and movement was close in degree. FC tended to weaken from the norm to gross hemiparesis. In RS, those changes were almost linear in most pairs (4 of 6). In passive movement, the values for 1 out of 6 connections (between left and right motor cortex) decreased linearly, with hemiparesis increase.

Thus, both in RS and movement, FC-fMRI changes between symmetric motor cortex regions were most clearly associated with hemiparesis severity. This result agrees with DTI data on a significant and high correlation between some regional FA of the CC, especially in Genu (SCC 0.71), and hemiparesis severity.

Conclusion: The evaluation of the FC in a corticospinal motor network, especially of a paretic hand, is informative in case of STBI. In RS, it has a greater diagnostic potential. In movement, changes in spatial organization of FC, as hemiparesis increases, may rather reflect the plasticity of the system studied.

The functional interaction between symmetrical motor cortex regions is shown to be important in the development of posttraumatic hemiparesis, and FC, associated with the CC state.

Supported by RFFI https://kias.rfbr.ru/index.php

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Unconscious detection of verbal and non-verbal ambiguous stimuli

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Ambiguity plays an important role in our everyday cognitive experience. Since the 1980s, the neural bases for the perception of ambiguous information have been investigated but remains poorly understood. In our previous research, an increase of the N400 ERP component was found to be a common response for the perception of two different types of ambiguous stimuli: “canned” verbal jokes and ambiguous figures (Shcherbakova, Filippova, 2016; Filippova, Shcherbakova, Shtyrov, 2018). The current experiment aimed to understand the relationship between the error related negativity (ERN) component arising from jokes and ambiguous figures mistaken for non-humoristic texts and non-ambiguous figures.

Fourteen participants (<u>9</u> females) went through two similar experimental procedures with 36 ambiguous and 36 non-ambiguous figures; 14 verbal jokes and 14 similar but non-humoristic short stories. Firstly, participants were presented with figures of both types and asked to identify whether each figure was ambiguous or non-ambiguous. We recorded ERPs that were time-locked to each answer about ambiguity/non-ambiguity of the figure presented. Secondly, participants were presented with the verbal stories and asked to identify whether each story was a joke or not. In this case, ERPs were time-locked to each answer about the key phrase of a joke/non-joke presented word-by-word on the computer screen after the whole text.

But we found an increase of the ERPs’ negativity in ambiguous figures that were mistaken for non-ambiguous ones in the ERN time window (Fz (F(3,622) = 12.6; p < 0.00) and Cz (F(3,625) = 6.96; p < 0.00)). Also, the results revealed no increase of the ERPs’ negativity in verbal jokes that were mistaken for non-jokes in the ERN time window. The results show that participants appeared to be sensitive (without awareness) to ambiguous figures that were identified as non-ambiguous ones. The level of this unconscious sensitivity is therefore reflected by the increases in negativity.

When a participant cannot correctly identify ambiguous stimulus at a conscious level, increases in negativity may be indexing greater violations of incongruence within an internal representation of meaning. These violations may precede semantic reversion of ambiguous figures and the understanding of a joke’s meaning.

Supported by RFBR (Dpt of Humanities and Social Sciences) grant ¹-17-06-01014 A and RFBR grant ¹-18-013-01086.
<b>Introduction:</b> Sadness is evoked by various situations and divided into subtypes. Previous research indicated that loss- and failure-sadness are encoded by different verbal expressions. Loss-sadness is associated with static features, while failure-sadness is linked to dynamic and voice properties. Thus these subtypes of sadness are memorized as different emotional concepts in our mind. However, it is unclear how such a conceptual difference is supported by neurophysiological foundations. To examine this question, the present study used the priming paradigm testing long-term memory representation, and conducted an electroencephalogram (EEG) experiment of processing emotional words under emotional contexts. As the brain activity marker, N400 was selected because of reflecting contextual integrations.

Methods: EEG recording was performed for 23 participants during the priming experiment, in which one of three types of contextual prime stimuli (loss, failure, or neutral) preceded emotional target words (onomatopoeia related to manner of crying). The target words were selected from our previous study. That study reported that the emotional words were divided into three types of contextual fitting (high-, middle-, and low-fitting words) based on congruency ratings between emotional contexts and words.

Results: The different negative event-related potential (ERP) effects yielded at the middle processing phase (around 300 ms after word-offset) between the loss and failure contexts. The loss context yielded a sadness-bias negativity effect, in which the loss-priming contexts promote processing of the sadness-related stimuli. On the other hand, the failure context showed another negativity effect for contextual integration burden because of the weaker relation between the failure contexts and target words. On the other hand, similar negative ERP effects at the late processing phase (> 400 ms) indicated that the loss-and failure-sadness contexts yielded similar voluntary attentional processing.

Conclusions: These findings suggest that loss- and failure-sadness are verbally encoded as different concepts in the mind, especially founded on the middle-phase psychophysiological processing of emotion.

NEURO-EDUCATIONAL APPROACHES ON PREFERENTIAL SELECTION IN INDIVIDUALS WITH INTELLECTUAL DISABILITIES

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Introduction
Promoting self-determination is important for individuals with intellectual disabilities (ID). Previous studies have shown individuals with severe disabilities are capable of making choices. However, there might be no way of knowing whether their choice behavior could be considered purposeful. Therefore, we examined cerebral activity during preferential selection in individuals with ID using near-infrared spectroscopy (NIRS).

Methods
26 normal adults (mean age 21.6 years) and 2 individuals with ID (Case A: 17.2 years, IQ69; Case B: 18.0 years, IQ50) participated in this experiment. 40-second baseline period and 20-second activation period were repeated twice, followed by 40-second baseline period at the end. In the baseline period, an alpaca or hedgehog statue and its pixelated image were simultaneously presented at the left and right side of the screen. Participants were asked to press a button with their thumb of the side where the un-pixelated image was presented. In the activation period, different animals as stimulus pair were presented at the left and right side of the screen. Participants were asked to report the preferred animal by pressing a button with their thumb. 2 different conditions were conducted in a randomized order to the participants. Stimulus pairs in “easy condition” were combination of animals with neutral attractiveness value. NIRS was recorded from 16 channels in frontal area (OEG-16, Spectratch). Mean values of oxy-Hb at each channel was compared between 10-second baseline period prior to the activation period and 20-second activation period in each condition.

Results
In normal adults, oxy-Hb concentrations significantly increased at all frontal recording sites under difficult condition compared to the 10-second baseline period, but focally increased under easy condition, i.e., in the bilateral dorsolateral prefrontal cortex (DLPFC) and orbitofrontal cortex (OFC). Furthermore, oxy-Hb concentrations in the second half of the activation period were significantly larger at all sites in difficult condition compared to easy condition. In individuals with ID, similar results to normal adults were shown in Case A. However, in Case B, robust activation was observed in easy condition but not in difficult condition.

Conclusions
Since the DLPFC and OFC were activated in even simple forced-choice decisions such as easy condition, NIRS would be able to capture hemodymanic responses related to purposeful decision making. We might be able to evaluate objectively the cognitive process of reaching their own decision in individuals with ID.
The functional state of magnocellular and parvocellular visual pathways and cognitive functions in first-episode of schizophrenia

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Introduction
The aim of this study was to examine the functional state of magnocellular and parvocellular visual pathways, features of their interaction and cognitive functions in healthy participants and patients with first-episode schizophrenia. The magnocellular and parvocellular systems are different sensitive to spatial frequency. The magnocellular system is most sensitive to low spatial frequencies, parvocellular system - to high spatial frequencies.

Methods
Twenty five patients with first-episode schizophrenia and fifty healthy participated in the study. The cognitive control and attention was measured with the Trail Making Test. The second part of the test used to examine executive functioning and selectivity of attention. Contrast sensitivity thresholds were measured with the visual contrastometry. Contrast sensitivity of the visual system was recorded in the task of contrast distinguishing. We use the Gabor gratings with spatial frequencies of 0.4, 3.6 and 17.8 cycles/degree.

Results
It was found that patients with first-episode schizophrenia are characterized by increased contrast sensitivity at distinguishing contrast gratings low spatial frequency. At the same time contrast sensitivity in the range of medium and high spatial frequencies is reduced. The obtained data are considered as the evidence of the mismatch in the functioning of magnocellular and parvocellular systems, which leads to increased levels of internal noise in visual system in patients with schizophrenia. The results of the neuropsychological research also indicate violations of cognitive control, of thinking and selectivity of attention in schizophrenia. A significant correlation of the detected disturbances with the activity of the magnocellular system responsible for the global analysis of the information is established. An inverse correlation with contrast sensitivity in the range of low spatial frequencies indicates that the higher the activity of the magnocellular system, the more pronounced, are the violations from cognitive control and selectivity of attention.

Conclusions
Thus, in schizophrenia, there is a violation of cognitive control and selectivity of attention at early levels of information processing as a result of the hyperactivation of a magnocellular system, responsible for global information analysis, peripheral vision and attention distribution.

As a result of the hyper activation of the magnocellular system and, accordingly, violations of the selective attention function, an excessive amount of information enters the brain, which leads to a disruption in the integrity of perception, disorganization of thinking and behavior, which is reflected in the clinical picture of psychosis.

This research was supported by the Russian Foundation for Basic Research (grants 18-013-01245).

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Neurological and psychological status of multiple sclerosis patients after a year in program of personalized psychological interventions

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Introduction
Necessity of psychological interventions in multiple sclerosis (MS) is caused by high neurological risk of increasing disability and impact of possible negative psychological consequences. A wide range of psychological methods and attitudes are reported to have controversial results. We tried to design and implement into clinical practice a personalized program of psychosocial interventions for MS patients aimed at specific targets of different clinical stages of the disease.

Methods
The study covered 104 MS patients (25 men and 79 women aged 19 to 64) who participated in a one-year program of special in-patient and out-patient psychological interventions. The patients were diagnosed relapsing-remitting multiple sclerosis (RRMS) or secondary progressive multiple sclerosis (SPMS). The program included psychoeducation, neuropsychological training, social skills training, behavioral training, cognitive-behavioral therapy, personality-oriented (reconstructive) psychotherapy, family psychotherapy, supportive psychotherapy. At the end of the program, neurologists and psychologists assessed the dynamics of MS patients' neurological and psychological status (improvement, stabilization, deterioration). The evaluation was carried out based on Expanded Disability Status Scale (EDSS) scores, frequency of MS exacerbations during the year and the nature of psychopathological disorders.

Results
By the end of the psychological interventions program four out of five MS patients (83.65%) showed stabilization of their state, reliably more often than deterioration (|||P|||<0.01) or improvement (|||P|||<0.01), which was characterized by no increase in EDSS points, no MS relapse, absence or alleviation of psychopathological disturbances, no report on worse clinical-and-psychological parameters during the year. We did not reveal higher rate of state stabilization in the certain
course of MS (|$\triangle P$| > 0.05). Every fifth SPMS patient (22.6%), reliably more often than RRMS patients, showed exacerbation of the disease (|$\triangle P$| < 0.05), which was accompanied by an increase in EDSS points and MS exacerbation rate, by newly arising or deteriorating psychopathological disturbances, and by worsening of clinical-and-psychological parameters during the year. This was obviously associated with steady progression of the disease, which had a strongly pronounced organic nature. Every tenth RRMS patient (9.58%) showed improvement of their state with no increase in EDSS points, no MS exacerbation or its lower rate, no psychopathological disturbances, and positive dynamics of clinical-and-psychological parameters during the year.

Conclusions

The implemented personalized program of psychological interventions in MS patients may be regarded as complementary to medical rehabilitation methods of psychophysiological influence, which have various effects at various clinical stages of the disease.

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Neural substrates associated with the level of anger-related traits in the recall of anger experience

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Brain regions associated with anger experience include the amygdala, insula, orbitofrontal cortex (OFC), superior temporal gyrus (STG), and hippocampus. The intensity, frequency, and duration of anger are associated with anger-related traits (e.g., trait anger and anger control). Previous studies report that anger-related traits are associated with the variation of brain activity during the anger experience. Thus, this study was to investigate the relationship between anger-related traits and brain activity while anger is experienced.

fMRI scanning was conducted on 22 participants (age range, 19–32 years) while they recall the anger-inducing memory and thus experience anger. Trait anger and anger control were measured, using the Korean adaptation of the STAXI. The stimuli consist of three anger-inducing memories and three neutral-inducing memories that were selected by each participant. After the scanning session, participants were to rate their experienced anger responses to each memory on a scale of 0 to 10. Neuroimaging data were preprocessed and analyzed using SPM 8. For the ROI analysis of peak voxels, coordinates obtained according to the results of the group analyses were selected. Mean percent signal changes in the different conditions were separately extracted for each participant using Marsbar. Correlation analyses were performed for mean percent signal changes and anger-related trait measures.

While recalling the anger memory scripts compared to recalling the neutral stimuli, much more brain activations were shown in the right amygdala, the right insula, the left OFC, and the right STG (|$p$| < 0.05, FDR-corrected). Correlation analysis revealed that the level of trait anger was positively correlated with the activation of the right insula. Also, the level of anger control was negatively associated with the activation of the right amygdala during the anger experience. We generally assume that different levels of anger-related traits possibly influence the function of the right insula and the right amygdala when individuals experience anger. As a result, their psychological emotion experience would be determined through this mechanism (Supported by NRF-2015R1D1A1A01059095; Correspondence: Jin-Hun Sohn, jhsohn@cnu.ac.kr)

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Effects and Side Effects of Infraslow Network Neurofeedback (ISF-NF): a randomised double blind placebo controlled trial.

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Effects and Side Effects of Infraslow Network Neurofeedback (ISF-NF): a randomised double blind placebo controlled trial. Sook Ling Leong1, Sven Vanneste6, Joyce Lim1, Mark Smith1, Patrick Manning1, Dirk De Ridder1, Theresia Stoeckl-Drax4 1University of Otago, New Zealand, 2School of Behavioral and Brain Sciences, University of Texas, Dallas, USA, 3Neurofeedback Therapy Services of New York, 4Neurodevelopmental Clinic, Munich, Germany

Introduction:
The combination of training the infraslow frequency band (0.0-0.1) in a specific brain network is a relatively new NF approach. In a clinical pediatric and young adult population with attention problems this ISF-NF with the DMN (default mode network) as targeted network had given indication to improve self perception, and self awareness of the attentional state but also self control regarding eating and led to better relaxation as well as improved sleep onset and depth. Those “side effects” gave the idea to the study on obese women, using the same treatment protocol.

Methods:
Twenty one eligible females participated in a randomized, double-blind, placebo controlled parallel trial. Over a period of two weeks, participants received six sessions of either ISF-NF (n=11) or placebo (n=10), directed at the PCC. Brain activity was measured using EEG and food craving was assessed using the Food Cravings Questionnaire State (FCQ-S) at baseline (T0) and two days after the last treatment session (T1).

Results:
At T1, there was a significant increase in infraslow activity as well as infraslow/beta nesting in the PCC, for the ISF-NF group compared to placebo at T1 and to treatment T0. Results also showed significant decrease in the ISF-NF group in different dimensions of state food craving at T1 compared to T0. 9 out of 11 women of the treatment group guessed correctly because they noticed less craving and they felt better rested. Only rare side effect were vivid dreams, no headaches, dizziness, nightmares or confusion were reported.

Conclusions:
These preliminary study demonstrates that ISF-NF of the PCC results in electrophysiological changes in the PCC associated with reduced food craving. Even if the long term outcome is still missing ISF- network neurofeedback can be considered an effective treatment tool and should be explored in further studies and patient populations. As effects and side effects only describe the full picture of its efficacy, all possible reported effects should be controlled in order to learn more how it can affect health and well being.

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Validity and reliability of the Utrecht Work Engagement Scale-Student Version in Sri Lanka
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Introduction: Despite the growing enthusiasm in student engagement research across the globe, there is a paucity of literature in the South Asian context owing to the lack of validated assessment tools. Hence, the present study was aimed at assessing the validity and the reliability of a culturally adapted Sinhala version of the Utrecht Work Engagement Scale- Student Version (UWES-S) among collegiate cycle students in Sri Lanka.

Methods: The 17-item UWES-S was translated to Sinhala by using the forward-backward translation method and was pre-tested. The face, content and consensual validity of the instrument was assessed by a multi-disciplinary panel of experts by using a modified Delphi technique. Construct validity of the UWES-S was appraised by using multi-trait scaling analysis and exploratory factor analysis (EFA) on data obtained from a sample of 194 grade thirteen students in a selected educational division, Kurunegala district, Sri Lanka. Reliability of the UWES-S was assessed by using internal consistency and test-retest reliability, which was assessed by administering the instrument after a gap of two weeks to a sub-sample of participants.

Results: Except for item 13, all other items were rated as having good psychometric properties in judgemental validity assessment. Item-convergent validity and item-discriminant validity were confirmed for 16 items in the UWES-S, except for item 13. EFA using principal component analysis with Oblimin rotation, suggested a three-factor solution (including vigor, dedication and absorption subscales) explaining 65.4% of the total variance for the 16-item UWES-S (with item 13 deleted). High internal consistency was observed for all three subscales (Cronbach’s α>0.7) and test-retest reliability was high (p <0.001).

Conclusions: The Sinhala version of the 16-item UWES-S is a valid and a reliable instrument to assess the work engagement among collegiate cycle students in Sri Lanka. The Sinhala version of the 16-item UWES-S, due to its brevity, ease of administration and sound psychometric properties, could be used as an effective screening tool at the school level.

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The perception of advertising images by children of 5 years old
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Introduction. The purpose of the research was to analyze how a child chooses the products in the markets and later to compare the results with the choice of his/her parents.
In view of the age-related features of child development, at the preschool age the greatest influence is exerted by the phenomena of psychological contamination (affecting the emotional sphere of the personality), imitation (involving the appropriation of behavior models that have been observed) and indoctrination. Children entreat and even compel their parents to buy attractive products, which are far too often inferior, and this sometimes leads to friction with the parents, who refuse to do so. When parents explain that these products are deleterious to their health, 23 percent of children agree with them, but 60 percent actively protest and become upset (Strasburger et al., 2009).

It has been shown that the extent to which a child has formed the theory of mind plays a significant role in their understanding of the purpose behind advertisement (Sergienko et al., 2013). Investigations into children’s perception of a package by using an eye-tracking device are rarely found in the research of child psychologists. Sequential presentation of visual patterns on a computer screen and documentation of children’s eye movements using an eye tracker will make it possible to analyze in greater detail their areas of interest and prove what advertising material has a special effect on children’s preferences.

Methods. The participants were 25 children between the ages of 3 and 7 (12 boys and 13 girls) and their 50 parents. In order to achieve our objectives, we used several psychodiagnostic procedures: a survey for children about their knowledge
of the products. Theory of mind analyzing and eye tracking. The Eye Tribe Tracker (ET1000) and the Ogama program were used. For the subsequent statistical analysis, the following facts were used: the number of fixations, the total gaze duration, the percentage of the time on the areas of interest and the length of the saccades.

Results and conclusion. The gaze duration for the advertising the image of a fairytale character’s on a package is substantially longer than those for the taste and the brand. Food selection for preschool children is based predominantly on good feelings for a character depicted on a package. The study is founded by Russian Foundation of Fundamental Research, project #18-013-00323a, by Russian Scientific fund #14-18-02135.

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Ostracism and Physiological Arousal Across the Ages
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<b>Introduction.</b> Recent research suggests that some populations are more vulnerable to the negative psychological effects of ostracism than others. The current study investigated the effects of ostracism on participants’ self-reported needs satisfaction and physiological arousal, and whether this effect was moderated by quality of life (QoL) and perceived social support. <b>Method.</b> Twenty early adulthood (aged 18 – 24; M = 19.5, SD = 1.05), 17 middle adulthood (aged 40 – 60; M = 54.6, SD = 5.2), and 15 late adulthood (aged 75 and older; M = 79.8, SD = 3.1) participants played <i>&lt;</i>Cyberball,<i>&gt;</i> a virtual ball tossing game. All participants completed two counterbalanced conditions: an inclusion condition where they received the ball fairly, and an exclusion condition where they received four ball tosses initially, then none for the remainder of the game. Skin conductance was measured continuously throughout each condition, and response quantified as the difference between the mean value obtained for the 2-minute pre-experiment baseline (following 10-minute rest) and each 10-second epoch throughout the task. After each game participants completed questionnaires of needs satisfaction and mood. Finally, they completed the Interpersonal Support Evaluation List, the World Health Organisation Quality-of-Life Scales (WHOQOL-BREF), and the Depression, Anxiety and Stress Scale (DASS).<b>Results.</b> Ostracism negatively affected participants’ basic needs satisfaction (belonging, self-esteem, meaningful presence and control), and, the magnitude of the effect was larger in the younger group compared to the two older groups [<i>&lt;</i><i>p</i>&lt;&i; (2.49) = 6.24, <i>&lt;</i><i>p</i>&lt;&i; (.004)]. This effect was not moderated by QoL and perceived social support. The anticipated age x condition x time interaction was not observed suggesting that there was no difference in physiological response to ostracism across age groups (<i>&lt;</i>&i;&lsim;i > .05).

<b>Conclusions.</b> Although ostracism may be a potent experience for all individuals, those in early adulthood may experience increased sensitivity to ostracism relative to their older counterparts, particularly when measured with self-report instruments. Further investigation is needed to identify any protective mechanisms in play for older adults, and to determine why these age group differences are not reflected in more objective, physiological measures.

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G/G genotype of COMT rs4680 links altruism to traumatic life experiences in people dedicated to volunteering
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<b>Introduction.</b> Prosocial behavior is represented by <i>&lt;</i>−&i;...a broad category of acts....beneficial to other people<cit. Penner et al., 2005</i>&lsim;]], such as cooperating, sharing, donating and volunteering, which produce a positive impact on society. Disposition to prosocial behavior varies substantially across individuals; studies on twins raised apart or in shared environments have shown that about 50% of this variance is explained by heritable factors, whereas the other 50% is attributable to the environment. In scientific literature, one study has linked altruism (evaluated by an experimental paradigm of fund allocation concerning an hypothetical donation to children in developing countries) to a functional single nucleotide polymorphism - rs4680 (G→A, Val/Met) - located in the catechol-O-methyltransferase (COMT) gene. Specifically, Val-allele carriers were more altruistic than Met/Met carriers. Interestingly, another study showed that the Val/Val genotype acts as a plasticity factor leading to the best executive functions and decision-making performances under stressful situations and to the worst performances under a favorable environment. Here we investigated whether stressful situations, such as traumatic experiences, in addition to COMT rs4680 genotype, modulate altruistic behavior.

<b>Methods.</b> We recruited 129 Volunteers (from non-profit organizations) and 111 Controls (with no history of volunteering). Each participant filled out the Altruistic Personality Scale (APS) and the Traumatic experience Checklist (TEC) and donated a saliva sample for DNA analysis. Genotyping was performed by qPCR-HRM.

<b>Results.</b> The frequencies of COMT rs4680 genotypes did not differ between Volunteers and Controls (p>0.05). Moreover, in both groups, none of the genotypes influenced the APS scores directly (p>0.05). As expected, Volunteers scored higher at APS than Controls (F(1,237)=5.162, p=0.001); moreover, the more Volunteers had been exposed to traumatic experiences, the more they scored high at APS (Wald chi-square=8.677, df=1, P<0.006). Interestingly, we found an effect of rs4680 genotype in mediating this relation (Wald chi-square= 14.850, df=3, P=0.006).

<b>Conclusions.</b> COMT rs4680 Val/Val genotype modulates altruistic behavior in response to traumatic experiences in Volunteers, but not in Controls. The use of a selected population, like in this case Volunteers that show high levels of
altruism, allowed us to highlight a weak gene by environment contribution to altruistic behavior, otherwise undetectable. Our findings show that the population selection is essential to reduce variability and to increase the statistical power of this kind of studies.

Picture 1: https://www.eventure-online.com/parthen-uploads/175/18001/add_1_459131_4ea227dd-f42a-4baa-b434-b71894b2874e.png

Caption 1: Correlation between APS scores and number of lifetime traumas in each genotype grouping of Controls (a) and Volunteers (b). Lines represent linear interpolations of data. APS score and the number of traumas positively correlate in G/G (red) Volunteers only (*uncorrected* = 0.008; *Bonferroni corrected* = 0.048).

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**Pilot study of correlations among interoception, cognition, and depressive symptoms in the elderly**

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**<b>Background</b>**

Interoception is defined as perception of the physical condition of the entire body (Craig, 2002). Many studies have reported that interoception of the heartbeat is correlated with cognition and emotion. Aging is correlated with decreasing interoceptive accuracy of the heartbeat (Khalsa et al., 2009; Murphy et al., 2017); however, no study has examined the correlations among interoception of the heartbeat, cognition, and depressive symptoms in the elderly. Hence, this study examined these relationships.

**<b>Methods</b>**

Five participants (2 males and 3 females, mean age = 75.20, SD = 10.46 years) completed a heartbeat tracking task (Schandry, 1981) for interoception, neuropsychological assessments for neurocognitive disorders, assessments for depressive symptoms, and questionnaires for activities of daily living and education. Interoceptive accuracy was estimated averages from the formulation of Murphy et al. (2017), whereby higher scores indicate better performance. This study was approved by the medical ethical review board of Kyoto Prefectural University of Medicine (ERB-C-853-2).

**<b>Results</b>**

Table 1 shows the mean score for each variable. Spearman’s ρ correlation coefficients were calculated between variables (Table 2). Notably, the results showed that interoceptive accuracy tended to be negatively correlated with age (ρ = -.90, <i>p</i> = .037) and positively correlated with the JST Index of Competence (ρ = .89, <i>p</i> = .041), total score on MoCA-J (ρ = .87, <i>p</i> = .054) and total score on the Geriatric Depression Scales (ρ = .87, <i>p</i> = .054). Moreover, the results showed that age tended to be negatively correlated with JST Index of Competence (ρ = -.89, <i>p</i> = .041) and Timing accuracy (ρ = -.82, <i>p</i> = .089).

**<b>Discussion</b>**

This study suggests that interoceptive accuracy of the heartbeat is correlated with greater cognitive function and depressive symptoms. Participants who were good at detecting their heartbeat seemed to be high complex competence of daily living and maintain cognitive function while being sensitive to depressive symptoms. We continue to collect data, and will present current results at the conference.

**<b>References</b>**


Picture 1: https://www.eventure-online.com/parthen-uploads/175/18001/add_441884_182afe45-49fb-4ba9-9ae6-e03561754a57.png

Caption 1: Table1

Picture 2: https://www.eventure-online.com/parthen-uploads/175/18001/add_1_441884_182afe45-49fb-4ba9-9ae6-e03561754a57.png

Caption 2: Table2

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**An ERP study of inhibitory control in adults with developmental coordination disorder**

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**Introduction**: Developmental coordination disorder (DCD) is a neurodevelopmental disorder that is characterized by
A cortical network related to cognitive control revealed by theta oscillations: a MEG study

Results: Nine subjects suspected for DCD showed increased movement difficulties in Aiming & Catching and Balance compared to normal subjects (Welch’s $t$-test, $p < .05$). As a result of sLORETA, we identified superior frontal cortex (SFC) as a source of NoGo-N2 and NoGo-P3 components, and anterior cingulate cortex (ACC) as a source of NoGo-P3. The DCD subjects showed increased current densities of NoGo-P3 at SFC compared to normal subjects (Wilcoxon rank-sum test, $p < .05$). However, differences were not found for other current densities between the two groups (all $p > .05$).

Conclusions: Increased current densities of NoGo-P3 in the DCD subjects suggested excessive monitoring of inhibition and error detections, since NoGo-P3 plays important roles in the post-response stage. The excessive cognitive loads in the post-response stage may interfere motor controls subsequently, which might disrupt a series of coordinate movements. In fact, the DCD suspects had low skills in the Aiming & Catching, and Balance, both of which require successive motor actions. In summary, the altered brain activities for monitoring of inhibition and error detections in DCD may be a part of impaired neurological characteristics related to their motor problems.

Saturday, September 8th, 2018

11.00 – 12.00 a.m.

POSTER SESSION 4

01 Neurofeedback in Psychological Rehabilitation of Stroke Patients

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Background. The number of people with stroke has increased significantly in recent years. Many rehabilitation techniques for stroke patients are oriented to physical and cognitive deficits. Recovery management of the emotional sphere leaves much to be desired. Neurofeedback is used as the rehabilitation method for reducing emotional disorders in different types of patients. The main aim of our study was to show the effectiveness of using neurofeedback in psychological rehabilitation of stroke patients. Methods. The study involved 84 patients with ischemic stroke (males, aged from 35 to 66 years, mean age 54.6 ± 4.01 years) with mixed anxiety and depressive disorder (F41.2 in ICD-10) diagnosed by a psychiatrist. Mixed anxiety and depressive disorder was evaluated using the Spielberg-Khanin anxiety scale, the Beck depression scale and the hospital anxiety and depression scale (HADS). Patients were randomly divided in two groups: 49 people passed through twenty neurofeedback training sessions and 35 patients - the control group without neurofeedback. EEG was recorded for all patients twice, before and after neurofeedback trainings in the first group and with 30-days interval in the second. Groups of patients did not differ significantly in age and neuropsychological tests scores. EEG indexes were computed and analyzed for theta (4-8Hz), alpha (8-13 Hz), beta1 (13-20 Hz) frequency bands. Results and Discussion. A comparative analysis showed various changes between the first and the second time recorded EEG parameters in the experimental group. After 20 trainings, the following changes were observed: an increase of theta-band activity in the anterior and central regions in eyes open condition ($p < .05$). The index of alpha-band activity decreased in the frontal and central regions. In the posterior region, an increase in the alpha-band index was noted. Decrease in the index of beta-1 activity recorded in the anterior, central and posterior areas. In the control group, the differences were also noted, but less expressed. We suppose that our results point on the normalization of brain bioelectrical activity in the experimental group of stroke patients. Changes in brain bioelectrical activity correlated with the improvement in the Beck depression scale and in the Spielber-Khanin anxiety scale. These results support the objectivity of including neurofeedback trainings in the rehabilitation process of people with stroke.

02 A cortical network related to cognitive control revealed by theta oscillations: a MEG study
Recent theories of cognitive control put large emphasis on theta oscillations in relation to action monitoring. Multiple EEG studies of cognitive control revealed increased power of theta oscillations restricted to midfrontal areas, while there is a substantial body of functional connectivity data demonstrating that theta oscillations may be a carrier of informational exchange over multiple cortical regions. fMRI studies revealed immense distributed networks involved in cognitive control. Paradoxically, MEG has been considered almost insensitive to theta oscillations in such an experimental context. It also remains debatable what is the functional role of such theta oscillations. An influential line of evidence links feedback-related theta oscillations to two types of prediction errors (unsigned and signed), but this distinction has not been tested during trial-end-error learning with theta activity measured beyond the midfrontal cortex.

We recorded MEG while participants were involved in trial-and-error learning within a novel multiple-choice behavioral task with complex stimulus-to-response mapping. Three conditions were analyzed: correct and erroneous trials during the initial stage of learning acquisition, as well as correct trials during stable performance. Sources of MEG activity were analyzed using minimum-norm estimation method within 4-6 Hz frequency range.

We revealed a number of bilateral cortical areas that displayed theta oscillations to the feedback signal: in addition to the "classical" medial frontal areas (the anterior part of the medial cingulate cortex and the pre-supplementary motor area), this network included the insula and the auditory cortex, the frontal operculum and posterior inferior frontal gyrus, the premotor cortex, the paracentral lobule, and the posterior part of the medial cingulate cortex. Granger causality analysis revealed overall communication directed from lateral to medial sites. During the initial stage of trial-and-error learning, we observed a strong non-differential response to feedback signal that reflected an unsigned component of the prediction error. The signed component of the prediction error was observed later – with greater theta activations after errors compared with correct responses.

Thus, using MEG, we were able to reveal a distributed network of brain areas in relation to feedback-related processing that included not only medial frontal, but also auditory areas, insula, lateral frontal, and medial parietal areas. The data obtained confirm the existence of two components of the prediction error, and this distinction was evident all over the network revealed.

The study was implemented in the framework of the Basic Research Program at the National Research University Higher School of Economics (HSE) in 2018.

The Role of Fear and Impulsivity in Exogenous Attention to Emotional Stimuli as Indexed by the Early Posterior Negativity and Late Positive Potential

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The Role of Fear and Impulsivity in Exogenous Attention to Emotional Stimuli as Indexed by the Early Posterior Negativity and Late Positive Potential

Kathrin Sommer, Vilfredo De Pascalis
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Emotional stimuli capture attention more readily than neutral stimuli, even when attentional resources are limited, suggesting that the emotion modulation of attentional allocation occurs rather automatically. The present study investigated whether exogenous attention to emotional stimuli, as indexed by the early posterior negativity (EPN) and late positive potential (LPP), is differentially influenced by underlying differences in the behavioral approach system (BAS) and its facets, the flight-fight-freeze system (FFFS), and the behavioral inhibition system (BIS), of the reinforcement sensitivity theory of personality (RST). Participants viewed neutral and emotional images that differed in arousal level to examine valence-arousal interactions in exogenous attention to emotional stimuli. On half of the trials, attentional resources were manipulated by having participants perform a visual detection task on emotional and neutral words that were presented successively in the surroundings of the image. The results suggest that exogenous attention is driven by the valence-arousal interactions with regard to the EPN, while it is driven by the arousal value of the stimulus with regard to the LPP. More importantly, the FFFS correlated negatively with EPNs elicited by negative images and negative words presented during directed attention trials. Impulsivity was associated negatively with LPP amplitudes elicited by negative and positive low-arousal images and positive words when attention was directed away from the affective image. Results are discussed within the revised RST framework that differentiates fear from anxiety and reward components from impulsivity.

DEPRESSED PATIENTS ARE MORE AROUSED BY LEFT PRESENTED STIMULI: A MULTILEVEL STUDY.

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Introduction

Major Depressive Disorder (MDD) is associated with emotional and attentional deficits over the visual field leading to physiological and cognitive manifestations. Hence, the aim of this study was to compare, in patients with MDD and healthy controls, the physiological and cerebral impact of the emotional pictures presented in central and peripheral vision (CV, PV).

Methods

Fifteen patients and 15 matched controls were presented with pictures from the International Affective Picture System. Two sets of 175 pictures (unpleasant and neutral) were presented at five eccentricities (-24°; -12°; 0°; +12°; +24°). The participants had to categorize pictures according to their emotional valence. Participants fulfilled questionnaires of depression (BDI) and anxiety (STAI). We analyzed the electrodermal responses (ED) to the pictures, as well as the dynamic of the associated cerebral events with a spatiotemporal principal component analysis (PCA) applied to the electroencephalogram signal.

Results

Unlike controls, patients with MDD showed greater ED responses for left than for right stimulation. This laterality effect correlated with anxiety scores (STAI-A and STAI-B): the more the participants were anxious, the greater were their ED responses to left presented stimuli. This laterality effect observed on the ED responses also correlated, in patients, with the same laterality effect on a 230-ms frontal component. Thus, in response to stimulation of their left hemifield, patients showed lower frontal activities and greater ED activity.

Discussion

Patients with MDD are more aroused by left presented pictures, which is linked to their anxiety level. This effect is associated with lower frontal activation, supporting the idea of a reduced frontal inhibition for the left visual hemifield. The mobilization of attentional resources toward the left presented stimuli seems to be facilitated by the anxious level observed in patients. Therefore, this effect, conjugated with the right hemisphere hypothesis, related to the specialization of arousal processing, could explain the arousal laterality effect.

BRAIN MECHANISMS OF CREATIVE ACTIVITY OF HIGH-CREATIVE AND GIFTED PEOPLE

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Introduction

Studying of a problem of creativity long time was carried out by psychology possibilities. However, the valid development of psychophysiology of creativity has appeared real only because of the technological revolution that created essentially new possibilities and have essentially updated traditional methods in physiology of a brain of the person. The creativity psychophysiology only arises as a direction. Understanding of brain mechanisms of creativity can have great possibilities and have essentially updated traditional methods in physiology of a brain of the person.

The purpose of the research was studying of the brain mechanisms of the creative process at its various stages in highly creative and gifted people.

Methods

50 senior pupils and students aged 15 - 20 years participated in the experiment. We used psychological tests of Torrance creativity, EEG method as the methods of research. The separation of patterns was analyses by comparison of EEG coherence of biopotentials in various areas of a brain in the alfa1, alfa2, beta1, beta2, theta1, theta2 bands. The coherent communications, which level, exceeded averages value for all areas and for each type of tasks were considered as significant.

Results

The distinctive feature of the dynamics of the frequency-spatial characteristics of the EEG in creative activity in comparison with uncreative is the growth of power in the beta-2 range in the frontal and right temporal zones. Differences in the EEG correlates of the dynamics of the creative process in subjects with different levels of creativity were revealed in the prefrontal and frontal-temporal zones.

Conclusions

Based on the results obtained, a multi-level model of the dynamics of the brain’s functional system was developed in the implementation of the creative act. The model includes three levels: the modulation level; cognitive level, specific to the creative process; specialized for highly creative and gifted people level.

Metacognitive strategies on improving reading performance of dyslexic students

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Abstract

The research aims at studying effectiveness of teaching metacognitive strategies on improving reading performance in dyslexic students. The design of this quasi-experimental research includes pretest post-test and a control group. The Statistical population includes all dyslexic students in elementary school referred to learning disability centers of Kerman in 2015-16. From them a group of 30 persons were sampled randomly and assigned into two groups of 15 students in control group and 15 students in experimental group randomly. To assess data, the experimental group received 8 sessions of teaching metacognitive strategies. Reading level recognition test (Kormi Noori & Moradi, 2009), Wechsler Intelligence Scale for Children-Revised (WISC-R) (Shahim, 2007), have been used. Data have been analyzed and evaluated by Analyze of...
The research was supported by grant of the Russian Science Foundation.

In view of the obtained results it can be assumed that the prematurity has specific (not global) negative effect on neurocognitive development in premature male infants at 5 months age. However, most of the studies were dedicated to those children who have reached the pre-school and primary school age [Stephens & Vohr, 2009; Marlow et al., 2005]. The impact of prematurity on neurocognitive functions in the early stages of development is not investigated thoroughly. The aim of research was to reveal the differences in neurocognitive development in premature and mature full-term male infants at 5 months of age.

The participants were 21 premature male infants at 5 months of corrected age and 21 age-matched healthy full-term male infants. The gestational age of preterm infants was between 29 and 35 weeks. The Bayley Scales of Infant and Toddler Development (3rd Edition) were used to evaluate the neurocognitive abilities in infants. The results were evaluated by one-way ANOVA, with level of performance in five Bayley scales as dependent variable, with group as between-subjects factors. Premature infants performed significantly (p<0.05) more poorly than the full-term infants on cognitive scale, receptive language and gross motor. No significant (p>0.05) differences were found between preterm and full-term infants on expressive language and fine motor.

In view of the obtained results it can be assumed that the prematurity has specific (not global) negative effect on neurocognitive development in premature male infants at 5 months age. The research was supported by grant of the Russian Science Foundation.

Picture 1: https://www.eventure-online.com/parthen-uploads/175/18001/add_1_444149_62b75715-0dab-4431-8495-7d84a346d8ca.png

Picture 2: https://www.eventure-online.com/parthen-uploads/175/18001/add_444149_62b75715-0dab-4431-8495-
Subjective estimation of time intervals has EEG-correlates in 13-30 frequency band

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The aim of the study was to investigate the subjective estimation of time spent for Go/No go task performance and to search for the EEG-correlates of differences in subjective time estimation.

We have studied the dynamics of EEG power (10/20 standard electrode positions: O1, O2, P3, P4, C3, C4, F3, F4) during Go/No go task performance. Twelve participants performed four blocks of Go/No go task trials. Each block lasted 331s, 429 s, 545s or 827s. The durations of blocks in their sequence varied in pseudorandom order. After every block of trials the participants reported the time estimation of block duration (in seconds). We divided all blocks into the three groups accordingly to quartiles of time estimation distribution (as a time estimation unit we used difference between physical time and subjective time). The group of overestimation of time intervals (OG) included trials under first quartile (data<67s), the accurate time judgments group (AG) - between first quartile and median (67s<data<74.5s), and the group of underestimation of time intervals (UG) contained trials over median of time estimation distribution (data>74.5s). We analyzed the averaged power spectra and averaged relative power spectra (in percent to whole power spectra 2-30 Hz) in 4-6 Hz, 6-13 Hz and 13-30 Hz frequency bands. For statistical data analysis we used ANOVA (<i>F1</i> - participant; <i>F2</i> - electrode position with levels 'Frontal', 'Central', 'Parietal', 'Occipital'; <i>F3</i> - lateralization with levels 'Right', 'Left'; <i>F4</i> - subjective time estimation (STE) with levels 'OG', 'UG', 'AG'; <i>F24</i> - electrode position*STE; <i>F34</i> - lateralization*STE) and Student’s t-test (with Bonferroni correction).

We revealed the relationship between subjective interval estimation (among other independent variables) and beta-subband power (13-30 Hz) (<i>F1</i> =12.35184; <i>F2</i> =2173.64, <i>F3</i> =3.35184; <i>F4</i> =79.89, <i>F3</i> =3.35184; <i>F4</i> =15.04, <i>F3</i> =3.35184; <i>F4</i> =7.562, <i>F3</i> =3.35184; <i>F4</i> =0.01). The short-term time estimation is accompanied by greater relative beta power (significant differences was observed in all electrode positions for groups UG and OG; in frontal, parietal and left central area (C3) for groups OG and AG; in parietal area, right central area (C4) and left occipital area (O1) for AG and UG). Asymmetry of relative beta-power is observed in frontal (28.4±0.4% vs 26.8±0.3%, <i>t</i> =2.54, <i>p</i> <0.05) and central (25.2±0.3% vs 26.8±0.3%, <i>t</i> =3.28, <i>p</i> <0.001) cortical areas for AG and in parietal area (28.1±0.2% vs 27.3±0.2%, <i>t</i> =2.51, <i>p</i> <0.05) for UG, no inter-hemispheric differences of relative beta power was observed for OG.

Thus, subjective time estimation of task duration has EEG-correlates in relative power spectrum in 13-30 frequency band.

Default mode network is mechanism for semantic color-emotional interdomain integration

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Introduction. Interrelation of complex “Color” and “Emotions” mental domains at perceptual and semantic levels of representation is subject of long and inconclusive debates in psychology and cognitive neuroscience. Current study is aimed to find brain mechanisms specific to semantic color-emotional interdomain integration. Methods. The study involved 35 right-handed Russian-speaking participants (16 men), 21.9±1.9 y.o., with no history of neurological or psychiatric illness. The fMRI images were obtained by a T2*-weighted using a 3T MRI scanner (Siemens Magnetom Verio) and further processed using SPM12. The image acquisition parameters were as follows: 65 slices, TR=2200 ms, TE=25 ms, voxel size=2x2x2 mm, FA=90°, MB 5 (CMRR). The fMRI data were acquired during 3 experimental conditions: presentation of Russian-language names for 10 basic colors (“Color” domain), 10 basic emotions (“Emotions” domain) and the combined 10 colors + 10 emotions. Stimuli were presented successively in quasi-random order, block paradigm was used. To activate intra- and interdomain associations, the participants were given with the task to specify the subjective semantic differences between stimuli as “strong”, “medium” or “weak” by responding with right hand using the 3-button joystick. We separately analyzed three conditions then compared the third condition (scaling of color-emotional differences) to the first and second conditions together (contrast: -1 -1 2). This way we have identified the brain areas specifically involved in interdomain task vs intradomain tasks and highlight brain structures related to semantic color-emotional integration. Results. We found activation in left middle frontal gyrus, left precentral gyrus, and bilaterally in superior parietal lobule, angular gyrus, supplementary motor cortex similar in all three experimental conditions, all greater in left hemisphere (FWE p<0.05). This activation corresponds to processes of perception, working memory, semantic and motor execution. For interdomain comparison contrasted to combined intradomain 1+2 conditions we found specific greater activation in following groups of structures, see Figure: (1) precuneus, (2) angular gyrus, supramarginal gyrus and middle temporal gyrus, (3) anterior cingulate gyrus and ventromedial segment of superior frontal gyrus (all bilaterally but more pronounced in right hemisphere),...
uncorrected p<0.001. Aforementioned activation closely resembles classical core functional hubs of Default mode network (DMN). Primary involvement of DMN in process of interdomain comparison is related to complex cognitive functions of DMN and can be more specifically treated as part of global DMN-driven interdomain informational integration. Conclusions. Activation of default mode network is specifically related to process of semantic color-emotional interdomain integration.

![Picture 1](https://www.eventure-online.com/parthen-uploads/175/18001/add_1_445592_a0b53990-be41-482b-8d2c-988016bdd4b8.png)

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Effect of eyedness on cognitive control

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Cognitive control (CC) is one of the crucial functions in humans. Neuroimaging studies were provided mostly in right-eyed individuals; however, lateralization of CC could be related to the eyedness. The aim of this study was to reveal brain areas involved in CC tasks performance within group of participants with left-eyedness by fMRI. We focused on inhibition as one of the functions of CC.

Methods.

14 left-eyed participants performed Stroop 1, Stroop 2, Stop-signal tasks. Two Stroop tasks included the Russian words “red” and “green” written in red or green font. The subjects had to press right or left button as a response to presenting of words written in red or green font, respectively (Stroop 1). The same subjects needed to inhibit response to the word “red” and responded only to the word “green” (Stroop 2). In Stop-signal task (with vowel and consonant letters) participants had to press different keys depending on the place of appearance of the green stimuli and ignore specific verbal stimuli (red letters). The fMRI data were obtained using a 3T scanner Siemens Magnetom Verio (T2*-weighted gradient-echo EPI, 65 slices, TR=2200 ms, TE=25 ms, voxel size=2x2x2 mm, FA=90°, MB 5 (CMRR), block design) and processed using SPM12.

Results.

The activated areas were revealed (p<0.001 uncorrected) in the contrasts: Stroop 2 > Stroop 1 contrast - right precuneus; Stop-signal > Stroop 1 contrast - left occipital pole and left superior occipital gyrus; Stop-signal > Stroop 2 contrast - left occipital pole; Stroop 2 > Stop-signal contrast - left precuneus and left cuneus. Analysis for Stroop 1 > Stroop 2, Stroop 1 > Stop-signal contrasts revealed no significant difference between conditions.

Conclusions.

The results of the current study demonstrated the important role of precuneus in inhibition in individuals with left-eyedness.

The study of ethnic attitudes using psychophysiological reactions

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Traditional questionnaires and special tests for studying ethnic attitudes have certain drawbacks and limitations. One of them is due to the fact that respondent responses may reflect the desirable conscious preferences. To overcome this type of drawbacks it is necessary to develop new tests which combine technologies for presenting realistic scenes of interethnic interaction with technologies for recording involuntary behavioral and psychophysiological respondent reactions. We investigated ethnic attitudes arising while participants perceived avatar’s faces of own/other ethnic appearance with the help of \textquoteleft\textquoteleft\textquoteleft psychophysiological techniques\textquoteleft\textquoteleft\textquoteleft. We proposed that ethnic attitudes may be manifested in participant’s dynamic functional states which reflect the degree of “acceptance/rejection” of own/other race faces. We also proposed that changes in states would be accompanied by changes in psychophysiological reactions during face perception. A feature of the developed method was the combination of verbal assessments (the Bogardus questionnaire evaluating the social distance) with the psychophysiological reactions registered during face perception. The twenty two participants (10 M, 12 F, age 18-26, all positioned themselves as Russians) took part in our study. 3D models of avatar faces of Slovenian, Asian, Caucasian and Black African appearance (four faces for each ethnicity) were created using the program “MakeHuman1.0.2”. The faces were presented using the HMD technique. The procedure started with a presentation of one of the sixteen avatar faces followed by one of the three questions of the modified Bogardus scale, reflecting the social distance between the participant and the avatar. When answering a question psychophysiological reactions (the brain rhythmic activities as well as the heart rate, the galvanic skin response (GSR) and the photoplethysmogram amplitudes) were registered. Analysis using a one-way ANOVA revealed significantly higher heart rate values (p<0.05), a greater deviation of the GSR amplitudes (p<0.01) and smaller ratio of alpha/beta brain waves (p<0.05) while perceiving faces of own-race group in comparison with faces of other-race group. Also it was shown that the differences in photoplethysmogram amplitudes were insignificant (p = 0.09).
The variability of cardiorhythm and its interrelation with the ability of primary schoolchildren to navigate in the structure of the sensory flow
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Introduction. Sensorimotor integration reflects the integrative activity of the brain in performing cognitive processes and has a special role for the organization of mental activity. A high quality of sensorimotor integration manifests itself in the accuracy and the speed of the sensorimotor reaction, the latter being a quantitative parameter. The reaction accuracy is considered to be a qualitative index meaning, firstly, a small variation in the reaction time, and secondly, the correspondence of the reaction time to the place of each sensory stimulus in the stimulus flow. The functioning of sensorimotor integration is associated with the ratio of sympathetic and parasympathetic influences of the autonomic nervous system. Our hypothesis was that the high activity of the sympathetic nervous system in primary schoolchildren can be related to such objective psychophysiological characteristics as, for example, the ability to navigate in the structure of the sensory signals flow and to recognize (perhaps unconsciously) the ordering of its structure if there is any.

Methods. 82 primary schoolchildren participated in the study (the mean age was 9.1 ± 0.5 years), among them 39 girls and 43 boys. The variability of the cardiorhythm was estimated by Omega-M diagnostic complex which allows statistical processing of human heart rate variability in a wide frequency band with the electrodes attached to both wrists. The evaluation of both simple and complex sensorimotor reaction parameters was done using the ReBos technique (Vergunov, Nikolaeva, 2014).

Results. It was found that the children with the dominating sympathetic influence demonstrate a significant tension of regulatory mechanisms when describing an emotional situation. Those children who were able to recognize the structure of the sensory flow from the very beginning of a series of simple sensorimotor reactions made fewer mistakes than the children of the other group, and the quality of their performance did not change throughout the series. We found significant differences in the reaction time of both simple and complex sensorimotor reactions in the first and the second part of the series in all groups.

Conclusions. The speed of the sensorimotor reaction is gender-related. Higher levels of the activity of the sympathetic nervous system in the process of describing the emotional situation correspond to the higher ability to recognize sensorimotor stimuli, that is, the more distinguished an ability to mobilize in a complex situation is, the more accurately the child can predict sensory stimuli.

The work was supported by RFFI grant number https://kias.rfbr.ru/index.php, https://kias.rfbr.ru/index.php.

Substantiation of Nicergoline effectiveness in treating psychophysiological disorders of vascular genesis obtained in animal experiments
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Introduction. Nicergoline is a semisynthetic ergot alkaloid, widely used for correction of clinically significant various psychophysiological disorders. Its vasodilatory, antiagregant, metabolic effects, improving cerebral blood circulation, memory, cortical neurons’ distress tolerance are well-known. Nicergoline is used for correcting cognitive, somatic and psychophysiological behavioral disorders.

On the other hand, an adequate blood flow to body tissues becomes possible due to activities of vascular reflexogenic zones (E. Cyon, K. Ludwig, 1866; C. Heymans, D. Cordier, 1940; V.N. Chernigovsky, 1947; S.V. Kupriyanov, 1994 etc.). In particular, the role of vascular reflexogenic zones chemoreceptors in reflex regulation of blood circulation when they are acted on by not only endogenous (CO2, O2, pH), but exogenous substances as well is significant (C. Heymans, J. Bouckaert, 1930; V.N. Chernigovsky, 1960; S.V. Kupriyanov, 2007 etc).

Methods. We investigated the role of vertebral arteries zone (VAZ) chemoreceptors in blood supply regulation in the internal ear and the brain during their stimulation with Nicergoline which is applied in treating cerebral circulation disturbances. Our experiments were conducted on 24 adult cats under general anesthesia. Hemodynamics in the ear labyrinth was studied by Beutog method (1954) with using biomicroscopy of cochlear window vessels and cerebral hemodynamics by bulbar conjunctiva vital biomicroscopy before and after stimulation of hemodynamically isolated VAZ with therapeutic Nicergoline doses. Extravasal, valsal and invasal status of microvessels was estimated according to the classification of V.F. Bogoyavlensky (1969) in S.V. Volkov modification (1976). All the experiments were conducted with regard to ethical norms of the Guide for the care and use of laboratory animals. Differences in continuous variables between
cases and controls were analyzed using the unpaired Student's *t*-test.

**Results.** Stimulation of chemoreceptors in a hemodynamically isolated VAZ with Nicergoline caused improvement in microcirculation in the inner ear and the brain: increase of the arteriovenular coefficient by 16.98% and 16.36% respectively, dilatation of arterioles and venules, increase in the number of functioning capillaries and visual acceleration of bloodflow in them. These changes were not reproduced after Novocain introduction into VAZ, which is indicative of a reflex nature of observed microcirculation reactions.

**Conclusion.** The above-stated gives the opportunity to recommend Nicergoline for correcting various psychophysiologic disorders, associated with cerebral insufficiency.

### 15

**The connection of lateral preferences with the specificity of cardiac rhythm variability in children**

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It is known that in adults the intensity of emotional reactions is associated with the nature of lateral preferences. It is shown that the increase in the number of left signs in the sensory and motor spheres correlates with the intensity of emotional reactions in various tests (Leutin, Nikolaeva, 2008). The evidence has been obtained that the difference in emotional reactions in people with different profiles results in a significant difference in the effectiveness of adaptive processes (Nikolaeva et al. , 1995) and the incidence of cardiovascular disease and neurotic disorders (Nikolaeva et al., 1993).

At the same time, the data on the peculiarities of emotional response of children and its connection with lateral features is not enough to make unambiguous conclusions. According to the hypothesis explaining this difference in cardiovascular reactions to stress, people with the left profile have two centers of vegetative regulation-in the right and left hemispheres, whereas people with the right profile have only one center located in the right hemisphere. In this case, under the stress or in the process of adaptation, the activated right hemisphere produces an additional load on the right hemispheric center of vegetative regulation, which leads to a greater probability of cardiac disorders (Goldberg, 2003).

The assessment of the lateral preferences was carried out using a set of tests, the most common in the literature (Leutin, Nikolaeva, 2011). For the evaluation of cardiac rhythm variability the hardware and software complex "OMEGA-M" were used. The study took place in three stages, during each of them 300 R-R intervals were recorded. In the first stage there was a record of 300 R-R intervals at rest in the background, at the second stage the records were done during recalling about rewards by children, and the third one during recalling about punishments in families.

20% children in our sample were left handers. In the transition from a state of rest to a state of emotional situations in families the activity of the sympathetic part of the autonomic nervous system increased. These reactions were different in right handers and left handers. Heart rate changes of left-handed children are within their adaptation resources, heart rate variability of right-handed children was beyond their adaptation resources and the distribution of R-R intervals shown multimodal structure. The study is founded by Russian Foundation of Fundamental Research, project #18-013-00721

### 16

**Deception detection by means of eye-tracking in the concealed information test**

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In the current study we assessed perspective of eye-tracking technic for revealing concealed information. Healthy adult participants (N=28) were randomly divided into two groups: "guilty" group and "innocent" group. We devised a mock crime scenario: 3 high-priced objects were hidden in the experimental room and each participant from the "guilty" group made a mock crime by "stealing" one of them. The other group didn't take part in any activities related with the crime.

Eye tracking recording was performed in both groups. Six stimuli contained written questions related with the crime and according to the standard polygraph guilty knowledge test were exposed to the participants.

We found statistically significant differences in fixation duration and fixation dispersion between the two groups: "innocent" participants were looking at the distractors more frequently and their fixations were more distributed. At the same time "guilty" participants had fixations in the areas which were related with the object of crime and/or had more fixations in the blank areas. Saccade velocity was higher and saccade amplitude was smaller in the "guilty" group. Their gaze was moving at smaller distances within saccades and did it significantly faster than in the "innocent" group.

The proposed paradigm helped to successfully reveal concealed information about a fake crime. We suggest that additional tests are needed to make broader conclusions about its applications in real life situations.

### 17

**Is the emotional impression affected by the chromatic stylization in dynamic advertisements?**

N.V. Pavlova, Y.G. Pavlov
Executive Functions as the Factor of Cognitive Efficiency in Elderly Patients with Essential Arterial Hypertension

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Introduction

Wide range of the techniques, aiming to influence the perception of the consumers, has a special impact in the dynamic advertisements, which allow to strengthen the effect accumulated in time. Discoloration is one of the frequently used methods, improving the products promotion efficiency, but mostly in static advertisements. The goal of the study was to assess the effect of chromatic (in color) and in achromatic (in black and white) video advertisements on the psychophysiological state of the participants, in particular, emotional reactions.

Methods

The participants were sixteen adults (8 males). Four videos, advertising perfumery products were presented to the sixteen participants (8 males), university students, in two versions: stylized (achromatic) and not stylized (chromatic) advertisements were counterbalanced in two groups. In this way, for the first group stimuli number 1 & 3 were achromatic, 2 & 4 - in chromatic version. The second group has seen the same videos, but in conversely versions. The electrical brain activity (EEG data), skin conductance responses (SCR), heart rate and pulse wave amplitude (photoplethysmogram) were recorded synchronously. The subjective reports, evaluating advertisements, were measured by questionnaire.

Results

The ANOVA RM analysis revealed significant main effect of number of video for the scale “general impression”, as well as for the theta power in frontal electrode sight (F3) and alpha power in parietal (P4). Whereas, between-groups significant differences were not find. At the same time, subjective values of the stimuli and psychophysiological parameters depended on the videos’ content and sex of the participants. Thus, women in common evaluated all the videos more positively and had significantly higher overall EEG power values during the presentation. Changes in SCR amplitude were influenced by the target audience (gender) of advertisements.

Conclusions

The results obtained in the study demonstrate, that chromaticity of the dynamic advertisement has no effect neither on the subjective evaluations nor on physiological indicators of emotions. Although the content has impact on the subjective evaluations and psychophysiological reactions, as well as displays gender differences.

Attention tests proved apparently unstable concentration and rapid exhaustion of attention for most patients. Before the treatment impaired attention was revealed by 69% of patients, re-examination displayed 60% of patients. Most of EAH patients (80% before the treatment and 51% after the therapy) would display disturbances in programming, regulation, and control of thinking. This manifests itself in disturbances of strategic decision making in problem solving, and in the impulsive character of most answers. Obtained data bring forward the evidence of dysfunction of frontal lobes, according to the interpretation in the framework of neuropsychological syndrome analysis (Luria, 1980).

The correlation analysis data display a significant interconnection in frequency between multilevel diversity of thinking phenomena and impulsive answers, both before (r=0.652, p<0.001) and after the course of therapy (r=0.512, p<0.01). This indicates a particular relevance of the neuropsychological factor known as voluntary regulation of mental activity.

Neuropsychology studies reveal that EAH patients exhibits malfunctions in programming and control, inadequacy in simultaneous syntheses, a lowering of the level of generalization in accomplishment of various tasks, – videlicet, the disturbances of executive functions. These symptoms are described in classical neuropsychology for dysfunction of the frontal lobes (Luria, 1980; Korsakova, Varako, 2005; Zinchenko, Pervichko, Ostroumova, 2013). The research was supported by RFBR; project 17-06-00954.
Autonomic-system representation of emotion associated with listening to short musical fragments
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Introduction. It is known that listening to music can influence the functions of autonomic nervous system. In this pilot study, we measured the dynamics of the heart rate variability (HRV) in response to short musical fragments of different emotional contents.

Methods. Eight volunteer students (6 women and 2 men, average age 24 ± 4.09 years) took part in this study. The participants were asked to listen to 12 musical fragments, each fragment 3-min long. There were two main categories of the musical fragments: “happy” (with the predominance of the major mode) and “sad” (with the predominance of the minor mode). The participants were asked to indicate their emotional responses to music in points of intensity (from 1 to 7) for 11 emotions: sadness, anger, disgust, arrogance, fear, anxiety, surprise, amazement, joy, pleasure, and relief. The investigation used the technology of event-related telemetry of heart rhythm. Episodes of acute stress were detected by the dynamics of HRV.

Results. Based on the spectral analysis of heart rate variability (HRV), a vegetative-system mapping of the musical fragments was constructed in the space of the following parameters: the total power of the HRV spectrum, LF (0.04-0.15 Hz), HF (0.15-0.4 Hz), LF/HF (the index of vegetative balance), the frequency of stress episodes. A strong positive correlation (0.87) of responses was found within the module of positive emotions (relief, pleasure, joy and amazement) and within the module of negative emotions (malice, disgust, arrogance, fear, anxiety). There was a strong negative correlation (-0.84) between these modules. Moreover, the emotions “sorrow” and “surprise” formed separate independent components of the map of emotions. We found that the strength of the negative component on the map of emotions was related by the logarithmic dependence to the strength of the positive component. It was found that the valence of the emotion was represented by the density of short-lived stress episodes experienced during listening to music fragments; the negative emotions were associated with the greater density of the stress episodes.

Conclusions. The results revealed significant correlations between the estimates of individual emotions and individual indices of vegetative regulation: an increase in “malice” was positively associated with the growth of adaptive potential; “surprise” was associated with a decrease in the vegetative maintenance (HF) of cognitive control; and the intensity of “joy” and “pleasure” was associated with a decrease in RR-intervals. Supported by grants from RFBR 16-06-00133, 18-013-01225.

Efficacy of EEG Biofeedback Procedures in Correcting Attention Deficit Hyperactivity Disorder in children
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Introduction

Attention deficit hyperactivity disorder (ADHD) is affecting about 5% of children worldwide. The alternative to medical treatment, which induces adverse reaction in over 20% of cases, is the method of EEG biofeedback (EEGBF). There are two most substantiated EEGBF training protocols for children with ADHD: 1 - increases beta activity (16–20Hz) while suppressing theta activity (4–8Hz); 2 - suppresses theta activity and simultaneously increases sensorimotor rhythm (SMR; 12–14Hz).

Methods

In this study, a double biofeedback from patients’ EEGs was used. The first loop was the auditory feedback stimuli from the EEG (4–8Hz). Sound was delivered via headphones (sound intensity 0-40dB; frequency100-2000Hz), and served as a reference for the conscious manipulation of the EEG by the patient. The second feedback loop was the rhythmic light stimulation using lightemitting diode eyeglasses (under 100µW). Its parameters were automatically modulated by the narrowband component of the EEG α-SMR rhythm (8–14Hz) for the patient in order to activate it in resonance. The volunteers were instructed to try to decrease the sound intensity while paying no attention to light stimulation.

Results

A total of 23 subjects between 11 to 12 years of age participated in the study: 11 children with ADHD and 12 healthy children. EEG at rest was recorded for 5 minutes before and after stimulation. A two-loop feedback stimulation was recorded for 10 minutes. The Mann Whitney U test and the Wilcoxon signed-rank test were used for analysis. The power levels of the β rhythm in children with ADHD is significantly higher (p < 0.00006). The total power in the α range in healthy children is significantly higher (p = 0.02). The power of α rhythm significantly increased after the stimulation in both groups (p = 0.01). When comparing the power in theta and alpha range in healthy children before the stimulation, and in ADHD group after the procedure, there is no significant difference in the alpha range, which indicates the shift in this index in children with ADHD to the normal value. The absence of significant differences in theta rhythm in both groups before and after the
THE DEFEICIENCIES IN FILTERING OF THE INFORMATION AT EARLY LEVELS OF PERCEPTION DETERMINE COGNITIVE IMPAIRMENTS IN SCHIZOPHRENIA

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INTRODUCTION. The cognition functions and the spatial-frequency characteristics of the visual system were studied in mentally healthy persons and in patients with therapeutic resistance schizophrenia. It has been shown repeatedly that in schizophrenia there is a mismatch between the way magnocellular and parvocellular system work. The purpose of this study is to determine the relationship between cognitive impairment and the functional state of the magno- and parvocellular neuronal systems in patients with therapeutic resistance. Our research hypothesis is that - deficiencies in information filtering at early levels of perception determine cognitive impairments. The magnocellular system is more sensitive to the low spatial frequencies, and involved in processing of information on the global organization of a stimulus. The parvocellular system, in turn, is more sensitive to the high spatial frequencies and responsible for description of fine details of the object.

METHODS. We used a test of visual contrastometry. We measured the thresholds of contrast sensitivity in spatial frequencies of 0.4, 3.6 and 17.8 cycles/degree. Neuropsychological research was conducted using the methods of Verbal association test, Complex figure, Auditory memory test, Attention test. The patients participated in our study were diagnosed of paranoid schizophrenia with therapeutic resistance.

RESULTS. A significant correlation of the detected disturbances with the activity of the magnocellular system responsible for the global analysis of the information was established. An inverse correlation with contrast sensitivity in the low spatial frequencies indicates that the higher the activity of the magnocellular system is, the more pronounced, are the violations on cognitive control and selectivity of attention. The dysfunction in visual motor coordination is correlated with the decreasing contrast sensitivity on the low spatial frequency. The volume of short-term memory is in direct correlation with the contrast susceptibility in range of low spatial frequencies. Sustainability of memorizing is connected with the parvocellular system which is responsible for objective vision, while the ability to switch is inversely proportional to the activity of the magnocellular system. Insufficiency of cognitive control correlates with sensibility in the range of low frequency, which are processed by the magnocellular system. Sustainability of attention is connected with activity of parvocellular system, which is responsible for fixation on small parts of objects.

CONCLUSIONS. The deficiencies in information filtering at early levels of perception correlates with cognitive impairments.
alpha-rhythm with its domination in the frontal lobes, synchronization of alpha-activity with an outburst of slow waves in frontal parts, alpha-rhythm inverse frequency gradient, paroxysmal activity (p<0.05). The spectral analysis of NLD patients revealed rise in power of delta-activity (p<0.05), which may indicate the presence of more severe structural and functional disorders.

Conclusions. The obtained psychophysiological characteristics may determine a stronger affective intensity of ND clinical manifestations and a relatively emotional monotony of NLD manifestations. These results are important for improving diagnosis and can be widely used in clinical practice.

Towards psychophysiological mechanisms of major and minor chords perception

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In our previous works it was found that attenuation pattern of a signal (amplitude envelope) plays significant role in perception of isolated major and minor chords. Four types of modified chords – without attenuation, linear attenuation, MIDI-generated, and real (piano, professionals) were administered to two groups of subjects - non musicians (N=28) and professional musicians (N=14). Both groups estimated stimuli by 35 subjective unipolar scales. They also performed psychological testing: red-black tables, tapping and Spilberger’s state anxiety. Non-musicians were mostly unable to identify chords other than real, while professionals could do it successfully. Factor analysis was performed on the subjective evaluations results. Factor structure (50% explained variance) of non-musician’s responses consists of three factors: 1) general demand for resources to cope with sound (pleasant, relaxing, positive, vs. muffle it, straining, hard, - 30%), 2) activation, cheering up (energetic, cheer, confident vs. dull – 14%), and 3) minor ( help it, asking, minor vs. tout – 6%). Factor structure of the professional’s results (55%) has three factors: 1) major-minor (Major, optimistic, merry vs. minor, sad, cold – 36%, 2) demand for resources (pleasant, kind, relaxing vs. muffle it, straining, hard, evil – 11%) 3) affiliative activation by minor (help it, something will happen, asking, vs. major, old, dull – 8%). In both groups subjectively identified minor was connected to scales “help it”, “asking”. Assuming that major and minor refer to relative position of the third stage of a chord (not at the fixed frequencies) it may be supposed that while perceiving of a chord perception of its third stage works as a certain switch indicating either some kind of an opposition of larynx and head resonators to thorax resonator (minor), or their joint action (major). Real sounds were much shorter than all of the generated with necessary information being conveyed in some 200 ms. Basing on this observation existence of two processes in estimation of resources those are needed to cope with sound may be stated: 1) task related – that refers to the whole piece perception and 2) state related - that refers to estimation of a current state of resources available and needed. In non-musicians group the third factor refers to state estimations, its’ factor scores had more correlations with the results of psychological testing than those of the other factors, they correlated negatively with the results of both tapping and red-black tables.

Positive ERP components as markers of saccadic programming and inhibition. Slavutskaya M.V.1,2, Karelin S.A.1, Shulgovsky V.V.1 Lomonosov Moscow State University, Russia 1; National Mental Health Research Centre, Moscow, Russia2; mvslav@yandex.ru

Positive ERP components as markers of saccadic programming and inhibition. Slavutskaya M.V.1,2, Karelin S.A.1, Shulgovsky V.V.1 Lomonosov Moscow State University, Russia 1; National Mental Health Research Centre, Moscow, Russia2; mvslav@yandex.ru

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Saccadic eye movements as a simple motor act is informative model for studying neurophysiological mechanisms of executive control, including attention, decision-making and inhibition processes. In order to study EEG correlates of cognitive control of saccadic preparation and inhibition the “Go / no go” paradigm was used. The parameters and topography of P1, P2 and P3 ERP components were shown to depend on the stimuli signal meaning and saccadic latency (LP). All subjects were divided into two groups: “slow” subjects with LP=277 ± 11ms and “fast” subjects with LP=193 ± 10ms.
The Go-P2 component in “fast” group and the Go-P3 component in “slow” one, coinciding with the saccade onset and spike potential, may reflect the processes of initiation and backward afferentation.

Our data allow us to suggest that Go-P1 in “fast” group and Go-P2 in “slow” one may be a markers of decision-making stage of saccade programming. They located in the 120-60 ms interval before the saccade onset and coincided with premotor component P – (minus) 100, which is associated with motor preparing and decision making. The parameters and topography of Go-P1 in “fast” group and Go-P2 in “slow” one indicate the inclusion of attention at the stage of decision-making. The Go-P100 in “slow” subjects may reflect the stage of stimulus analysis and evaluation, preceding the decision-making. The Go-P3 in “fast” group may reflect the processes of behavior monitoring and information transfer into working memory.

Regardless of subject groups Nogo-P2 amplitude was increased compared with Nogo-P1. We supposed that Nogo-P2 also reflects the decision-making stage. The meaning of decision (Go or No go) may be reflected in opposit patterns of the space-time dynamics of its focuses along the fronto-parietal networks of saccadic control: “top-down” in “Go” conditions and “bottom-up” in “No go” conditions.

The Nogo-P100 may reflect the stage of analysis and evaluation inhibitory stimulus. The focuses of Nogo-P3 prevailed in the front-central zones in “fast” subjects and in the parieto-occipital zones in “slow” subjects, which may reflect a greater level of the prefrontal cortex activation necessary for monitoring behavior and translating information into working memory. The obtained data suggest various mechanisms of cognitive regulation in the preparation and inhibition of saccadic
Responses in “fast” and “slow” subjects, which are associated with different levels of cortex activation and spatial organization of the fronto-parietal networks of attention, inhibition and saccadic control. The study was supported by the RFBR (projects 16-04-01079).

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Characteristics of psychological and physiological responses while anger experiencing in individuals with depression

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Introduction: A close relationship between anger and depression has been demonstrated by previous studies. That is, depressed people tend to experience anger more yet they express less by suppressing when compared to normal people. Anger suppression activates the sympathetic nervous system that result in larger physiological responses leading to somatization symptoms. The aim of the study is to investigate psychological and physiological responses induced by anger stimuli among individuals with depression.

Methods: Participants were divided into two groups, depression and control groups, by depression scale of the Korean version of revised Beck Depression Inventory (BDI). Thirty depressed females (experimental group) and thirty normal females (control group) participated in the study. Electrocardiogram (ECG), electrodermal activity (EDA), and photoplethysmogram (PPG) were measured while participants watched the anger film clip. Participants rated their psychological variables of experiencing emotion on the emotion assessment scale (intensity, valence, arousal, approach, and coping ability). Heart rate (HR), low frequency (LF), high frequency (HF), LF/HF ratio, pulse transit time (PTT) and skin conductance response (SCR) were also measured before and after the stimulus presentation.

Results: There were no significant differences in psychological responses between the two groups but in coping ability. Depression group, when compared with the control group, reported being unable to cope with anger caused by the anger stimulus. Depression group showed significantly decreased HR, reduced HRV, shortened PTT and increased SCR, which indicates that the depressed have much more sympathetic activation through the α-adrenergic pathway with vasoconstrictive and cholinergic effects in responses to anger stimulus. Although the study outcome differs from those of the previous studies, i.e., increased HR, and pulse transit time (PTT), this discrepancy can be explained with participants’ perceived threats by the clip with the scenes that the character in the clip was being assaulted as supported by other studies reporting decreased HR and increased vasoconstriction by threatening stimuli or decreased HR and increased SCR.

Conclusions: We suggest that the psychological and physiological responses can be used as objective indicators for anger emotion in individuals with depression (supported by the Korea Basic Science Institute, T37800; Correspondence: Jin-Hun Sohn, jhsohn@cnu.ac.kr).

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Incremental recall across trials for controls and temporal lobe epilepsy (TLE) patients.

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Introduction

Remembering is a widespread hindrance in temporal lobe epilepsy (TLE) patients. We appraised their memory through free-recall of emotional and neutral pictures across three trials, assessing a TLE experimental group (<i>EG</i>) and a matched control group (<i>CG</i>). We predict: (i) Higher recall for emotional than for neutral pictures across groups. (ii) Incremental recall over trials. (i)iii Better recall for emotional than for neutral pictures across groups.

Method

Design

Mixed factorial 2 × 3 × 3 (Group: patients or controls) varied between-participant. Stimuli (positive, negative, and neutral) and Recall Trials (<i>R</i>₁–<i>R</i>₃) varied within–participant.

Participants

Ten adult patients of Mexico’s National Institute of Neurology & Neurosurgery diagnosed by an examiner as having TLE, and no other medical or psychiatric conditions, comprised the <i>EG</i>. Another ten adults, matched for laterality, age, gender, and years of education, and without any known neurological condition, constituted the control group (<i>CG</i>). We also matched both groups on Teng’s Cognitive Abilities Screening Instrument, and Beck’s Depression and Anxiety Inventories.

Materials

Forty-five colour pictures (IAPS, International Affective Picture System), 2008. Emotional valence: 15 positive, 15 negative, and 15 neutral, with equivalent arousal values.

Procedure

We tested participants individually; they studied the pictures sequentially. We unsystematically mixed the pictures by valence, and presented them in the same order to both groups, 10 sec/picture. Verbal free-recall trials lasted 5 min each, with two 5 min inter-trial intervals.
Within-group ANOVAs show incremental CG recall across trials, F(2, 8) = 13.75, p < .003, η² = .98. More importantly, recall also increased significantly in the EG, F(2, 8) = 6.97, p < .018, η² = .64. A 2 x 3 x 3 mixed ANOVA indicates three highly significant main effects: Group, F(1, 18) = 8.74, p = .008, η² = .33; CG > EG; Trials, F(2, 17) = 18.56, p < .00005, η² = .69; R1 < R2 < R3, Stimuli, F(2, 17) = 38.05, p < .00005, η² = .82; emotional recall surpassed neutral recall. Additionally, negative recall exceeded positive recall. No other results approached significance.

Conclusion

We substantiated our three predictions. More importantly, we also report hypermnesia#_ftnref1 recall for TLE participants for the first time, suggesting that although lessened by their condition—their incremental retrieval mechanisms are still operational.

#_ftnref1 We use hypermnesia in the experimental sense of incremental memory across trials or conditions, not in the clinical sense of uncontrollable or recurring thoughts.

Using Resting State Intrinsic Network Connectivity to Identify Suicide Risk in Mood Disorders

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Importance: Little is known about the neural substrates of suicide risk in mood disorders. Improving the identification of biomarkers of suicide risk in mood disorders could lead to more targeted treatments to reduce risk. The aim of this study was to use intrinsic network connectivity to identify individuals at risk for suicide, as indicated by a history of suicide-related behavior (SB).

Method: A cross-sectional study was conducted at two urban communities with medical centers. Resting-state functional connectivity was examined within intrinsic networks, including cognitive control network (CCN), salience and emotional network (SEN), and default mode network (DMN). Participants (Mage = 21.88, SD = 2.70; 67% female) were 112 individuals with a mood disorder with no history of suicide-related behavior (NSB), 18 young adults with a mood disorder who had a history of SB (as indicated by endorsing a past suicide attempt), and 82 healthy comparison participants (HC). Strength of resting-state connectivity of intrinsic networks was compared between SB, NSB, and HC groups.

Results: Several regions (k = 57, p < .005) were identified in the three networks in connectivity to fronto-parietal regions, including right middle and inferior frontal gyrus and inferior parietal lobe, that were significantly different in SB relative to NSB and HC groups for both within-network connectivity (in the CCN) and cross-network connectivity (DMN-CCN and DMN-SEN).

Conclusions: These results suggest that individuals with a history of SB may show distinct patterns of intrinsic network connectivity, even when compared to those with mood disorders and no history of SB. Resting-state fMRI may serve as a promising tool for identifying mood disorder patients at risk for suicidal behavior.

Picture 1: https://www.eventure-online.com/parthen-uploads/175/18001/add_1_432318_3110899e-2417-40ab-876a-e9c588a59.png

Differential Impact of an Error Detection Mechanism in Brain Activity Related to Verbal Creativity

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Introduction. Creativity can be generally considered as an ability to generate new, original ideas, to deviate in thinking from stereotypes and traditional schemes. Creative activity is non-standard one and how it is controlled by brain action monitoring system such as an error detection mechanism (Bechtereva&Gretchen, 1968) which controls the correct performance of stereotypical everyday routine, remains under investigated. Theoretically error detection might improve creative activity by enhancing the process of selection creative variant of acting or impede it by preventing going beyond behavioral stereotype. To check these possibilities we conducted fMRI study utilizing the verbal creativity paradigm with control and creative conditions which additionally varied in in terms of subject tasks. Participants completed the sentences by selecting either creative/non-creative variant from the presented list of candidate words (Choice) or by producing overtly their own variants (Improvisation).

Methods. There were 19 healthy, right-handed subjects who participated in fMRI study. Behavioral data was statistically analyzed using Nonparametric Wilcoxon match pairs test. Functional MRI data were acquired by 3T Philips Achieva and were
statistically analyzed using SPM12. Additionally, generalized psychophysiological interactions analysis (gPPI) was performed for the brain areas demonstrated significant changes in the BOLD-signal.

Results.
As a result all conditions with creative task were characterized by greater activity in the inferior frontal gyrus bilaterally, left middle frontal, angular supramarginal gyri and middle temporal cortex. Functional activity of anterior cingulate cortex (ACC) and inferior frontal gyri was stronger for creative “improvisation” condition, which can be considered as a proof for the idea about improving role of action monitoring system (aka error detection). For further checking of this hypothesis we performed the gPPI analysis for the ACC as region of interest. Surprisingly the differential functional integration of the ACC was revealed for the creative conditions as compared with control ones. The increase of connectivity was detected only for the middle frontal gyrus (bilateral BA 10). In contrast supplementary motor areas bilaterally, right inferior frontal and angular gyri were greater integrated with ACC for the control conditions.

Conclusions.
From this it can follows that: 1) controlling influence of an error detection mechanism over brain regions associated with executive brain functions increases for the non-creative tasks; 2) monitoring system facilitates the activity of brain regions associated with representation of abstract task rules and behavioral goals, which probably improves the finding of creative solution. Both hypothesis deserve further investigation.

Supported by the Russian Science Foundation grant #16-18-00040

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The study of early stages of information processing in male violent offenders with schizophrenia. Z.I. Storozheva, A.V. Kirenskaya, V.J. Novototsky-Vlasov, V.K. Bochkarev, A.A. Tkachenko Serbsky National Research Centre for Social and Forensic Psychiatry, Moscow, Russia

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Violent behavior has a strong association with schizophrenia. The similarity of brain dysfunction in schizophrenia and violence was notified. The automatic information processing abnormalities were also found in association with schizophrenia and aggressive behavior. However, only single investigations have been provided. The aim of this study was to compare the prepulse inhibition (PPI) of the acoustic startle response (ASR) and P50 evoked potential suppression between violent and non-violent schizophrenic patients and healthy controls.

Participants were 171 right-handed males aged 21-53 years. The main group included 62 schizophrenic patients with violent behavior (committed homicides), the comparison group -53 non-violent patients, and the control group - 56 healthy participants. The neurophysiological testing was carried out according to recommendations of Consortium on the genetics of schizophrenia (COGS). Patients’ current symptomatology was assessed with Positive and Negative Symptom Scale (PANSS).

The comparison of clinical symptoms revealed that O14 scale (impulsivity) was higher in violent patients compared to non-violent ones (3,03±0,27 vs. 1,82±0,30, p=0,019). Decreased (relative to controls) PPI rate from the right eye at 60 ms lead interval was observed in both groups of patients (p<0,05) but PPI reduction from the left eye (p<0,05) was found in violent patients only. Non-violent patients displayed longer baseline ASR latency and diminished ASR habituation level compared to controls. Analysis of correlations between ASR measures and PANSS scores revealed positive correlations between high rate of ASR habituation and Suspiciousness (P6, r=0,37, p=0,0008) and Hostility (P7, r=0,42, p=0,0001) scales in the group of violent patients; the negative correlation between ASR latency and O14 scale (r=-0,55, p=0,027) was found in non-violent patients group.

The sensory gating deficit estimated by P50 suppression was found in both patient groups (p<0,01) compared to healthy subjects. But the increase of amplitude of P50 response to the second (testing) stimulus was found in violent group only compared to controls (p<0,05). Non-violent patients displayed the P50 latency facilitation that manifested as decrease in P50 latency in response to the testing stimulus compared to the conditioning one, and these differences were significant (p<0,01) when compared with both the group of violent patients and healthy controls.

The current study revealed the specific disturbances in the early stages of attention and information processing related to the mechanisms of aggressive behavior. The revealed differences between violent and non-violent patients may be used to identify the risk of schizophrenia. Supported by Russian Foundation for Basic Research (grant 16-06-00117).

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Experience differentiation from individual to joint appetitive operant task in female rats.
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</b>Introduction</b>
Social cooperation of subjects is a complex phenomenon which has many aspects. One of them is mutual adjustment of subjects’ behavior. This aspect is the basic one because it appears to be important even if a mutual benefit of joint actions is
absent. In this study we addressed the issues of how animal behavior is adjusted in a condition of joint appetitive session, and which neuronal groups are involved into such adaptation.

Methods
We trained animals (female Wistar rats) an appetitive operant task of lever pressing for two weeks in the experimental cage with one lever and one food-cup. For at least five days animals had to perform this task individually at the level of a plateau. The last session (30 minutes long) was to perform the same behavior, but in a condition, when a home-cage-mate rat (rats were housed in pairs) was also present in the same experimental cage at the same time trying to perform the same behavior. We evaluated peculiarities of their behavioral adjustments by tracking animals’ behavior. Neuronal group involvement was assessed by the means of immunohistochemical Fos protein mapping (transcription factor, which specifically marks neurons involved into learning).

Results
No conflicts were detected during the joint session. In most cases if one rat pressed the lever, the other rat got the reward. Their roles were frequently switched. From the very beginning of the joint session intensity of rats’ rears was greatest and significantly reduced from 10.3 (the first five minutes) to 1.3 (during the last five minutes) on average. There were pairs of rats performed the nearly equal number of lever presses, in other pairs one rat pressed the lever more frequently than the other. After the joint session the increased numbers of Fos positive neurons were found in the cingulate cortex, the prelimbic cortex and the retrosplenial cortex, but not in the nucleus accumbens of the rat brain. Intermediate level of Fos induction was found in the basolateral amygdala, central amygdala and the medial amygdala.

Conclusions
We found that rats adjusted their behavior into new situation of joint session. In a condition when they had to compete for food and operating the same lever, they choose to cooperate. This cooperation was subserved mostly by the frontal cortical neurons.

This study was supported by RSF grant # 14-28-00229.

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THREE-STIMULUS AUDITORY ODDBALL PARADIGM WITH ENVIRONMENTAL SOUNDS
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Introduction
In three-stimulus oddball task, target stimuli elicit positive potential with a peak latency of approximately 300–600 ms (termed “P3b”), and non-target stimuli also elicit a similar component with shorter latency (termed “P3a”). Previous studies have reported that the amplitude and latency of P3a is affected by stimulus distinctiveness, stimulus context, and task difficulty. However, many studies have used low-meaning stimulus, such as geometric figures, pure tones, or white noise. Therefore, the present study employed three-stimulus auditory oddball tasks with environmental sounds, which have higher meaning than pure tones, leading to stronger features of P3a.

Methods
Fifteen student volunteers (20–24 years old) participated in this study. Three-stimulus auditory oddball paradigm was used under two conditions: (1) similar condition: “dog barking” (standard), “dog barking with pitch frequency decreased by 15 Hz” (target), and “dog pup yelping” (non-target) were used as stimuli; (2) dissimilar condition: the standard and target stimuli were identical to the similar condition, and non-target was changed to “cat meowing”. Participants were asked to respond only to the target, and performed 300 trials for each condition, comprising standard, target, and non-target trials with probabilities of .80, .10, and .10, respectively. Electroencephalogram (EEG) signals were recorded from 19 scalp locations with Ag/AgCl sintered ring electrodes. A common reference electrode was placed at the nose tip. The impedance was maintained below 10 kΩ. Horizontal and vertical electrooculogram (EOG) signals were also recorded simultaneously. The EEG signals were digitalized at 500 Hz, and filtered offline between 0.01 and 30 Hz. The peak amplitude and latency values at 250–600 ms were measured. Trials with a response error, or those in which the EOG signal exceeded ±100 µV, were rejected.

Results
There were no significant differences in error rate and response time between conditions. Amplitude and latency of P3b for target stimuli was similar between both conditions. Conversely, P3a over the frontal area was larger and longer in the similar condition than in the dissimilar condition. These findings contradict the result from a previous study in that a target-dissimilar non-target elicits a larger P3a amplitude than a target-similar non-target.

Conclusions
Since the target similarity induced semantic conflicts in similar condition (i.e., both “dog” and “dog pup” belong to the same basic-level category), the focal attention was needed to distinguish stimulus type and ignore the target-similar non-target. Therefore, semantic factor affected the difference of P3a amplitude and latency between conditions.

Picture 1: https://www.eventure-online.com/parten-uploads/175/18001/add_1_458502_66126f51-901d-4ab6-9aed-b4dd57e7f968.png

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The aim of this study was to determine the oscillatory dynamics of implicit perception of positive, negative and neutral sentences during the search of syntax errors in healthy subjects. 11 volunteers (5 men and 6 women aged from 19 to 22 years) took part in this study. In the task subjects were instructed to find syntax errors in sentences, pressing "one" if the sentence contains a mistake or "two" if the sentence does not contain a mistake, respectively. Fast and accurate responding was emphasized. Sentences were written in Russian language and had three types of expressions - negative expressions related to depression symptoms (for example, "It's difficult for me to feel joy"), positive (I have a lot of strength and energy) and neutral expressions (After the rain there are puddles). The scheme of one trial. A fixation cross appeared at the center of the screen for 500 ms. Then a sentence was presented. 1700 ms after face presentation were used as the test interval, whereas 1000 ms prior to the fixation cross presentation served as the prestimulus baseline. To assess face-evoked changes in spectral power, event-related spectral perturbations were calculated using EEGLAB toolbox (Delorme and Makeig, 2004). FDR correction for multiple comparisons was used to reveal significant effects. The perception of emotional sentences during time interval from 100 to 450 ms after the presentation was accompanied by higher theta desynchronization as compared to neutral ones. Alpha desynchronization during the time interval from 250 to 1200 ms after the presentation of emotional sentences was more pronounced as compared to neutral ones. In general, our results are consistent with the previous studies, which indicate the increase of theta rhythm after the presentation of emotional stimuli. The degree of alpha desynchronization according to Gevins et al. (1997) can reflect the number of resources involved in the task, thus the emotional content of sentences can make it more difficult to find errors. The part of study concerning the development of methods of EEG analysis was supported by the Russian Science Foundation (RSF) under Grant 17-18-01019; the study and the development experimental paradigm was funded by RFBR according to the research project 18-313-00174.

The changes of brain activity associated with postoperative cognitive dysfunction after coronary bypass surgery

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Introduction: It has been reported a high risk of brain damage and the postoperative cognitive disorders in patients with severe coronary artery disease (CAD), requiring coronary bypass grafting (CABG). Postoperative cognitive dysfunction (POCD) is characterized by a specific development and progression, associated with a loss of independence, a reduction in the quality of life, and death. Meanwhile, the characteristics of brain activity accompanying POCD are not well studied. The purpose of this study is to identify the electroencephalographic (EEG) correlates of POCD in CAD patients.

Methods: The study was performed in 85 middle aged (45-69 years) patients scheduled to elective CABG at Kemerovo Cardiology Center. Inclusion criteria were age ≥70 years, MMSE≥24, comorbidity such as chronic obstructive pulmonary disease, malignant pathology, neurological disorders and evidences of brain damage on CT. Preoperative evaluation of a cognitive and emotional state of CAD patients using the following scales: MMSE, FAB, BDI-II and STAI was performed. In addition, detailed neuropsychological examinations ("STATUS PF" battery tests) and resting-state monopolar EEG recording with closed and open eyes was made at baseline and 7-10 days after CABG. The incidence of POCD was estimated based on arbitrary criteria such as 20% decline on 20% of the tests.

Results: We showed that POCD occurred in 72% of the patients at 7-10 days after surgery. All the patients showed theta band (4-8 Hz) power increase in comparison to preoperative data, possibly indicating that ischemic brain damage associated with bypass. The EEG markers of POCD was augmented beta activity both before and after CABG. Binary regression analysis revealed that higher values of beta band power and theta/beta ratio were accompanied by high probability of POCD in patients underwent CABG.

Discussion and conclusion: The present results suggest that an increase of theta rhythms power may be considered as a sign of ischemic neuronal damage and disturbance of cortical-subcortical interactions following hypoperfusion and microemboli during CABG. An increase of beta-rhythms power as probably neurotransmitter deficits is an additional aggravating factor in patients with ischemic brain damage after CABG and together it leads to the development of POCD.

Relationships between attentional network functioning and spontaneous EEG activity in patients with coronary artery disease

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Background and aim: It is known that the patients with severe coronary disease have also cognitive disturbances,
particularly, attention disorders. The development of cognitive deficits in cardiac patients is associated with insufficiency of the cerebral blood supply and inhibition of the brain functional state. This process manifested itself as an increase of slow rhythms power in the background electroencephalogram (EEG). At the same time, the functioning of the attention networks is closely related to the oscillatory activity in the theta range. This study investigated the relationship between background theta activity and attentional networks functioning in patients with severe coronary artery disease (CAD).

Methods: We assessed the activity of the attention networks parameters: alerting, orienting and executive control of forty-one male CAD patients in the attentional network task (ANT). Resting-state EEG with eyes closed and open was recorded from 62 channels positioned according to the International 10–20 system. Spectral EEG power was calculated for frequencies from 0.1 to 50 Hz. Statistical analysis was done using Statistica 10 software package.

Results: The regression analysis revealed positive associations of alerting and the theta rhythm (4-6 Hz) power in the right fronto-central and temporo-parietal cortex regions. Negative relationships between the alerting system and the theta rhythm power in the right frontal and left occipital sites were obtained. Orienting system was positively related to the reactivity of the theta rhythm power in the left temporoparietal and right fronto-central cortex regions; a negative relationship was established for the right occipital site. The executive control correlated negatively with the reactivity of the theta power in the right frontal and left occipital areas of the cortex, positively - right fronto-central region. Inverse relationship between total theta power and the integral indicator of cognitive status, determined on the Mini-mental state examination (MMSE) scale was found.

Discussion and conclusion: Previously it has been found evidence for attention-dependent modulations of frontal theta oscillations (Friese et al., 2016). We proposed that the disorders of attentional network functioning are associated with augmented theta activity in the frontal cortex in CAD patients. The results of the study provide a basis for the application of resting-state EEG parameters for the prediction of attention disorders in patients with severe cardiovascular diseases.

Electrodermal activity - a promising tool to study emotional dysregulation and cardiovascular risk in adolescent hypertension
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Introduction: Exaggerated activity of the sympathetic nervous system plays a key role in the pathomechanisms of essential hypertension. Several studies found increased cardiovascular sympathetic stimulation in hypertensive adolescents, however, there is lack of knowledge about the changes of central sympathetic regulation in hypertensive children. Recently, elevated blood pressure was found to be associated with mood disorders in adult population. Therefore, we aimed to study potential relationships between impaired mood and sympathetic regulation in hypertensive adolescents using electrodermal activity (EDA), which represents a noninvasive index of central cortical and subcortical sympathetic regulation and reflects the effects of various psychophysiological processes.

Methods: Studied population included 40 adolescent boys aged 13-16 years with excluded effect under/overweight. EDA was continuously recorded using ProComp Infinity (Thought Technology Ltd., Canada) during 5 minutes of supine rest. Depressive mood was assessed using Children’s Depression Inventory (CDI). Afterwards, participants were divided into four groups: normotensives with normal mood (CDI: 2.9±0.6, n=10), normotensives with impaired mood (CDI: 12.0±0.5, n=10), hypertensives with normal mood (CDI: 3.3±0.6, n=10), hypertensives with impaired mood (CDI: 12.0±0.6, n=10).

Results: Normotensive adolescents with impaired mood had significantly lower sympathetic activity assessed using EDA compared to normotensive adolescents with normal mood (p<0.05). EDA in hypertensive adolescents with normal mood was significantly higher compared to normotensives with normal mood (p<0.05). EDA in hypertensives with impaired mood was significantly lower compared to hypertensives as well as normotensives with normal mood (p<0.001, p<0.05).

Conclusions: We found increased sympathetic activity assessed with EDA in hypertensive adolescents compared to their healthy peers. Impaired mood significantly reduced sympathetic over-activation in adolescent hypertension, and thus masked the effects of autonomic dysregulation, which is considered to be an important risk factor for later cardiovascular complications. With respect to recently found increased prevalence of depressive symptoms in patients with hypertension, attention should be paid to potential effects of impaired mood on autonomic regulatory processes in the evaluation of cardiovascular risk in adolescent hypertension.

Acknowledgements: This publication is the result of the project implementation “Biomedical Center Martin” ITMS code: 2622020187, supported by the Operational Programme Research and Innovation funded by the ERDF, and was supported by Grant VEGA 1/0044/18.
Sleep spindles are phasic bursts of thalamocortical activity, typically defined as 11–16 Hz (in sigma frequency band) with a duration 0.5 and 2 seconds. Spindles are most prominent during N2 sleep and are a defining feature of this stage. The study sample consisted of 17 healthy male subjects aged between 19-28 years. Approximately %80 of the sample is graduated from high school. The participants had no medical or psychological conditions and were not taking any medications that might affect their sleep pattern and neuropsychologic measures. Polysomnography recordings were conducted from 22:30 to 07:00 h for two subsequent nights. The first night was for adaptation to the laboratory conditions and to rule out sleep apnea syndrome and periodic leg movements during sleep. The second night was used to analyze macro and micro parameters of sleep. A neuropsychological test battery comprised of Serial Digit Learning Test, Raven Standart Progressive Matrices, Verbal Fluency Test, Trail Making A-B, Auditory Verbal Learning Test was administered before the second-night sleep recording session. Sleep spindles in all NREM Stage 2 sleep were scored visually from the C3-A2 EEG derivation after polysomnographic analysis completed. Each 30-sec epoch was analyzed with a high-pass band filtered at 0.3 Hz, and low-pass band filtered at 35 Hz. Spindle characteristics such as duration, amplitude, mean and peak frequencies were analyzed by using the Fast Fourier Transform algorithm. Association between characteristics of sleep spindles and neuropsychological test scores were analyzed using Spearman correlations. All p values were two-tailed, with statistical significance determined at α = 0.05. We found significant correlations between spindle density (number of spindle /h of stage 2 sleep) and verbal auditory learning performance ($r=0.524$) and verbal fluency, cognitive flexibility, semantic organization ($r=0.568$). There was also positive correlations between mean duration ($r=0.727$); mean frequency ($r=0.562$) and peak frequency ($r=0.495$) of sleep spindles and serial digit learning test. Finally, mean duration ($r=0.548$), mean frequency ($r=0.524$) of spindles was positively correlated with verbal fluency, cognitive flexibility, semantic organization. We found significant associations between spindle features and verbal learning abilities which is consistent with the other research findings in adults suggesting that sleep spindle activity may be linked with an aptitude for learning (Fogel et al., 2007).

Reference

### Cognitive outcomes in patients after coronary artery bypass grafting at five-year follow-up

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<b>Introduction:</b> Postoperative cognitive dysfunction (POCD) is a serious neurological complication followed coronary artery bypass grafting (CABG). POCD may result in case of progressive decline in cognitive performance. The study was aimed at assessing cognitive outcomes in patients after CABG and the long-term evolution of cognitive functioning at the 5-year follow-up period.

<b>Methods:</b> Seventy-four male patients undergoing elective on-pump CABG aged 45 to 69 years were recruited to the study. Neuropsychological testing was carried out 3-5 days before surgery, 1 year and five years after CABG using the “Status PF” software package (Ivanov et al., 2001). The following cognitive parameters were assessed: complex visual-motor reaction time and the number of errors, the level of functional mobility of nervous processes and the feedback-based activation of brain performance (reaction time, the number of errors, missed signals). The Bourdon’s test was used to assess the attention. The visual short-term memory was assessed with the tests memorizing 10 words, 10 numbers, and 10 nonsense syllable. Individual postoperative changes in neuropsychological performance were calculated using the formula: (baseline value - value after surgery)/baseline value* 100%. POCD was established when 20% decline of the postoperative parameters compared to the preoperative ones in 20% of the test battery has registered.

<b>Results:</b> The rate of unfavorable cognitive outcomes (POCD) 1 year after CABG was 57%. Sixty percent of patients had the short-term memory disturbances, 52% had neurodynamic disorders, and 35% had deterioration of attention. At the five-year follow-up, POCD was diagnosed in 58% of patients. Cognitive decline in the short-term memory domain occurred in 46% of cases, neurodynamics - in 61% and attention - in 20%. It was found that among those patients who had POCD 1 year after surgery the symptoms of POCD in 59% of cases were preserved, while 41% of patients had no POCD. In the cohort of patients who did not have a POCD 1 year after cardiac surgery, 60% of the cases were presented with the onset of POCD de novo and only 40% patients did not have at the 5-year follow. Only 15% of patients had no POCD 1 year and five years after CABG.

<b>Conclusion:</b> The incidence of POCD in long-term postoperative period of CABG was 58%. A high percentage of cognitive decline persists over the five-year follow-up in the cognitive domains such as neurodynamics and short-term memory, important for maintaining the quality of life of patients after cardiac surgery.

### Lateralization of functional and effective connectivity in the human frontopolar cortex

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<b>Introduction:</b> The existing ideas about the interaction of cognitive processes with the processes of voluntary action generation define the role of the frontopolar cortex (FPC) in switching activity — from internal thinking operations to desired action. The present study has revealed asymmetries between the left and right FPC hemispheres under resting-state
conditions.

<b>Methods</b>. MRI data were obtained from 25 healthy subjects, mean age 24 (range from 20 to 35 years). The participants were instructed to close their eyes and lie still and relaxed (falling asleep was monitored). The MRI data were acquired using 3 Tesla SIEMENS Magnetom Verio scanner. fMRI data were acquired as T2*-weighted echo-planar images: 30 slices, TR = 2000 ms, TE = 25 ms, slice thickness = 3 mm, flip angle = 90°, and FOV = 192 × 192 mm², 1000 time points. fMRI and anatomical data were preprocessed using SPM8 based on Matlab with the correction for magnetic inhomogeneity using field mapping protocol and the slice-timing correction. Masks for the FPC in both hemispheres were created using MARSBAR toolbox. The resting state was modeled using a General Linear Model with a discrete cosine basis set (400 functions, 0.0078–0.1 Hz, F-contrast). The obtained statistical parametric maps were then masked with previously created FPC masks. The intersection of mask and statistical map were next used for time-series extraction. The assumption was checked by the application of the transfer entropy (TE) and spectral Dynamic Causal Modeling (DCM) methods.

<b>Results</b>. The results of the TE calculation showed the presence of information flows both from the left front-polar region to the right, and in the opposite direction. The group analysis results of the DCM method showed the activating effect of the FPC region of the right hemisphere to the left one (0.21 Hz, p <0.05, Bonferroni correction).

<b>Conclusions</b>. The results of the DCM method suggest the hemispheric asymmetry of the FPC with other regions in maintaining the baseline level of consciousness (Fig.1). Our recent results indicate higher expression of protein-coding genes in the FPC in the right hemisphere compared to left hemisphere.

Our research was partially supported by the RSF (grant 17-78-30029, on the brain mapping) and by the RFBR (ofi-m grants 15-29-01344 and 17-29-02518, on the wave-like processes in consciousness and the cognitive-effective structures of the human brain, respectively).

Picture 1: https://www.eventure-online.com/parthen-uploads/175/18001/add_1_444371_f927dd9e-53c2-4567-9850-54622bc7ba0a.png

Caption 1: Fig. 1 The hemispheric asymmetry in effective connectome at the resting state (DCM method, p <0.05, Bonferroni correction).

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Semantic brain mapping of the large continuous segments of Russian-language texts: Tourgenev and Tolstoy versus Siemens and Apple

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<b>Introduction</b>. Human consciousness operates with images, concepts, signs, etc. To understand the work of consciousness, it is important to visualize the concepts of semantic maps in the human brain regions. On the basis of the functional MRI (fMRI) it was conducted the neural-semantic mapping of perception and understanding of the text in Russian, describing two different subject areas: natural phenomena and technical devices method.

<b>Methods</b>. MRI data were obtained from 10 healthy subjects, mean age 24 (range from 20 to 35 years). Eleven texts (2064 words) were selected as the stimuli: 6 extracts from classic literature with the descriptions of nature and 5 texts with the popular description of diverse technical devices, like lock, refrigerator, steam engine. Certain concepts between the texts from two groups were overlapping – like ‘sun’, ‘reflect’ and ‘beams’ for nature and the description of a telescope. Texts from the two domains were interchanged, the text order within each group was randomized. The relative frequency of each word was evaluated basing on a frequency dictionary. Texts were recorded by a professional broadcaster. The stimuli were linguistically annotated - words and pauses, grammatical characteristics, semantic tags. The MRI data was acquired using a 3 Tesla SIEMENS Magnetom Verio MR tomograph. fMRI: 30 slices, TR = 2000 ms, TE = 25 ms, slice thickness = 3 mm, flip angle = 90°, FOV = 192 × 192 mm². fMRI and anatomical data were preprocessed using SPM8 based on Matlab with the correction for magnetic inhomogeneity using field mapping protocol and the slice-timing correction. Statistical analysis was performed using Student’s T-statistics (p<0.05, with correction for multiple comparisons (FWE)).

<b>Results</b>. At the comparison of brain activities with the perception of the technical text in relation to the natural the statistically significant activity was in the brain regions: Cerebelum_4_5_R, Temporal_Pole_Sup_L, Temporal_Mid_LR, Temporal_Sup_L, Frontal_Inf_Orb_L, Insula_RL, Cingulum_Ant_LR, Cingulum_Mid_LR, Frontal_Mid_L, Supp_Motor_Area_R, Supp_Motor_Area_L.

<b>Conclusions</b>.

The obtained data show that certain semantic categories and knowledge can be stored in different areas of the cerebral cortex (Fig. 1, yellow positive effect, blue negative), in its internal regions and in the cerebellum structures. Our research was in part supported by the RSF (grant 17-78-30029, on the brain mapping of semantic categories) and by the RFBR (ofi-m grants 15-29-01344 and 17-29-02518, on the wave-like processes in consciousness and the cognitive-effective structures of the human brain, respectively).

Picture 1: https://www.eventure-online.com/parthen-uploads/175/18001/add_1_444371_f927dd9e-53c2-4567-9850-54622bc7ba0a.png

Caption 1: Figure 1. The cerebral cortex activity (p<0.05, FWE) 1a - TT to the rest state, 1b - NP to the rest state, 1c - TT to NP.
Is stealing a movie from a store just as immoral as illegally downloading it? Participants (n=21) read sentences evaluating either physical theft or digital piracy (e.g. "<>I think theft/piracy is good/bad for society<>"), We hypothesized that humans possess automated psychological mechanisms for handling violations of physical property but not for digital piracy, an evolutionary novel form of property theft. Accordingly, we predicted that value-based disagreement is stronger for physical relative to digital property violation and this should be manifested in higher amplitudes of early brain potential components (P200 and N400), previously seen to respond to value-based disagreement. Our results showed that, as anticipated, participants responded faster and more negatively to sentences approving physical theft relative to digital piracy. Most interestingly, P200 and N400 amplitudes were enhanced when participants were evaluating sentences referring to physical vs. digital stealing. This suggests that the human mind possesses relatively fast heuristics for evaluating violations of physical property rights, but not digital copyrights.

Picture 1: https://www.eventure-online.com/parten-uploads/175/18001/add_442145_5e3b65e6-acfc-43aa-80c0-89e2f9883e83.png
Picture 2: https://www.eventure-online.com/parten-uploads/175/18001/add_1_442145_5e3b65e6-acfc-43aa-80c0-89e2f9883e83.png

EEG theta/beta ratio during mind wandering episodes.

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In spontaneous (resting state) EEG, the ratio between power in the slow frequency band (theta) and the fast frequency band (beta), known as the theta/beta ratio (TBR) has previously been negatively related to executive cognitive function, like attentional control. Braboszczy and Delorme (2011) reported that increased theta and reduced beta power (increased TBR) was present during mind wandering episodes, and lower theta and higher beta power, during on-task periods. Thus, increased resting state TBR could be related to mind wandering, which is described as involving a decline in working memory and attentional control (McVay & Kane, 2009), and is a predictor for performance errors (Smallwood & Schooler, 2006). If so, the regularly observed relation between measurements of spontaneous resting state TBR and attentional control may reflect episodes of mind wandering increasing the average resting state TBR in people with low attentional control. We therefore aimed to replicate the results of Braboszczy and Delorme as a first step toward studying this hypothesis. Fifty-five healthy young adults performed a 40 minute breath counting task as in Braboszczy and Delorme while EEG was measured. Results from Fourier transformation showed that theta power was significantly higher before participants pressed a button (indicating to have mind wandered) than after the button-press while beta power was significantly lower before compared to after the button-press. These data replicate the previous results and confirm that increased TBR could indeed be related to mind wandering or off-task episodes.

Neural Correlates of Mental Rotation Relate to Fluid Intelligence

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The current study examined the relation between mental rotation and fluid intelligence using performance measures augmented with brain potential indices.

Methods: 37 participants (12 males) took a Raven Standard Progressive Matrices Test and performed on a mental rotation task presenting upright and rotated letter stimuli (60°, 120° or 180°) in normal and mirror image requiring a response execution or inhibition depending on instructions.

Results: The performance results showed that the linear slope relating performance accuracy, but not speed, to the angular rotation of the stimuli was negatively related to individual differences in fluid intelligence. The mental rotation process was related to a negative shift of the brain potential recorded over the parietal cortex (rotation-related negativity, RRN). The linear function relating the amplitude of the RRN to rotation angle was associated with fluid intelligence. The slope was more pronounced for high- relative to low-ability participants.

Conclusions: By and large, the results suggest that high-ability individuals flexibly adjust their expenditure of mental effort to the mental rotation demands in order to maintain an appropriate level of accuracy while the low-ability ones are less proficient in doing so.
Introduction. Working memory (WM) updating is an important executive function responsible for controlled information processing. WM updating is often studied with variants of the mental counters task. In this task, the subject is sequentially presented with several stimuli categories and has to increment their mental counters accordingly. The exact neurocognitive mechanisms of performance in this task are still unknown.

Methods. The subjects (N=36, mean age 22.3 years, 18 females) were presented with a series of geometrical figures (circles or triangles) or male/females faces (the KDEF database) and had to mentally count stimuli categories. Subjects proceeded through the task by pressing a key. Functional images for each condition were obtained using a 3T MRI scanner (Siemens Magnetom Verio) (73 slices, TR = 2200 ms, TE = 25 ms, voxel size = 2x2x2 mm, flip angle = 90°, FOV = 192 x 192 mm, multiband 5, CMRR). A block paradigm was used with 10 blocks of 15.4 s. The fMRI data were pre-processed using SPM12 (p FWE < 0.05).

Results. When data for figures and the faces conditions were considered jointly, increased BOLD-signal was found in bilateral frontal, parietal, and temporal regions. Frontal activation was observed in medial frontal gyrus, frontal operculum, anterior insula, left supplementary motor cortex, and precentral gyrus. Parietal activation was seen in the superior parietal lobule. Temporal activation was found in the right middle temporal gyrus and in the right superior temporal gyrus. When both stimuli conditions (faces/figures) were considered separately, processing of faces added activation in the right fusiform gyrus while processing of geometrical forms added activation in the left inferior occipital gyrus.

Conclusions. The results support the crucial role of the dorsolateral prefrontal cortex for WM updating. These regions may be involved in maintenance (middle frontal gyrus) and controlled processing of materials in WM (frontal operculum). The involvement of motor areas by motor responses. The results also suggest a role of attention switching in WM updating, mediated by superior parietal lobe. WM updating also implicates a rehearsal mechanism mediated by temporal cortices. Finally, WM updating involves sensory cortices for encoding and storage of specific materials like geometrical figures (inferior occipital gyrus) and faces (fusiform gyrus). In sum, performance in mental counters task with various stimuli is mediated by a functional network which subsumes components for counters' maintenance, for incrementing counters', and for internal attention management.

This research was supported by RFBR, grant no. 16-06-00065.

A pupillometric study of task switching under mental fatigue

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Methods. An undergraduate sample (N=41, 26 female, mean age 21.8 years) performed the letter-digit switching task. In half of the trials, the task was parity judgment, while in other trials, the task was to judge the whether a letter is a consonant or a vowel. The tasks alternated in randomized order with a cue indicating the next task. Pupillary responses were measured with the Eyelink 1000 eye-tracker at 500 Hz with ellipsoidal pupil fitting. Blinks were removed through cubic interpolation. Pupillary responses were normalized to baseline (first 50 ms of a trial) via the computation of pupil size percent change and median filtered. Mental fatigue was assessed with a questionnaire, and the subjects were median-split on the fatigue score.

Results. Reaction time switch costs were not associated to fatigue (r=0.07, p>0.05), while accuracy switch costs increased with fatigue (r=0.32, p<0.05). Normalized pupillary responses for 2 s epochs were averaged across subjects and trial type (switch/repeat). Pairwise t-tests were performed comparing pupil dilation in switch and repeat trials in low and high privilege group. In low fatigue group, the pupillary response in the switch trials were higher than in the repeat trials. These differences (ps < 0.05) were observed between 150 ms and 800 ms from the cue onset. In high fatigue group, the dynamics of pupillary responses resembled that observed in the low fatigue group, but there were only sporadic differences between switch and repeat trials in the high fatigue group.

Conclusions. The necessity of switching tasks leads to increased involvement of cognitive resources as indicated by a systematic increase in pupil dilation during switch trials in low fatigue group. During fatigue, repeat trials require as much involvement of cognitive resources as switch trials. This suggests fatigue is leading to either an inefficient deployment of cognitive resources during fatigue, or to the exhaustion of cognitive resources as a consequence of fatigue. Although fatigue leads to more mental effort during cognitive tasks, objective performance suffers much less. This complies with the notion of human functional state in which effort mobilization may counteract performance decrements under unfavorable conditions like fatigue.
Introduction. Visual recognition impairments are associated with changes in gaze strategies. Generally, researchers use presentation of statical and abstract visual stimuli for study of visual agnosia. This work describes new methodological approach to the study of agnosia – eyetracking during exploring real scene with ecologically valid stimuli.

Methods. In our research we model natural environment in the video. The film shows a room with three people (actors) inside it. The location of people is standardized - one person is in the left part of a monitor, other two people – in the central and right parts. Actors perform simple daily activities. There are some events on the video, which should cause attention shift to left, central or right part of screen. We used eyetracker Mangold VT3 mini (sample rate-200Hz, accuracy-0.5°). The study involved 12 subjects: normal group (4 male, 6 female, age 20-72), and two subjects with visual agnosia (hemispatial neglect – female, age 20, simultagnosia - male, age 27).

Results. In the first seconds of the video, subjects from the normal group made most of gaze fixations at significant objects of scene - faces, hands, objects related to people (72-85% of all fixations). When there was a motion in the video, gaze involuntary shifted to moving object or person. If an actor intently looked in one direction (e.g., looked out of a window), subject’s gaze tracked the direction of actor’s gaze. Some of these gaze movements were predictive (e.g., subject looked at the door knob before actor grasped it). These strategies were unconscious.
Subjects with different types of agnosia had another gaze strategies. In case of simultagnosia, it was scanning of the screen sequentially in one direction (e.g., from right to left). Fixations at significant objects were rare (19% of all fixations). There were no gaze shifts to moving objects. In case of neglect for the left side of visual field, scanpath was similar to norm (80% of all fixations at significant objects), but there were no fixations in the left part of the screen at all. Only motions in the central and right parts of scene caused gaze shift.

Conclusions. Eyetracking during watching video of natural scene highlights some features, which are not obvious in different conditions. Combining this method with others (EEG, fMRI), we can deeply investigate mechanisms of visual perception. Also, these studies can be used for development of diagnostical methods for locked-in patients with visual agnosia.

This research was supported by Russian Foundation for Basic Research grant №16-29-08255.
Food preferences in the carriers of different polymorphisms of BDNF and COMT genes
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Introduction. Nowadays the problem of overeating and unhealthy food preferences becomes central in many ways. Additional exploration of the factors influencing people’s choice of food is necessary. Recently some research has been conducted on the role of dopaminergic and serotoninergic systems' genes in the onset of eating disorders and the process of recovery [Avsar et al., 2017; Rosenblat, 2017; Luis, 2017; Peng, 2016; Donofry et al., 2014; Roth, 2013]. During the recent years there were some attempts to understand the role of dopaminergic system’s genes in shaping food preferences in children [Wallace, 2015] but the area of genetic predisposition to consuming some foods in adulthood remains largely uninvestigated. Thus, the goal of our study is to explore the food preferences of carriers of different BDNF, COMT and HTR2A genes polymorphisms.

Methods. Participants - 55 carriers of BDNF gene Val/Val polymorphism, 31 carriers of BDNF gene Val/Met polymorphism; 29 carriers of COMT gene Val/Val polymorphism, 82 carriers of COMT gene Val/Met polymorphism. “AmpliPrime DNK-sorb-AM” was used for DNA extraction, “Tertsik” was used for PCR (DNK-Teknologiya, Russia). Food preferences were analysed with a bunch of food preferences inventories (Food Choice Questionnaire, Food Habit Checklist, Adult Eating Behaviour Questionnaire) Statistical processing of the results will be conducted with the help of STATISTICA 13 software.

Results. We expect the carriers of Val/Val polymorphism of the dopamine-related catechol-O-methyltransferase gene and of BDNF gene to display higher rates of desirability of “unhealthy” foods in comparison with the carriers of other genotypes.

NEUROFEEDBACK TRAINING AS A METHOD OF DEVELOPMENT OF CREATIVE EFFICIENCY
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Introduction. Creativity and creative approach to the activities can be called an inexhaustible source of growth of human effectiveness. We understand creative work as a process that produces something new, but the notion of creative potential includes efficiency, the ability to move away from stereotyped ways of thinking, the ability to see original ways of solving problems that have not been used before. In recent years there has been an increasing interest in finding out the neurophysiological mechanisms of creativity, which has made possible to form an idea of the areas cerebral cortex and frequency ranges most involved in the process of creativity [Sviderskaya, N., 2011; Dikaya L., Skirtach I., 2015]. That is why the aim of our empirical research was to study the possibility of increasing creative efficiency of dancers via neurofeedback technology. Twenty-five dancers participated in the research.

Methods. For estimating changes in creative efficiency we used group of experts, which included three teachers of dance studios. The neurofeedback training was aimed at increasing beta2 frequency (24.00-35.00 Hz) along the cognitive axis (left anterior and right posterior regions of the brain cortex) and the axis of creativity (right anterior and left posterior regions of the brain cortex) during mental dance improvisation. We felt that this training would improve creative efficiency of subjects. The course consisted of six neurofeedback trainings. The feedback consisted of sound tones of different heights, which are carried to the subject through the headphones. The subject was asked to increase and maintain the pitch in the process of mental dancing improvisation. We conducted a presentation of the dance improvisation for the group of experts before and after the course of training.

Results. Results of research allow us to conclude that all subjects could achieve the task successfully. The learning curve for each training was based on values ratio of training toward background (Figure 1). The learning curve has a positive trend, as evidenced by its regression coefficient: according for lead F4, we have k=0.135; for lead O1 k=0.182; for F4+O1, k=0.116; for F4+O1+F3+O2, k=0.061. The greatest value of the regression coefficient is observed in lead O1 (p<0.05).

Conclusion. The stage of training of beta-2 index in the rear ares was the most successful on part of the tested
subjects. It corresponds with the logic of training task for visualization improvisation. The experts' conclusion by the growth of the creative efficiency subjects revealed a positive increase in the results.

Picture 1: https://www.eventure-online.com/parthen-uploads/175/18001/add_1_443897_3c2c5444-ca78-4ed2-8b2e-8a7f5258e4af8.png
Caption 1: Figure 1. The learning curve for different leads (p 0.05).

Automatic detection of orientation changes of configural processing: A visual MMN study
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Introduction:
Adults’ expertise in recognizing faces is attributed to configural processing, whereas the object identification is mainly based on featural processing. It has been shown that we distinguish three types of configural processing: the first-order relational properties, holistic information, and second-order relational properties. Although there was evidence that face rotation disrupts the processing of configural information and is relatively independent of attentional resources, it is unclear that which type of configural processing could occur at the pre-attentive stage under a non-attentional condition. An ample evidence revealed that the MMN is a reliable indicator for evaluating the automatic change detection ability of human beings. Therefore, in this study we set out to broaden our understanding of how first-order relational information are processed and which properties play a more efficient role in explaining the configural processing under non-attentional condition.

Methods:
Visual mismatch negativity (vMMN) elicited by deviant orientation (90°/270° vs. 0°) schematic faces, scrambled faces and face contour was analyzed using the Oddball paradigm respectively.

Results:
We found that compared to standard stimuli (0° orientation), the orientation changes (90°/270°) elicited larger N170 and smaller P2, regardless of schematic faces, scrambled faces or face contour. Compared with scrambled faces and face contour, the vMMN elicited by the orientation change of faces was significant enhanced with shorter latency, and the amplitudes of face contour and scrambled faces were no significant differences. In addition, during the time range between 100–300 ms post stimulus onset, schematic face orientation changes elicited larger occipital–temporal distributed vMMN.

Conclusions:
The data supported the hypotheses that the disruption of facial configuration processing is more sensitive to the first-order configural information and is relatively independent of attentional resources.

Electrophysiological correlates of attentional engagement and disengagement from threat in anxious children
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Pediatric anxiety disorders are characterised by attentional biases (AB) towards threat. Electrophysiological studies in adults revealed enhanced P100 and P200 amplitudes for threatening faces reflecting enhanced detection, perceptual processing and disengagement impairments. Studies investigating these questions in children are scarce while they may allow to model anxiety’s effects on attentional processes under development. This study aimed to investigate electrophysiological correlates of attentional engagement and disengagement abilities from threatening faces in anxious children. Fifteen children reporting high levels of social anxiety and twenty healthy controls completed the State-Trait Anxiety Inventory for Children (STAI-C) and the Social Phobia and Anxiety Inventory for Children (SPAI-C) to examine the separated effects of these variables. They performed an emotional spatial-cueing task in which they had to detect targets cued by neutral or disgusted faces. Electrophysiological activity was recorded throughout the task. Results showed that children with high levels of trait anxiety had larger P100 amplitudes for disgust while high levels of social anxiety were correlated to larger P200 amplitudes. Children with high trait anxiety had larger P100 amplitudes for targets following disgusted faces. However, social anxiety did not influence targets processing. These results confirm the presence of AB towards threat in anxious children but the type of anxiety seems to moderate this effect. Trait anxiety is associated with enhanced attentional engagement whereas social anxiety seems to be characterised by disengagement impairments. Interestingly, these processing were associated to a faster processing of disgust for all children confirming a distinction between the notions of effectiveness and efficiency in anxiety disorders.

Prevalence and associated factors of burnout among collegiate cycle students in Sri Lanka
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Caption 1: Figure 1. The learning curve for different leads (p 0.05).
Introduction: Even though the concept of burnout has been widely explored across the globe, the evidence base on burnout among high school students in the South Asian context is scanty. Against the backdrop of ever-increasing educational demands and expectations, the present study was designed to determine the prevalence and correlates of burnout among collegiate cycle students in Sri Lanka.

Methods: A school-based cross-sectional study was conducted among 872 grade thirteen students in 15 government schools in an educational zone, Kegalle district, Sri Lanka, selected by a stratified cluster sampling technique. The validated Sinhala version of the 15-item Maslach Burnout Inventory-Student Survey (MBI-SS) was used to assess burnout. The adjusted prevalence of burnout was computed, based on the clinically validated cut-off values using the “exhaustion+1” criterion. Multivariant logistic regression was carried out using backward elimination method to quantify the association between burnout and selected correlates identified at bivariate analysis at p value less than 0.10.

Results: The response rate was 91.3%. The adjusted prevalence of burnout among grade thirteen students was 28.8% (95% CI=25.0%-32.7%). Multivariable analysis elicited a multitude of statistically significant associations with burnout when controlled for other factors included in the model (p<0.05). Perceived satisfaction related to the school environment (classroom and library facilities), school curriculum (scope, relevance and difficulty of the subject content), study enthusiasm (preferred subject stream), study support (support from parents and teachers) and future expectations (personal and parental expectations) emerged as statistically significant negative associations with burnout, whereas, having to encounter disturbances while studying and being subjected to bullying at school emerged as statistically significant positive associations with burnout.

Conclusions: The burnout prevalence among grade thirteen students in the selected educational zone, Sri Lanka is high. Most of the significant correlates of burnout are directly related to the academic endeavours. It is recommended to strengthen the counseling services at the school level to rectify the problems related to burnout among collegiate cycle students in Sri Lanka.

Maturation of connectivity in oscillatory brain networks: An EEG study of novelty processing
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Background: The human brain undergoes major changes throughout adolescence. During this time period, premises for a successful adult life are developed and trained. Therefore, the brain is especially prone to new situation and objects due to their rewarding character [1]. Electroencephalography (EEG) in combination with simple cognitive tasks enable investigation of maturational changes in fast, task-related brain processes as reflected in event-related oscillations [2, 3, 4].

The maturation of the frontal cortex and its involvement in global neuronal networks, such as the fronto-parietal–network (FPN), contribute to an improvement of performance of tasks involving executive functions. Slow brain oscillations, such as theta oscillations, seem to provide the basic neuronal mechanism for coordination and signal integration between distant brain areas [5]. Long-range theta connectivity specifically reflects fronto-parietal processing of cognitive control.

Thus, we investigated maturation of brain connectivity of the oscillatory theta response during target detection, non-target processing and distraction by novel stimuli.

Methods: A simple, visual novelty oddball task with a button-press response to rare target stimuli embedded in a sequence of non-target stimuli and distracting novel stimuli was performed by 79 participants between the ages of 8 and 28. Analysis of neuronal network activity was performed by inter-electrode phase coherence measures.

Results and conclusion: With ongoing maturation of the brain, inter-electrode connectivity strength of frontal brain areas increased. This may reflect structural changes of the frontal cortex and its increasing involvement in global neuronal networks.

Significance: The here presented project demonstrates the potential of modern spatial phase coherence analysis of brain networks and its importance for investigation of brain maturation.

References:

Relationships between trait anger and night-time blood pressure dipping in an ethnically diverse African sample
A Williams
Introduction. Cross-sectional studies demonstrated ethnic and gender differences in ambulatory blood pressure (ABP) dips, but little is known about these differences among African population.

Methods. This study sought to evaluate the association between trait anger and night-time blood pressure dipping among Nigerian youth/young adults aged 16 to 31 years. A total of eighty-eight participants (42 Yoruba, 26 Ibos, 20 Binis, 39% men) participated in 24-h ambulatory monitoring for blood pressure.

Results. Strong interactions were obtained such that trait anger was significantly and negatively related to night-time blood pressure dipping for Ibos and males had higher levels (P < 0.001) than Yorubas/Binis and females. For night-time systolic blood pressure (SBP) faster increase of SBP with age (P < 0.01) in Ibos was additionally observed. The ethnic difference in night-time blood pressure levels and its increase with age were significantly larger at night. Following Bishop et al. (2003), significant sex × trait anger interactions were obtained for systolic blood pressure, diastolic blood pressure, and mean arterial pressure in females. Gender and ethnic differences persisted after adjustment for body mass index, height, and socioeconomic status. Family history of essential hypertension explained ethnic differences in daytime blood pressure. trait anger was negatively related to blood pressure dipping for men but not for females.

Conclusion. In conclusion, the night-time blood pressure dip with age in Ibos corroborate and extend findings of cross-sectional studies. The mechanism underlying nondipping is not completely.

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Approach-avoidance responses to curved vs. angular objects: A facial EMG study
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Introduction: Curved objects are generally preferred to angular objects. However, it remains unclear whether the preference bias is due to liking curvature or disliking angularity. To investigate the mechanism underlying this bias, reaction times (RTs) and facial electromyograms (EMGs) were recorded when participants performed an approach-avoidance implicit association test (IAT) task.

Method: Twenty-five university students (8 men and 17 women, with a mean age of 22.5 years) performed an IAT task (the manikin task) in the compatible and incompatible conditions. Each condition consisted of 60 trials, which contained 30 curved and 30 angular images. In the compatible condition, participants were asked to approach the curved objects and avoid the angular objects, whereas the opposite responses were required in the incompatible condition. Participants moved a manikin closer to or farther from a stimulus image that was presented at the center of a computer screen. The facial EMGs were recorded from the corrugator supercilii and zygomaticus major muscles. The mean correct RTs were calculated for each condition. The EMG values were log-transformed and the change scores from the baseline (500 ms prestimulus period) were calculated. The data were analyzed using a repeated measures analysis of variance that included the factors of contour (curved vs. angular) and compatibility.

Results: The participants made more errors when responding to curved stimuli than angular stimuli. For RTs, the main effect of compatibility was significant (p < 0.01). The Contour × Compatibilty interaction effect was also significant (p < 0.02). Subsequent tests showed that approaching curved objects was faster than avoiding them, whereas no significant response bias was found for angular objects. The facial EMG analysis showed a significant main effect of contour, as there was higher corrugator supercilii activity for curved objects than for angular objects. However, there were no significant effects found when analyzing the zygomaticus major muscle activity.

Conclusion: The RT results suggest that curved contours are associated with approach responses, while angular contours are associated with neither approach nor avoidance responses. The facial EMG analysis showed that curved objects induce higher corrugator supercilii activity than angular objects, likely due to a larger response conflict in responding to curved objects. If, the opposite pattern would have been obtained. These findings support the view that curved objects are preferred because curvature itself is liked, but not because angularity is disliked.

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Cognitive processing of a strange feeling in a face-matching task
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Introduction: It has been reported that a feeling of strangeness reflects that something is not right and could be related to an inconsistency between stimuli (Kawabata, 2006). This feeling causes stimuli to be observed and analyzed in more detail (Uchino et al., 2005). In this study, we investigated the cognitive processing of a strange feeling in a familiar face matching task by using event-related potentials (N2, P300 and N400).

Method: University students (N = 20, 10 women and 10 men, mean age 21.7 ± 0.79 years) participated in this study. Participants judged and indicated whether two face pictures matched or not (S1 and S2) by pressing a key. We measured the number of correct responses, reaction times (RTs) and the EEG during this task. The S2 pictures were classified by the degree of inconsistency and the feeling of strangeness, which were significantly and positively correlated (r = 0.99). Five conditions were tested; Match condition (S2 is consistent with S1), Mismatch-1 (mismatch-rate between S1 and S2 is 14.3 ± 4.9 %),
Mismatch-2 (40.0 ± 6.5 %), Mismatch-3 (59.3 ± 11.0 %), and Mismatch-4 (82.9 ± 8.0 %). S2 pictures were presented in a pseudorandom order.

Results indicated that the correct response rate increased in the larger mismatch-rate conditions. RTs in Mismatch-2 condition was slower than in Match, Mismatch-1, 3 and 4 conditions. Moreover, the correct response rates and RTs increased in Mismatch-2 than in Mismatch-1 (\(p<0.001\)). Furthermore, the P300 amplitude for S2 increased in Mismatch-2 than in Mismatch-1 (\(p<0.05\)). On the other hand, N2 and N400 amplitudes increased in Mismatch-2 than in Mismatch-1 condition (\(p<0.001\)).

Discussion:

These suggested that the feeling of strangeness was induced in Mismatch-2 condition. The P300 and N2/N400 components might respectively reflect the ease of making a judgement and detecting inconsistencies, or the strange feeling between stimuli. However, it is not clear whether N2/N400 components reflected a feeling of strangeness or simply reflected the inconsistency between stimuli because the stimuli used in this study were positively correlated with inconsistency and strangeness. Future studies need to reinvestigate cognitive processing of the feeling of strangeness by using of stimuli that are negatively correlated with inconsistency and strangeness.

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ERP P3 of school age children and prenatal exposure to dioxin: the Hokkaido Study on Environment and Children’s Health
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Introduction: Prenatal exposure to dioxins, which is environmental chemicals, induces some effects on the neurodevelopment of children. Our previous studies showed neurodevelopment at 6 months and 18 months (Nakajima et al., 2017) and 42 months (Ikeno et al., 2018) were associated with prenatal exposure levels to dioxin and dioxin-like compounds. However, it is unclear how long these effect remains. We investigated association between maternal dioxin levels during pregnancy and brain activity of school age children using ERP (event-related brain potentials). We focused on P3 during three-stimulus visual oddball paradigm, because P3 amplitude and latency could be interpreted as cognitive resource and stimulus classification speed, respectively.

Methods: The basic information of participants and chemical data were obtained from a hospital-based prospective birth cohort study, the Hokkaido Study on Environment and Children’s Health, which enrolled pregnant women from 2002 to 2005 in Japan (n=514). We collected ADHD-RS questionnaire written by mothers, and 80 mothers and children agreed with recording of ERP. We recorded their electroencephalogram during 3-stimulus visual oddball paradigm (standard, 70%; target, 15%; non-target, 15%), in which the stimuli were presented in random order, once every 2 s. We analyzed data from 69 children who had both dioxin, and ERP data without artifacts during recording. Dioxin values were log10 transformed, and participants were divided to 3 groups according to ADHD-RS (High, Middle, and Low ADHD group). Multiple regression models were constructed for target P3 amplitude and latency, adjusted by age of children at recording. After that, we did same analysis for each ADHD groups.

Results: Mean age of children was 11.9 years old (SD 0.7). Characteristics and dioxin value of participants in this study were not different from that in our previous study (Kishi et al., 2017). P3 for target trials were observed over the parietal electrodes from 390 to 490 ms on the grand averaged waveform. Multiple regression analysis showed that increased dioxin level significantly associated with increased P3 latency (\( \beta=42.3, 95\% CI: 1.7, 83.0 \)). When the model was stratified by ADHD group, marginal significant association was observed only for high group (\( \beta=53.7, 95\% CI: -6.9, 114.3 \)). These results suggest that dioxin levels in maternal blood is associated with stimulus classification speed of school age children, especially for high-ADHD group. It might indicate modulation of cognitive ability by prenatal exposure to dioxin underlie ADHD symptom.

Conclusion: Prenatal exposure to dioxin is negatively associated with cognitive ability in school age children.

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EEG-FMRI STUDY OF THE STRUCTURAL AND FUNCTIONAL ORGANIZATION OF FOCUSED VISUAL ATTENTION IN HEALTHY PERSON
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Focused attention (FA) is one of the main components of cognitive processes in normal and pathology [Navon, 1989; Coull 1998]. Combination of EEG and neuroimaging allows to clarify already existing ideas [Luria, 2002; Machinskaya, 2003; Peterson, Posner, 2012] about structural and functional basis of FA in normal and pathology.

Objective: to investigate topography of EEG and fMRI changes when the visual FA activated in healthy subjects, and to compare them with neuroanatomy of orienting and executive attention systems by Posner [Peterson, Posner, 2012].

EEG studies were performed in 24 healthy subjects (aged 21-30 years). In 4 of them fMRI 3T was carried out. A computer-based method with red ball moving across the screen was used to activate visual FA, with preliminary instruction to
follow this object by eyes [Sharova et al., 2009]. EEG coherence indicators (CogEEG), as well as fMRI in FA test were statistically compared to state with simple opening eyes.

According to fMRI, FA task was followed by activation of posterior brain’s regions, more in the left hemisphere: visual cortex (lingual gyrus, middle occipital gyrus and calcaine), fusiform gyrus, parietal area and cerebellum. The most activation volume was in lingual gyrus, linked with visual attention according to the literature [Mangun, 1998]. In general, fMRI responses topography was correlated with Posner’s frontoparietal attention system, but only with its parietal part, possibly because of task simplicity. Visual cortex activity is determined by the test specificity. fMRI response lateralization corresponds with CogEEG changes in the most frequency bands, except delta: CogEEG increase in left hemisphere. Involvement of anterior hemispheres is clearly seen in EEG: frontal interhemispheric coherent EEG connections (both symmetrical and diagonal) decrease in beta-1 band, that can be seen in context of cingulo-opercular Posner’s attention system activation. Intrahemispheric EEG reactions in the same frequency band correspond to frontoparietal Posner’s system, but reciprocally: FA CogEEG decrease (in comparison with open eyes) in frontal and parieto-occipital areas of the right hemisphere, and its increase in the same regions of the left. Bilateral occipital CogEEG changes in virtually all frequency bands can probably be regarded as a specific component of visual test.

Thus, EEG-fMRI responses topography in visual FA test corresponds with frontoparietal and cingulo-opercular Posner’s executive attention systems, and also include the occipital activation. Identified FA markers in healthy people can be used as basis in studies of cerebral pathology. Supported by RAS and RFFI 16-29-08 255 ofi-m

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Goal Coordination in Free Choice and Specified Grasping: An ERP Study
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This study explored the neurophysiological mechanisms underlying the goal coordination in overt goal-related grasping. More specifically, event-related potentials (ERPs) were used to differentiate the cerebral activity during planning the grasp- and-rotation task with different pre-cued goal sequences. The sequences were consisted by the consecutively presented cues “how to grip” (immediate goal) and “where to rotate” (final goal) in the order of either immediate-final or final-immediate. Participants were asked to perform the free choice grips or specified grips and to rotate a handle towards a given target position. Reach and rotation times were shorter for the free choice compared to the specified grips. A significant interaction was found between goal sequence and grip type for reaction time. Free choice grips elicited faster reactions than specified grips in the final-immediate sequence. Larger P2s were found time-locked to the final goals in the frontal area regardless of the goal sequence and grip type. A larger frontal P3 was found in final-immediate comparing to immediate-final condition time-locked to the first cue. In the time window 800-1000ms time-locked to the first cue, we found more negative frontal slow waves for specified grips under the sequence of immediate-final. And, in the time window 1000-1900ms time-locked to the first cue, we found more positive posterior slow waves for free choice grips under the sequence of immediate-final. The results indicated that neural activity differed between free and specified actions and final action goal is more important than grasp posture with the novel contribution of separating cues for planning and for executing the grasping actions.

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CCEP Feature Extraction and Complex Brain Network Analysis in Epilepsy Patients
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Objective: Epilepsy is a brain disease of chronic and relapse, with a high prevalence rate. It has been seriously affecting the life of patients and their family. However, the mechanism of epilepsy has not been illustrated and the location of epileptogenic focus has not well been described yet. This paper is expected to provide help on the batch processing of CCEP signals and the localization of epileptogenic focus for the clinical study.

Method: We propose to explore electrocortography signals recorded from 8 refractory epilepsy patients with electrocortical stimulation, extracting time domain features of cortico-cortical evoked potential (CCEP) and analyzing the brain network for epilepsy. Graph theory is applied to analyze the network topology based on gross anatomy and Brodmann area (BA).

Results: 1. The connected matrix based on the features of CCEPs is asymmetric, and the number of effective CCEPs decreases with the distance between the stimulating-recording sites; 2. The distribution of CCEP responses is associated with the epileptogenic focus. In 6/8 patients, in-degree of areas in seizure onset zone (SOZ) is higher than areas in non-SOZ based on gross anatomy; local efficiency of areas in SOZ is higher than those in non-SOZ in 6/8 patients based on BA.

Conclusions: 1. The brain network of epileptic patients is mainly composed of short-distance connection, and it is asymmetric; 2. The in-degree and local efficiency are highly consistent to the distribution of epileptogenic zone, and they could be applied readily to local epileptogenic focus clinically.
Psychophysiological features in determining the individual professional trajectory of students
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The diagnostic of personal characteristics as the basis for professional self-determination becomes especially relevant. The study of the individual psychological features was carried out from the standpoint of differential psychophysiology. The purpose of the study was to diagnose the main properties of the nervous system and temperament as a basis for professional development.

The study was implemented at Perm State University. 140 students took part. The first method, that was used is “Rapid diagnostics of the nervous system properties” by E.Ilin. The psychomotor test tracks temporal changes in the maximum rate of movement with a wrist. It allows to determine the type of force-weakness of the nervous system; identify the stability and endurance of the individual to a variety of long-lasting irritants. The second method was “Study of the psychological structure of temperament” (B.Smirnov). The questionnaire of temperament structure includes 48 questions, allows to diagnose polar characteristics: extraversion - introversion, emotional excitability - emotional balance, reaction rate (fast - slow), the level of activity (high - low).

The results of the study showed that the majority of students are dominated by the average type of nervous system (43%). The maximum tempo is maintained at approximately the same level during the entire operation time. This type characterizes the nervous system of medium strength. Equally, there are both strong (13%) and weak (14%) types of the nervous system. The study of the psychological structure of temperament showed that among all students, extroverts (41.4%) and introverts (43.5%) are roughly equally encountered. Investigation of the properties of rigidity-plasticity determined a high (27%) and very high (31%) rigidity in the majority of respondents. Plasticity was observed in about 14% of respondents. Most of the students are characterized by high (39%) and very high (21%) emotional excitability. Emotional balance was observed much less often (about 11%). A significant proportion of students have an average rate of psychic reacts (43%) with an average level of activity (45%).

An individual personality profile of temperament properties was drawn up. Individual professional development trajectory assumes the account of features of the nervous system and temperamental characteristics in the selection of activities that will be the most comfortable environment for development in the profession. There were developed recommendations, that included the following information: recommendations on the organization of working hours, the selection of work schedules and further professional self-realization based on the diagnosis of temperament properties.

Working Memory Updating Training Improves Children’s Fluid Intelligence: An Evidence from ERPs
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Introduction: working memory updating training possibly improve the fluid intelligence of children, but its mechanism remains unclear. Cumulative empirical evidences indicated that inhibitory control was an essential factor to account for the relationship between working memory training (WMT) and fluid intelligence. Neuroimaging studies also suggested that some common brain areas (e.g. prefrontal lobe and parietal lobe) were involved in inhibitory control and those cognitive functions. Inhibitory control can be divided into conflict inhibition and response inhibition. P200 is regarded as the component of attention regulation, and the P200 component induced by the frontal area is considered to reflect the inhibition ability of the individual to irrelevant information. The present study speculates that working memory updating training could improve children’s inhibitory ability, showing a decrease in P200 wave amplitude, thus leading to the improvement of children’s fluid intelligence.

Methods: A total of 45 children (aged from 9-11 years) were randomized into a WMT group (25) or a control group (20). All subjects were tested on the day before the training, the 10th day, 15th day and 20th day of the training, control group did not participate in the training stage. All children were asked to be tested in the Standard Progressive Matrices Test. Event-related potentials were recorded during the stroop task and go/nogo task.

Results: the study showed that, the children in the training group outperformed those in the nontraining group in terms of accuracy in the Raven Standard Progressive Matrices scores (see Table1). The P200 amplitude of the training group decreased significantly in the go/nogo task (see Fig 1). However, the P200 effect disappeared in the stroop task.

Conclusion: the results demonstrate that working memory updating training improves fluid intelligence, which may be related to the improved inhibition ability, and has nothing to do with conflict inhibition ability.

Table 1 Test scores on the Raven Standard Progressive Matrices test

<table>
<thead>
<tr>
<th>Group</th>
<th>Raven Standard Progressive Matrices Test</th>
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<tbody>
<tr>
<td>WMT</td>
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<tr>
<td>Control</td>
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 Theta and beta oscillations dissociate two types of errors: a trial-to-trial correlational study
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Introduction
Mechanisms of cognitive control include monitoring and regulation of both task-specific attentional processes and non-specific motor threshold. Failures in one or the other of these two mechanisms may lead to different kinds of responses, post-response adaptations and, importantly, distinctive behavioral correlates. Slow responses can be interpreted as responses committed after attentional lapses and, therefore, during the state of uncertainty, while fast responses can be interpreted as responses committed in conditions of lowered motor threshold. Thus, slow and fast errors have different nature and require different brain adaptations.

The aim of the current study was to confirm the idea that modulations in oscillatory brain activity can distinguish between these two types of responses.

Methods
EEG was recorded during performance of the auditory two-choice condensation task, which requires sustained attention and does not require inhibition of prepotent responses.

Results
Increased frontal midline theta (FMT) power was observed during pre-response time interval for both correct responses and errors. Enhanced error-related FMT power was found in post-response and post-feedback time intervals. Increased frontal beta power was observed in post-feedback time interval. We also observed significant positive trial-to-trial correlation between pre-response FMT power and response time (RT) for both correct responses and errors, negative trial-to-trial correlation between post-response FMT power and RT for errors, and positive trial-to-trial correlation between post-feedback frontal beta power and RT.

Thus, slow erroneous responses characterized by high uncertainty were accompanied by increased FMT power before the response and by increased frontal beta power following the feedback; these effects, presumably, reflect enhanced cognitive effort and feedback processing, respectively. On the contrary, fast erroneous responses characterized by low uncertainty led to increased post-response FMT power, which, presumably, reflects internal error detection. Thus, this study confirmed the idea that RT can be a valid index of uncertainty level, with high uncertainty occurring due to attentional lapses and low uncertainty occurring due to failures to keep a sufficiently high motor threshold.

The study was implemented in the framework of the Basic Research Program at the National Research University Higher School of Economics (HSE) in 2018.
An analysis of fMRI signal during voluntary breath hold and carbon dioxide challenge: physiological correction and modeling issues

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Functional MRI data has to deal with physiological phenomena related to respiratory and cardiac functions. Correction techniques can minimize their effects with the risk of discarding relevant information. This is particularly significant when the focus is the study of emotions or ANS-CNS link. Here, we describe a study on the central control of breathing during voluntary breath hold (VBH) and CO₂ challenge paradigms. Twenty 3mm thick oblique slices comprising brainstem, putamen, thalamus and cortical areas above corpus callosum were acquired. In VBH study, we compared linear and nonlinear models considering the time course of end-tidal CO₂ (PETCO₂) (1). Specifically, we used a polynomial static nonlinearity (2) applied to the individual PETCO₂ time series within a multiple regression framework. Adjusted R squared (R²-adj) measures were compared at single subject level using different delays (till 12s) and polynomial orders, from 1, i.e. linear, up to 5. Data were analyzed both after applying and without applying retrospective cardiac and respiratory correction (RETROICOR) (3). The R²-adj results show an improvement using the fifth order nonlinearity: th...
captured by RETROICOR correction.
This observation was supported by an exploratory analysis of CO₂ challenges data (block design administration of 3% and 7% concentration levels). Group level Independent Component Analysis (ICA) was performed. The spatial distributions of task-related ICs obtained from both challenges were highly correlated (r=0.7). A similar IC was found from a free breathing task. Interestingly, a nonlinear analysis of IC amplitudes obtained from corrected data, normalized to reflect percent signal change, revealed a super-linear relationship with the CO₂ changes in the putamen, thalamus and pons. Overall these results indicate a complex relationship between PETCO₂ and BOLD changes, and the need of further exploring the effect of correction techniques for the study of breath control with fMRI.