The role of gamma band activity in human relational reasoning

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Several studies using similar tasks and neuroimaging techniques have shown that reasoning is associated with bilateral prefrontal (PFC) and posterior parietal cortices activation. Here, we investigated the brain EEG activity (with special interest on gamma band) during two types of cognitive tasks — memory task and memory with reasoning. The first task required the subjects to memorize three pairs of unrelated elements (e.g. D and S; F and C; E and R), whereas in the second the subjects had to infer about relations between presented elements (e.g. after presentations of: A>B; B>C; C>D; subject was requested to answer questions concerning relationship between elements which were not previously presented, e.g. A>C?).

The first phase of both tasks, in which subjects were required to only maintain the information (memory task) or to create the linear order (reasoning task), was used for this analysis. The ICA algorithm was applied to the data and resulted with 61 components, which were later clustered using k-means method. Two clusters revealed significant differences between memory and reasoning tasks in gamma band. The first of these clusters was located in frontal sites. The localization of the second cluster was more distributed and covered parietal as well as frontal sites. The first cluster showed increased gamma band activity (as shown by event related spectra perturbation, ERSD) in working memory tasks comparing to reasoning task. In the second cluster the gamma band activity was higher during the reasoning task.

These results are in line with previous findings from studies with brain-damaged patients and neuroimaging experiments showing that logical reasoning is implemented in cortical networks consisting of parts of the fronto-temporal cortex and the posterior parietal cortex. It was found that during relational and conditional reasoning, an occipital–parietal–frontal network was activated. This suggests that spatial processing of relations might be a key information in mental models constructed during reasoning. We hypothesize also that the two clusters appearing in frontal and parietal locations represent the results of the activity of different information processing streams.

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Emotional expression can be recognized without awareness but structure of the face stimulus requires consciousness

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First article on subliminal perception of faces was published by Murphy and Zajonc (1993) more than a decade ago. Despite the extensive research, the neural mechanisms of this phenomenon are still not known. Here we studied this problem recording Event Related Potentials (ERPs) evoked by subliminal stimuli.

Nine right handed subjects were examined. Three subliminal stimuli of 16.6 ms duration were used: (i) smiling face, (ii) neutral face, (iii) white noise. They were immediately followed by mask stimulus of 1 s duration. There was one additional condition where no subliminal stimulus was used (mask exposition only). The Biopack EEG was used to record a signal (0.1–35 Hz bandpass filter, 500 Hz sampling rate).

The P1 slope was significantly faster and the amplitude was larger in ERPs for white noise backward masked comparing to mask exposition only. The responses for white noise and neutral face reveled differences in amplitudes of P1 and P3a. The P1 component was larger and the P3a component was smaller for neutral face comparing to white noise exposition. This comparison did not expose, however, difference in face specific N170 component, although it showed VPP (vertical positive potential) increase for neutral face comparing to noise. Similarly, the comparison of ERPs evoked by exposition of neutral and happy face, did not reveal N170 difference but exposed larger VPP amplitude for neutral face.

We conclude that:

The differences in ERPs observed during all comparisons suggest that discrimination of visual stimuli takes place fast and without consciousness. The difference in VPP but not in N170 component supports hypothesis of two parallel face processing streams: structural encoding and facial expression. The facial expression stream, which was postulated to be reflected by VPP, does not required consciousness to distinguish visual features but the structural encoding stream, reflected by N170, does. We hypothesize that human nervous system can distinguish emotional expression but cannot identify faces without awareness.

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What do we really predict during language comprehension?

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Several recent event-related potential studies have uncovered existence of predictive mechanisms in comprehension of language. They have demonstrated that if semantic context is constraining enough, the language comprehension system predicts specific words which have not yet been presented. In the present study we try to extend previous findings to check if the predictive mechanisms always target specific words, or maybe in some situations they can target sublexical semantic properties of words. We do it by exploiting a property of Polish (and other Slavic languages) — animacy, which is both a semantic and a morphosyntactic category. By constructing special context sentences, we make our participants expect that the direct object of item-final sentence will be something animate or inanimate. Then we probe for that expectation by introducing a violation to a prenominal adjective (by substituting masculine-animate gender suffix with masculine-inanimate, and vice-versa), tied with the predicted object noun in an agreement. We show that although Polish readers' predictive system is sensitive to distinction between masculine–animate and masculine-inanimate genders (we obtain a N400 component at the incongruent adjectives), the prediction is carried mainly by specific words and not by expectation of an animate or inanimate entity, as the congruency effect shows up mainly in items whose contexts are strongly constraining for specific nouns.

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Histamine release from human blood basophils triggered by Fc gamma receptor-specific ligands and C-reactive protein

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Pentraxin family contains such proteins as C-reactive protein (CRP) and serum amyloid P component (SAP) known to play a protective role in innate immunity. Some of them (e.g. CRP) are markers of acute inflammation. CRP attracts attention by properties of both a conservative lectin and antibody. It binds bacterial antigens and such endogenous ligands as phosphorylcholine (PC) or smRNA, and behaves like immunoglobulins in binding to cell surface Fc receptors (FcR) and complement activation. CRP participates in atherogenesis, arterial wall damage and is implicated in stroke. People with cardiovascular events and low vascular response to acetylcholine (ACh) due to endothelial-vascular dysfunction show elevated blood levels of CRP. Our data indicate that CRP bind ACh and diminish its effects on rat vascular tone and heart rate in vivo. In vitro CRP inhibits breakdown of ACh by acetylcholinesterase. ACh mediates parasympathetic cholinergic regulation of immune responses and acts as a signal molecule produced by immunocompetent cells during their cell-to-cell interactions. We have shown that CRP administration ameliorated immediate type hypersensitivity reactions to antigen in guinea pigs in vivo. CRP reduced the therapeutic effect of a PC-related nACh blocker as well. Mast cells (MC) and basophils are responsible for the release of vasoactive mediators and the response of vessels and bronchi in immediate type allergic reactions. They are activated by IgE or IgG and antigen via FcR. CRP and SAP are known to influence immunocompetent cells through FcgR. The role of pentraxins in MC and basophils activation is poorly defined. The cholinergic regulation of MC and basophils activity is also poorly understood, in particular in view of recent