These results support our hypothesis and suggest that the right PMd is potentially associated with processing of the likelihood.

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Tonic balance of neural excitation and inhibition for improving perceptual performance

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For sensory cortices to respond reliably to feature stimuli, the balancing of neural excitation and inhibition is crucial. A typical example might be the balancing of phasic excitation within cell assemblies (populations of neurons) and phasic inhibition between cell assemblies. The former controls the gain of and the latter the tuning of neuronal responses. A change in ambient GABA concentration might affect the dynamic behavior of neurons in a tonic manner. For instance, an increase in ambient GABA concentration enhances the activation of extrasynaptic receptors, augments an inhibitory current and thus inhibits neurons. When a decrease in ambient GABA concentration occurs, the tonic inhibitory current is reduced and thus the neurons are relatively excited. We simulated a neural network model in order to examine whether and how such a tonic excitatory-inhibitory mechanism could work for sensory information processing. The network consists of cell assemblies. Each cell assembly, comprising principal cells (P), GABAergic interneurons (Ia, Ib) and glial cells (glia), responds to one particular feature stimulus. GABA transporters, embedded in glial plasma membranes, regulate ambient GABA levels. Hypothetical neuron-glia signaling via inhibitory and excitatory synaptic contacts was assumed. When the network was presented with a stimulus, the former let transporters import (remove) GABA from the extracellular space and excited stimulus-relevant principal cells, and the latter let them export GABA into the extracellular space and inhibited stimulus-irrelevant principal cells. To see how the GABAergic gliotransmission mechanism affects sensory gain of the network, we impaired the Ia-to-glia projection. This depolarized glial cells, increased ambient GABA concentration around stimulus-relevant P cells, and thus depressed their responsiveness to the stimulus. This result indicates that GABAergic gliotransmission-mediated tonic excitation enhances the neuronal responsiveness, leading to the improvement of neuronal gain. To see how the GABAergic gliotransmission mechanism affects sensory tuning performance of the network, we impaired the P-to-glia projection. This hyperpolarized glial cells, decreased ambient GABA concentration around stimulus-irrelevant P cells, and thus heightened their activities. This result indicates that GABAergic gliotransmission-mediated tonic inhibition enhances the suppression of distractive sensory information, leading to the improvement of sensory tuning. We suggest that the glial membrane transporter may give a combinatorial excitatory–inhibitory effect on principal cells in a tonic manner, thereby improving the gain and tuning of neuronal responses. The GABAergic gliotransmission mechanism proposed here may provide balanced intracortical excitation and inhibition so that the best performance of the sensory cortex can be achieved.

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EEG informational code dependence on the functional state: General trends and characteristic period

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EEG signal is an important source to study the brain signalization in all its variety. The consideration of this signal as an informational process leads to the exploration of the properties of these processes, which are described in the terms of the information theory. Particularly, we can study the specifics of the information coding in EEG, such as: 'vocabulary' diversity (the information code), its evolution and characteristic time-scales of the latter. In order to study characteristics mentioned above, the Lempel–Ziv complexity (LZC) values were applied in our research. The EEGs we used were recorded for two states (relaxed arousal with open and closed eyes). The international electrode position system 10-20 was used. We used EEGs recorded in band range from 0.16 to 50 Hz and 50 Hz notch filter as well. For the processing, we selected artefacts-free EEG fragments.

As far as LZC is applicable to the binary code, the EEG has been converted there into using the algorithm suggested by Sprott (1995). The median of the time series was calculated, with all samples greater than the median value taken to be 1, and less than the median taken to be 0. We calculated the LZC values for time windows of different widths beginning with the same starting point and represented as LZC function versus the window size and represented their plots as a superposition of the slow changing trends and fast quasiperiodical oscillations (QPOs). Some semblance of the results was found only for the trends in the cases with open eyes for different people. Some characteristic frequencies in QPOs have been clearly observed as well. The features observed and mentioned above maybe interpreted as the evidence of the universal characteristic time scales in the vocabulary evolution. This effect was not revealed in the state with closed eyes.

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The study of EEG complexity in the positive and negative induced by music

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This study is aimed to find specifics of the complexity of brain functioning during the stimulation of emotions of different sign. The complexity was considered as correlation dimension of the EEG reconstructed attractor (D_2). Our approach to stimulation is based on emotional effect caused by listening to music examples. We used musical compositions, which produce positive or negative emotional effects. The 'positive' musical piece is Dmitri Shostakovich's "Romance", as defined by a number of musicologists. The 'negative' music example is Prokofiev's "Russia under the Mongolian Yoke", often described by the specialists as emphatically "mournful" music. As part of our experiments, selected