

Computer Graphics & Animation 2017: The Art of Encephalography and cinematic spatio-temporal pattern visualization to gain insight into brain dynamics associated with different cognitive states

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This research presentation is inspired from the work of Walter J. Freeman on brain field dynamics and its implications within the understanding of cognitive functions, intentional action, and decision-making. The most purpose is to present a completely unique way of applying the art of encephalography. We've moved from the mere plotting of brain signals within the time domain to Spatio-temporal frames that produce a brain dynamics movie with power to offer us different visual patterns of behavior in various conditions supported experimental data produced by different stimuli. The methodology of brain movie making is briefly described to elucidate how large quantities of brain data images are processed to supply the films which are then displayed so as to visually discriminate between different cognitive states, also because of the different stages of cognitive processes associated with the cycle of creation of data and meaning so vital for decision-making. It's proposed that careful observation of every one of those movies will facilitate a learning process, so as to: (a) identify different structures and visual patterns where large-scale synchronizations and desynchronizations are observed alongside the temporal evolution of the various stages of the hypothesized cycle of creation of data and meaning and (b) facilitate the study of brain dynamics across different frequency bands with the help of various indices just like the Pragmatic Information index which is predicated on the instantaneous phase and therefore the analytic amplitude. To summarize, the art of encephalography enhanced by brain dynamics movies allows us to spot brain patterns and events related to different measurements across bands and therefore the different stages of the cycle of creation of data and meaning. In recent decades, a big effort has been directed towards experimental and theoretical approaches to aiming at the establishment of neural correlates of upper cognitive functions and awareness. These efforts produce the massive amounts of knowledge on imaging brain structure and functions, and efficient methods are in high demand to form these data easily accessible and understandable to human experts. Here we describe the event of qualitative tools and methodologies where large quantities of brain imaging data

are processed and displayed for the aim of visually discriminating the varied stages of the cognitive processes. During this work we report and describe intimately a strategy inspired by the art of encephalography, whereby brain dynamics movies are created supported experimental data. The results are presented to spot large-scale synchronizations and desynchronizations across broad frequency bands as a possible manifestation of the cycle of creation of data and meaning. This visual process is additionally useful for the outline of learning and

adaptation processes in brains.

The human scalp EEG contains massive information that's correlated with higher cognitive functions. Samples taken from arrays of electrodes show that the knowledge is within the sort of spatiotemporal patterns of briefly stationary bursts of electrical potential differences (Pockett et al., 2009; Ramon et al., 2009; Freeman and Quian-Quiroga, 2013). The bursts are generated by masses of the cortical neurons located 10-30 mm below the scalp surface. They're signals that are involved with electrical noise from scalp muscles located 2-5 mm beneath in the scalp surface. Proper grounding is required both for the participants and equipment and it's strongly advisable to avoid lights and magnets near the measuring devices to reduce the impact of environmental electrical disturbances on the measured EEG signals. With these hints and practices, it might be possible to ideally collect data, which is fairly clean without filters. This study aims at obtaining a transparent reading of the frontoparietal cortex covering sensory-motor activity employing a non-invasive scalp EEG array with 48 densely-spaced (0.5 cm spacing) spring-loaded dry electrodes supported the successful technology described by (Liao et al., 2012). We conducted the spatio-temporal analysis using Power Spectral Density (PSD) both times and spatial domains, PSDt and PSDx, respectively. As we progressed with our analysis, we became convinced that distinguishing space and time domains is simply a convenient reductionism for analysis sake, whereas space-time appears together unified object in brain dynamics.