The EEG-guided meditation and what it may offer

Do everyone benefit equally from the same meditation technique?

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During the first decade of twenty-first century the delay in psychophysiological adaptation became especially noticeable through abruptly increased rates of neuropsychiatric and psychosomatic disorders among the human population of industrially developed countries. Another sign of fatal desadaptation is the increased cases of technogenic catastrophes due to a human error. The amount of information that humans create continues to grow massively and the world becomes more instrumented and interconnected leading to a high informational stress. Novel response strategies must constantly be developed and old ones abandoned. Worries has been expressed that the processes of psychophysiological adaptation of humans to an increasing speed of life and amount of information are much slower than the dynamics of technological and industrial progress of societies.

At the same time, having from the birth high functional potential – an astronomical number of elements, each one known to have plenty of nonlinearities – the human brain should have enormous psychophysiological resources allowing the human organism adapt to a very broad spectrum of external conditions, including the fast change of complex environmental situations with many unknowns and not obvious underlying regularities, as well as to the informational stress. Activation of such resources would be one of the most productive paths to maintain the healthy life-style in the modern world. Here the meditation and yoga techniques could be effective. Through history yogis and sages have claimed that there is a higher potential in humans to enhance balance, peace and coordination.

Despite the numerous scientifically proven positive effects of mediation/yoga on the human organism (stress reduction, mood elevation, and increased life expectancy of the mind and its cognitive functions, decreased blood pressure and improved functioning of the immune system), the concrete neurophysiological mechanism of such processes have been not understood for a long time. Only recently neurophysiologists start to uncover the brain processes that are directly related to meditation/yoga effects and that, at the same time, could themselves be influenced (modified) by meditation/yoga exercises. We are about to find out how and why the brain is able to improve itself.

Many of published papers have reported significant physiological changes in the brain during meditation/yoga, thus proving the causal effect link. At the same time, not all changes could be interpreted in a positive way. Some of the brain activity changes seem to be quite similar to those changes that characterize some known pathological conditions. For example, slowing of alpha waves and shift to theta waves, as well as decreased inhibition and hyper-excitability of cortical structures are often found in some meditation/yoga practitioners. Cortical disinhibition and hyper-excitability are usually associated with dysfunction of glutamate and GABA neurotransmission, which together with the EEG slowing is a known characteristic of many pathological conditions, including epilepsy, cognitive impairment and Alzheimer's disease. Generally, in some people meditation/yoga can have adverse health effects, inducing psychological and physical problems ranging from muscle spasms, facial tics, insomnia to hallucinations and psychotic breakdowns (see for example work of Dr. Margaret Singer and Dr. Janja Lalich, collected case histories from 70 clients seeking treatment for problems that began during meditation practice). Such unexpected findings raise concern about suitability of every

particular meditation/yoga technique for a particular individual. It looks that not any meditation/yoga technique is suitable for everyone.

If it so, then the second question is how one could understand which technique would be the most beneficial for her- or him-self. Here the objective assessment of brain functional state such as electroencephalogram (EEG) could be the most helpful, since it allows to identify the individuals who are most likely to exhibit positive alterations in psychophysiological functioning during concrete technique of meditation/yoga, and these would guarantee the efficient use of meditation as a therapeutic procedure. Quantitative EEG (qEEG) is digitally recorded electrical activity generated by the brain. In general, EEG is obtained using electrodes placed on the scalp with a conductive gel. In the brain, there are millions of neurons, each of which generates small electric voltage fields. The aggregate of these electric voltage fields create an electrical reading which electrodes on the scalp are able detect and record.

qEEG technique which measures a specific electrical activity in the cortex has been recognized to reflect functional state of the brain, levels of cognitive engagement, cognitive processing, skill integration, recalling relevant information and arousal regulation (just to mention a few). In this sense qEEG is a “natural” window into the human brain. It gives objective results on how meditation affects different functions in each individual brain.

Based on numerous scientific studies in cognitive neuroscience and advanced mathematical analysis of qEEG it is possible to quantify objectively the mental aspects of performance such as focus and attention, information processing speed, stress regulation, emotions and overall brain resources.

As scientific studies have been shown, various meditative states (those that involve focus on an object and those that are objectless) reached due to practice of a particular meditation technique are associated with different EEG spatio-temporal and oscillatory signatures and such signatures are directly related to baseline neuropshychological profiles of practitioners. Therefore if one knows in advance his/hers individual EEG profile, he or she could choose the meditation/yoga technique which would be most suitable and in such a way diminish the risk of negative effects.

In this context individual EEG profile allows for better comprehension by the individuals, coaching staff and trainers which cognitive skills are strong and which are weak. Thus, individual EEG profile provides a better guide to selecting individualised training protocols which permit people unlock the full potential of their brains.