

# Mapping Mental Outcome of Yoga on Stressed subjects by Neuroscientific Methods (EEG, fNIRS)

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## ABSTRACT

The rationale of this study is to find the scientific explanations and reasons by neuroscientific examination methods for the association between the Neuroscience and the Yoga in terms of its possible effect and affect over the brain and body. In spite of the recent advancements in this field, there are still quite a few unanswered questions related to cognition in relation to affective neurosciences. This is in a sincere attempt to understand the brain mechanisms which is responsible for the entire cognitive domain. Yoga which includes several mental and physical exercises has a huge potential to address most of the cognitive problems. Meditation techniques are expected to have a relation with respect to various neural activity neural circuitry. Establishing a correlation is the motto of this study.

## 1. Introduction

Yoga has been the subject of research in the previous couple of decades for helpful purposes for current pandemic sicknesses like mental pressure, stoutness, diabetes, hypertension, coronary illness, and constant obstructive pneumonic malady. Singular examinations report useful impact of yoga in these conditions, showing that it tends to be utilized as nonpharmaceutical measure or supplement to tranquilize treatment for treatment of these conditions. Be that as it may, these examinations have utilized just yoga asana, pranayama, as well as brief times of contemplation for remedial purposes (Taneja, 2014). Yoga is derived from the work YOG in Sanskrit and is gathering of physical, mental, and otherworldly practices or trains which started in antiquated India. Yoga is one of the ancient Hindu philosophical agreements. As indicated by Katha Upanishad, one of the 108 antiquated Upanishads of India. Since yoga involves yoga encompasses diverse outlines of exercises, postures, and inculcating them appropriately helps to improve muscle strength, stamina, immune stability, perpetual sharpness, intellect, remembrance, emotional stability and altogether maintain an encouraging physical and psychological health it is a perfect tool to tackle depressive disorder by all means

## 2. Yoga

Yoga is taken as a tool to analyze the impact it is creating over stressed subjects when subjected to it. There exists always a relation between the precise practices such as yoga and mind and body. When undergoing such practices people exhibit predictable and distinctive states which can be proved by certain cognitive or physical features or events phenomenally observable to the practitioner. The state instigated is said to predictably affect both personality and body such that, by initiating that state more than once, a professional can purportedly utilize it to upgrade desirable traits and repress unfortunate ones. The practices are steady as in the capacity to actuate the planned state should enhance after some time, with the end goal that an accomplished professional ought to reflect in a way that is better than a beginner. From the conventional viewpoint, this change is checked particularly by two wonderfully reportable highlights:

the securing of specific characteristics (cognitive, emotional or physical), or potentially the event of specific occasions (psychological, passionate or physical). At last, the training used to prompt the state must be adapted, more often than not from a reflection educator who is said to be a virtuoso in the training. That instructor will likewise fill in as a manual for the training in order to help the professional in enhancing the capacity to create the state.

The many techniques employed include the visualization of various syllables or other items at specific points in the body as a means to alter the flow of mental energy; physical exercises, including breathing exercises; and an array of other techniques, including manipulation of the diet. Propelled experts can produce new information that would not exist without continued mental preparing. These data encompass either meditative states or traits induced by meditation. Meditative states refer to the transient alterations of experience voluntarily cultivated by a given meditation practice (i.e. bodily awareness, relaxation, emotions, and so on). Personalities refer to the lasting changes in these magnitudes that persist in the practitioner's daily experience regardless of being actively engaged in meditation (Lutz, D Dunne, & J Davidson, 2007).

## 3. A Paradigmatic Framework of Study

Keeping Yoga Methodology as a variable it is suggested that Systematic Yoga activity will have an impact on Positive Mental health overcoming Cognitive and Emotional traits such as stress. The objective is to find out the causes influencing various parts of the brain.

The framework will contain the following

- Experiment Based Markers will be recorded as a first step eg: *frontal lobe change detection*
- Hippocampal activity vs cognitive difference
- Different paths(ventro)

A well-constructed and expert guided set of experiments in the following domains are going to be conducted over control and target groups to find out the eventuality. The stimulus are designed based on parameters such as i) Perception and

Attention ii) Memory iii) Perceptual Representation iv) Representation of Meaning and v) Reasoning.

The basic details of the experimentation study are as follows

- i) Nature of Stimulus (5 as mentioned above)
- ii) Appearance time for stimulus
- iii) Colour of screen before and after stimulus (Neutral preference Colour)
- iv) Intra trail durations (Few seconds)
- v) Paradigm (Mixed: Attention, Local & Emotional)
- vi) No of trails (At least 20 Trails per paradigm per type of stimuli / Subject)

The framework is divided into three phases

#### Study- Phase-I

The volunteers are categorized into

- i) Low Stressed
- ii) Medium Stressed and
- iii) Highly Stressed

Based on a stress evaluating set of questionnaires (scaling based) as recommended by the experts. Then all the groups are subjected to recording of the neural activity of patterns in response to the stimulus given by the designed experiments. Both the control and the test group are evaluated with the help of EEG/fNIRS at the initial stage. The Low stressed can be presumed as Control group and the rest as target group.

#### Study- Phase-II

The target groups are enrolled into following classification based on the recommendation of the expert.

- i) Daily Yoga training for a span of 15 days
- ii) Weekly Yoga training for a span of 4 weeks (Any 2 days in a week)

#### Study- Phase-III

After the afore mentioned durations the volunteers are categorized into three subdivisions

- i) Daily Respondents
- ii) Weekly Respondents
- iii) No Training Respondents

The entire process of Phase-I is repeated over the three categories and the neural activities are recorded after the stipulated duration. Comparative analysis over the pre and post impact of yoga over the subjects are assessed and a predictive model with ANN

is expected to be built to predict the effect of yoga over the subjects in a long term based on the given input parameters

#### 4. "Meditation/YOGA" in the context of Neuroscientific study

From a neuroscientific perspective, the first promising claim made by Buddhist contemplative traditions is that experience is not a rigid, predetermined and circumscribed entity but rather a flexible and transformable process. In this context, emotions, attention and introspection are enduring and labile processes that need to be understood and studied as

skills that can be trained, similar to other human skills like music, mathematics or sports. For example, neonatal rodents exposed to varying levels of maternal licking and grooming develop very different behavioral phenotypes. Those animals that receive high levels of licking and grooming (the rodent equivalent of highly nurturing parenting) develop as more adaptable and relaxed adults. For example, the cerebrum of a specialist, such as a chess player, a cab driver or an artist, is practically and fundamentally not quite the same as that of a non-master. London taxi drivers have bigger hippocampi than coordinated controls and the measure of time the individual has functioned as a taxi driver anticipated the extent of the posterior hippocampus (E A Maguire et al., 2000).

Further work by this group suggests that these differences in hippocampal size are the results of experience and training as a cabdriver and not a consequence of pre-existing differences in hippocampal structure (Eleanor A. Maguire et al., 2003). Likewise, research on depression indicates that patients with mood disorders exhibit structural differences in several brain regions including the hippocampus and territories with the prefrontal cortex; significantly, at least some of these differences are strongly associated with the cumulative number of days of depression across the patients' lifetime (Sheline, 2003). According to Urry and team that even very brief short-term training (30 minutes) in emotion regulation can produce reliable alterations in brain function. It is observed that a two month course in mindfulness-based stress reduction (MBSR) can produce alterations in patterns of prefrontal brain activity that we have previously found to accompany positive affect (Davidson et al., n.d.).

Cortical brain regions associated with attention, interoceptive, and sensual processing were found to be profuse for a group of mid-range physicians than for corresponding controls (the meditator participants had an average 40 minutes of daily practice of Insight meditation for an average of 9 years).

Quite literally, the question here is whether mental training can affect the body in a way that will have a significant impact on physical health. It is in this way as often as possible guaranteed that the investigation of meditation will add to our general comprehension of the neural premise of consciousness.

Empirical proof unmistakably demonstrates that just a particular arrangement of neurons in the cerebrum takes an interest in any given moment of consciousness. In fact, many emotional, motor, perceptual and semantic processes occur unconsciously. These unconscious processes are usually circumscribed brain activities in local and specialized brain areas (Dehaene & Naccache, 2001). It has been speculated that the neural action is critical for consciousness most likely includes the transient and persistent arrangement of dissipated mosaics of practically concentrated brain regions, as opposed to any single, highly localized brain process or structure (Dehaene & Naccache, 2001; Llinás, Ribary, Contreras, & Pedroarena, 1998; SINGER, 2006; Tononi & Edelman, 1998). A common theoretical proposal is that each moment of conscious awareness involves the transient

selection of a distributed neural population that is both integrated or coherent, and differentiated or flexible, and whose members are connected by reciprocal and transient dynamic links. The perceptual selection in rivalry is not completely under the control of attention, but can be modulated by selective attention (Ooi & He, 1999). Evidence suggests in particular that the frequencies of the perceptual switch can be voluntarily controlled (Lack, 1978)

It is possible that long-term practitioners of Focused Attention meditation can gain a more thorough control of the dynamic of perceptual switch than naïve subjects, and that they can also refine their descriptions of the spontaneous flow of perceptual dominance beyond the mere categories of being conscious of one or another percept, leading possibly to new brain correlates.

Long-term training in Compassion meditation is said to weaken egocentric traits and change the emotional baseline. Mindfulness/ Awareness meditation intends to encounter the present nowness, and it influences the "attention benchmark" by diminishing diversions or dream like thoughts. In this way, meditative practices are generally designed to cultivate specific qualities or features of experience that endure through time relatively independent of ongoing changes in somatosensory or external events. These qualities are thought to gradually evolve into lasting traits. When conceptualizing the notion of a baseline, perhaps the most useful approach is to consider a baseline in terms of the capacity for living systems to maintain their identity despite the fluctuations that affect them. In the

scientific context, the concept of a baseline plays an important role in characterizing a broad variety of biological phenomena. It is in this sense that the notion of a baseline is related to the ongoing identity of an organism.

Furthermore, given the sensitivity that most scrutinizing customs show to this sort of issue, the look for standard changes all through the continuum of mental preparing is a general procedure that can possibly be connected to clear up mind brain body cooperations at numerous informative interactions at many explanatory levels, including brain chemical, metabolic or electrical activity, the immune system, the cardiovascular system, and the hormonal system.

## 5. Conclusion

Our current understanding of the functional role of these tonically active networks is still limited. Evidence from brain imaging indicates that the posterior part of this tonically activated network (posterior cingulate cortex, precuneus and some lateral posterior cortices) are important for the continuous gathering of information about the world around and possibly within us, whereas the anterior part (ventro and dorsal ventral prefrontal cortices) are important for the ongoing association between sensory, emotional and cognitive processes that participate in spontaneous self-referential or introspectively oriented mental activity (Gusnard, Raichle, & Raichle, 2001). Such studies may bring the correlation between yoga and brain in a better sense in neuroscientific means.

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