Research Supporting NeuroMeditation

NeuroMeditation incorporates neuroscience and mental health. We at the NeuroMeditation Institute divide meditation practices into four categories: Focus, Mindfulness, Open Heart, and Quiet Mind. Each style has the potential to improve different mental health concerns.

A growing body of research supports the different effects achieved by different meditation styles. Additional studies also support the use of EEG neurofeedback to guide individuals through the process of learning to meditate and achieve specific brainwave patterns in specific regions of the brain.

The following citations are key for understanding the basis of NeuroMeditation. Please email us at info@neuromeditationinstitute.com to request access to our full research library with additional studies.

Brandmeyer, T., & Delorme, A. (2020). Closed-loop frontal midline neurofeedback: A novel approach for training focused-attention meditation. *Frontiers in Human Neuroscience, 14.* 10.3389/fnhum.2020.00246

Findings from this research help lay the groundwork for the development of brain training protocols and neurofeedback applications that aim to train features of the mental states and traits associated with focused-attention meditation.

Participants who received eight sessions of the adaptive frontal-midline theta meditation neurofeedback protocol were able to significantly modulate frontal-midline theta over frontal electrodes using focused-attention meditation strategies relative to their baseline by the end of the training and demonstrated significantly faster reaction times on correct trials during the n-back working memory task assessed before and after the meditation neurofeedback protocol. No significant differences in frontal theta activity or behavior were observed in the active control participants.

Fingelkurts, A.A., Fingelkurts, A.A., & Kallio-Tamminen, T. (2015). EEG-guided meditation: A personalized approach. *J. Physiol*. https://dx.doi.org/10.1016/j.jphysparis.2015.03.001

Quantitative electroencephalogram (qEEG) is a suitable tool that allows identification of individual neurophysiological types. Using qEEG screening can aid developing a meditation training program that maximizes results and minimizes risk of potential negative effectives. This brief theoretical-conceptual review provides a discussion of the problem and presents some illustrative results on the usage of qEEG screening for the guidance of meditation personalization.

Fox, K., Dixon, M., Nijeboer, S., Girn, M., Floman, J., Lifshitz, M., Ellamil, M., Sedlmeier, P., & Christoff, K. (2016). Functional neuroanatomy of meditation: A review and meta-analysis of 78 functional neuroimaging investigations. *Neuroscience and Biobehavioral Reviews, 65,* 208-228. http://www.elsevier.com/locate/neubiorev

This meta-analysis supports the neurophysiological dissociability of meditation practices, while also raising avenues for future research. Meditation is a family of mental practices that encompasses a wide array of techniques employing distinctive mental strategies. This study systematically reviewed 78 functional neuroimaging (fMRI and PET) studies of meditation and used activation likelihood estimation to meta-analyze 257 peak foci from 31 experiments involving 527 participants. The study found reliably dissociable patterns of brain activation and deactivation for four common styles of meditation (focused attention, mantra recitation, open monitoring, and compassion/loving-kindness), and suggestive differences for three others (visualization, sense-withdrawal, and non-dual awareness practices). Overall, dissociable activation patterns are congruent with the psychological and behavioral aims of each practice. Some brain areas are recruited consistently across multiple techniques—including insula, pre/supplementary motor cortices, dorsal anterior cingulate cortex, and frontopolar cortex—but convergence is the exception rather than the rule. A preliminary effect-size meta-analysis found medium effects for both activations (d = 0.59) and deactivations (d = −0.74), suggesting potential practical significance.

Tarrant, J., (2020). Neuromeditation: The science and practice of combining neurofeedback and meditation for improved mental health. In E.E. Editor & F.F. Editor (Eds.), *Smart Biofeedback – Perspectives and Applications* (pp. 1-16). InTechOpen. 10.5772/intechopen.93781

Beginning meditators often complain that they do not know if they are “doing it right” or give up before realizing significant benefits. Advanced meditators often reach a plateau and struggle to reach “the next level” of their practice. Modern researchers and practitioners are finding a possible new solution to these challenges by using EEG biofeedback to increase awareness of subtle states of consciousness and speed the learning process. By tracking brainwave activity in specific regions of the brain, we can tell if someone is focused or relaxed. We can tell if the mind is wandering, if they are engaged in body-based emotions, or if they have entered a space of internal quiet. By monitoring this activity and connecting it directly to the intent of the meditation, it is possible to help meditators learn to quickly enter a desired state of consciousness and maintain this state for increasing periods of time. This chapter will describe the early research conducted in this area along with an original case study conducted by the author. In addition, this technology can also be used as a treatment intervention for ADHD, anxiety, depression, and PTSD.

Travis, F., & Shear, J. (2010). Focused attention, open monitoring and automatic self-transcending: Categories to organize meditations from Vedic, Buddhist and Chinese traditions. *Consciousness and Cognition*. 10.1016/j.concog.2010.01.007

This research sheds light on the common mistake of averaging meditations together to determine mechanisms or clinical effects. This paper proposes a third meditation-category—automatic self-transcending— to extend the dichotomy of focused attention and open monitoring proposed by Lutz. Automatic self-transcending includes techniques designed to transcend their own activity. This contrasts with focused attention, which keeps attention focused on an object, and open monitoring, which keeps attention involved in the monitoring process. Each category was assigned EEG bands, based on reported brain patterns during mental tasks, and meditations were categorized based on their reported EEG. Focused attention, characterized by beta/gamma activity, included meditations from Tibetan Buddhist, Buddhist, and Chinese traditions. Open monitoring, characterized by theta activity, included meditations from Buddhist, Chinese, and Vedic traditions. Automatic self-transcending, characterized by alpha1 activity, included meditations from Vedic and Chinese traditions. Between categories, the included meditations differed in focus, subject/object relation, and procedures.

Valk, S.L., Bernhardt, B.C., Trautwein, F., Bockler, A., Kanske, P., Guizard, N., Collins, D.L., & Singer, T. (2017). Structural plasticity of the social brain: Differential change after socio-affective and cognitive mental training. *Science Advances*. Retrieved January 31, 2020, from https://advances.sciencemag.org/

Longitudinal findings indicate structural plasticity in well-known socio-affective and socio-cognitive brain networks in healthy adults based on targeted short daily mental practices. These findings could promote the development of evidence-based mental training interventions in clinical, educational, and corporate settings aimed at cultivating social intelligence, prosocial motivation, and cooperation.

van Lutterveld, R., Houlihan, S.D., Pal, P., Sacchet, M.D., McFarlane-Blake, C., Patel, P., Sullivan, J.S., Ossadtchi, Al, Drunker, S., Clemens, B., & Judson, A. (2016). Source-spaced EEG neurofeedback links subjective experience with brain activity during effortless awareness meditation. *NeuroImage*, 10.1016/j.neuroimage.2016.02.047

Findings of this study support the feasibility of using EEG neurofeedback to link an objective measure of brain activity with the subjective experience of effortless awareness. This suggests potential utility of EEG neurofeedback for meditation training.

Research subjects reported decreased posterior cingulate cortex (PCC) activity corresponded with effortless awareness, with high median confidence ratings. They showed high moment-to-moment median correspondence ratings between PCC activity and subjective experience of effortless awareness. Subjects were able to volitionally control the PCC signal in the direction associated with effortless awareness by practicing effortless awareness meditation.