

PARIETO-OCCIPITAL ALPHA BAND POWER AND CONNECTIVITY REGULATE ATTENTIONAL AND DECISIONAL PERFORMANCE

Laura Marzetti¹, Antea D'Andrea¹, Ole Jensen², Antonino Raffone³ & Vittorio Pizzella¹

¹Department of Neuroscience, Imaging and Clinical Sciences, University "G. d'Annunzio" of Chieti-Pescara, Chieti, Italy; ²Department of Psychology, Sapienza University of Rome, Rome, Italy; ³School of Psychology, University of Birmingham, Hills Building, Birmingham, B15 2TT, United Kingdom

Grant 66/16

Background: Meditation is as an awareness training resulting in alterations in attention, perception and cognition. Theoretical and empirical papers show effects of meditation on focused and sustained attention. Conceivably, improved attention skills also impact on perceptual sensitivity and decision-making performance although scarce evidence exists.

Aims: We aim at understanding whether and how mindfulness meditation training affects attention, perception and decision making and the rhythmic interplay between brain networks involved in these processes.

Method: We designed a visual perceptual decision-making task (study1) in meditators and non-meditators. Subjects monitor incoherently moving dots for periods of coherent motion. Additionally, we used in-house multivariate connectivity to detect behaviorally relevant long-range synchronization in a cued visual attention paradigm in non-meditators (study2). MEG data were acquired in both studies. In study 1, modulations of power were analyzed in response to coherent motion. In study 2, modulations of connectivity were analyzed in response to cue presentation.

Results: In study 1, in non-meditators a sustained decrease of alpha power is observed in occipital and parietal areas after coherent motion, the strength of which varies with the task difficulty. Such a decrease is not observed in meditators. In study 2, an increase in alpha connectivity between occipital and parietal areas in response to the cue presentation is found.

Conclusions: In both studies a role for alpha in enhancing or reducing inhibition of parietal and occipital regions is observed. A Brain Theory of Meditation has also been put forward providing theoretical support for the role of power and connectivity modulations.

Keywords: Mindfulness meditation, Phase synchrony, Magnetoencephalography, Brain Rhythms

Publications:

D'Andrea, A., Chella, F., Marshall, T.R., Pizzella, V., Romani, G.L., Jensen, O., & Marzetti, L. (2019). Alpha and alpha-beta phase synchronization mediate the recruitment of the visuospatial attention network through the Superior Longitudinal Fasciculus. *Neuroimage*, 188, 722–732. doi: 10.1016/j.neuroimage.2018.03.004.

Raffone, A., Marzetti, L., Del Gratta, C., Perrucci, M.G., Romani, G.L., & Pizzella, V. (2019). Toward a brain theory of meditation. *Progress in Brain Research*. 244, 207-232. doi: 10.1016/bs.pbr.2018.10.028.

Croce, P., Zappasodi, F., Marzetti, L., Merla, A., Pizzella, V., & Chiarelli, A.M. (2019). Deep Convolutional Neural Networks for Feature-Less Automatic Classification of Independent Components in Multi-Channel Electrophysiological Brain Recordings. *IEEE Transactions on Biomedical Engineering*, 66 (8), art. no. 8587223, 2372-2380. doi: 10.1109/TBME.2018.2889512

E-mail contact: laura.marzetti@unich.it