PercUP seminar UNIPD
Periodic and aperiodic features of the EEG power spectrum: towards new possibilities for cognitive neuroscience.

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Brain activity is characterised by a 1/f-like distribution where power exponentially decreases as the frequencies increase. Such distribution indicates the presence of an aperiodic component of the power spectrum, which can be differentiated from neural oscillations. For decades, aperiodic activity has been configured only as noise to be removed to emphasise brain oscillations. However, different studies provided evidence about its functional significance from a neurophysiological standpoint. Specifically, the spectral slope, which refers to the "speed" of the power decay across frequencies, has been associated with neuronal excitability while the offset, corresponding to a broadband shift in power, has been associated with neuronal firing rate. Alterations of these features have been found throughout development and aging and have been linked with different neurological conditions. In particular, evidence about alterations of aperiodic features computed from resting-state EEG in adults with Developmental Dyslexia and their link with performance at reading tests will be discussed. Beyond the relevance for clinical aspects, the interest in aperiodic features recently grew higher as few studies showed that aperiodic activity emerged as an important predictor of individual differences in cognitive performance across different domains (e.g., memory, processing speed, perceptual sensitivity). Moreover, from a methodological standpoint the parametrisation of aperiodic features offer new possibilities for the study of neural oscillations per se, allowing for a clearer estimation of oscillatory activity while protecting interpretations from confounds. With respect to these aspects, we found modulations of aperiodic and "aperiodic-corrected" oscillatory activity following transcranial alternating current stimulation (tACS) during a visual crowding task. Therefore, the study of aperiodic features of the power spectrum provides novel perspectives for cognitive neuroscience while also offering tools for the neurophysiological characterisation of different clinical conditions.

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