

JORDAN BROWN, MAHMOOD HOSSAIN, & TADASHI KATO, Fairmont State University, Fairmont, WV. A computational framework for analyzing the impact of psychological distress on EEG hemispheric synchrony.

Interhemispheric neural synchrony plays an important role in maintaining balanced emotional states. The goal of this study was to develop a computational framework to investigate how psychological distress influences hemispheric synchrony in EEG activity under varying conditions. Time-series EEG signals were recorded from participants performing five resting and active tasks. Data were collected from eight hemispheric channel pairs in 90-second segments, each corresponding to a distinct emotional state (e.g., anxiety, anger, depression).

EEG signals were segmented into two-second epochs following bandpass and notch filtering. Epochs exceeding a 250-microvolt threshold were rejected, and segments containing fewer than 20 valid epochs were excluded. The remaining epochs were categorized into theta, alpha, beta, and gamma frequency bands. Hemispheric synchrony was computed using ordinary coherence, imaginary coherence, and phase-locking value (PLV), with imaginary coherence used to account for volume conduction effects. Mean synchrony values were computed for each emotional state, channel pair, and frequency band.

Statistical analyses included mixed and one-way ANOVA with false discovery rate correction and Bonferroni-adjusted post-hoc tests. Linear regression results were interpreted using uncorrected p-values and meaningful R^2 values. Results indicated a strong association between depression and increased theta-band synchrony in central and parietal pairs. Anger showed broader effects in the alpha band across frontal pairs and in the theta band across frontotemporal pairs. Imaginary coherence revealed significant depression-related effects in the beta band at occipital pairs. These findings highlight the value of integrating PLV and coherence-based measures to better characterize EEG connectivity patterns associated with psychological distress.