**Data Preprocessing and Analysis**

For each block, the signals were divided into 5-second epochs, and band-pass filters were applied to remove artifacts and extract relevant frequency ranges: 0.5–50 Hz for EEG and 20–50 Hz for EMG. Filtered data was stored for subsequent analysis.

**Spectral and Statistical Feature Extraction**

For each epoch, power spectral density (PSD) was calculated using the Welch method with a window size of 512 samples and an overlap of 256 samples. Frequency bands (delta: 0.5–5 Hz, theta: 5–9 Hz, alpha: 9–13 Hz, beta: 13–30 Hz, gamma: 30–100 Hz) were defined, and relative power for each band was computed by normalizing with the total power. Additionally, the root mean square (RMS) of the EMG signal was calculated as a measure of muscle activity.

**Clustering and Classification**

Gaussian Mixture Models (GMM) with five clusters were applied to EMG RMS values to classify muscle activity into distinct levels. Cluster assignments were used to identify patterns in the data, with thresholds determined from cluster centroids. The fifth centroid corresponded to the lowest muscle activity, while the first centroid represented the highest muscle activity.

**Delta \* Centroid Analysis**

To evaluate the interaction between delta power and EMG activity clusters, the delta power values were multiplied by the corresponding cluster centroid values obtained from the GMM. This computation was performed separately for the first and second blocks under control and experimental conditions. The resulting data was stored for subsequent comparisons between conditions.