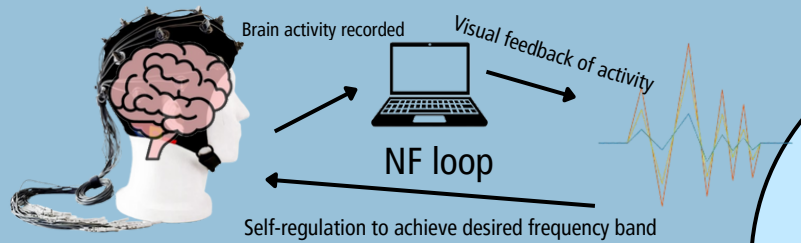
INVESTIGATING THE RELATIONSHIP BETWEEN ALPHA, BETA AND GAMMA NEUROFEEDBACK AND COGNITIVE PERFORMANCE TO PREDICT TRAINING OUTCOMES

RDDHIMA BORA, SHREWSBURY

Research question: Can early changes in alpha, beta, and gamma EEG activity during neurofeedback training (NFT) predict which individuals will show long-term improvements in cognitive performance?

Hypothesis: Individuals who show early increases in the trained frequency band (upper-alpha, beta, or gamma) will demonstrate greater cognitive gains across training.



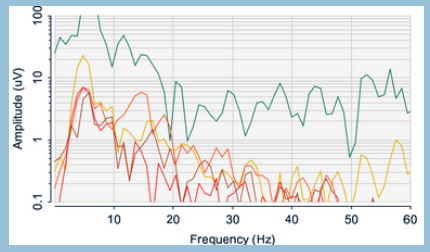


Figure 1: Baseline upper-alpha amplitude graph from Session 1.

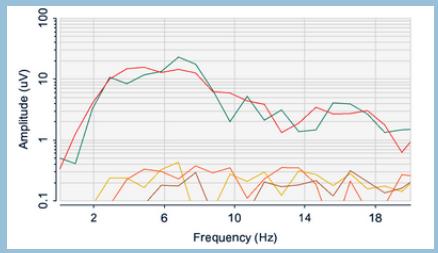


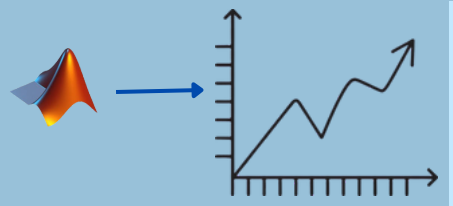
Figure 2: Final upper-alpha amplitude trends from Session 1. Additional data will include beta and gamma early-session changes.

EARLY BRAINWAVE CHANGES CAN PREDICT NEUROFEEDBACK SUCCESS AND GUIDE PERSONALIZED COGNITIVE TRAINING.

Data from the first NFT session shows visible amplitude stability and increase within the alpha band. More NFT sessions can help create a predictive slope of how NFT will be effective over time.

Major Criteria: Predict effects from alpha, beta, and gamma NFT within early sessions.

Conduct neurofeedback training sessions → Use MATLAB and FFT analysis methods to create a predictive learning slope



Compare the predictive power of alpha, beta, and gamma frequency bands. If time allows, train an ML model to create predictions.

Early neurofeedback sessions show measurable changes in EEG amplitude, particularly within the trained frequency band.

Alpha-band data suggest that amplitude stability and early increases may reflect an individual's ability to learn neural self-regulation. As additional sessions are collected, learning slopes across alpha, beta, and gamma bands will be analyzed to determine which frequencies best predict cognitive improvement. These findings support the idea that early EEG responses can serve as biomarkers of neurofeedback trainability and long-term cognitive outcomes.