This project aims to develop and apply multilayer hypernetworks as a tool for analysis of electroencephalography data (EEG). The approach of network connectivity for neuroscience has pushed the computational sphere forward and multilayer networks can extend this approach to work through time. EEG data was collected from participants during two cognitive tasks (updating and inhibition) embedded with stimuli of different valences (positive, negative, and neutral). The EEG signal was decomposed into the time-frequency domain to focus on alpha (8-12Hz) and theta (4-8Hz) frequency bands. Within-band phase lock values (PLVs) between electrodes (nodes) and a probabilistic analysis was done to determine if high PLVs repeated in certain times or conditions. The results showed that conditional probability is statistically significant between all valence groups in alpha and two valence groups in theta. This suggests that the role of alpha is broader in the context of emotional information in the task. Further research is required to see if these findings extend to power and other metrics. A conditional probabilistic approach was shown to have a lot of potential for further insight into network connectivity. Specifically, hypernetworks can contain this information and be predictive of neural activity across timepoints.