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Poster presentation

Synchrony-based integration of EEG and fMRI-BOLD in cognitive state transitions

Nathan Dees*[1], Linda Larson-Prior[2], Tracy Nolan[2], David Politte[2], Fred Prior[2] and Sonya Bahar[1]

Address: [1]Center for Neurodynamics, University of Missouri – St. Louis, St. Louis, MO 63121, USA and [2]Mallinckrodt Institute of Radiology, Washington University Medical School, St. Louis, MO 63110, USA

Email: Nathan Dees* - nathan.dees@umsl.edu

* Corresponding author

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Background

Both EEG and the blood-oxygen-dependent contrast (BOLD) signal used in fMRI are believed to reveal re-entrant signaling among complexly connected and dynamically reconfigured neural networks. As such, both signals show measurable responses to changes in global brain state. Simultaneous EEG and fMRI were collected during quiet waking rest after which subject's were asked to fall asleep. Using stochastic phase synchronization between low frequency amplitude envelopes (<0.2 Hz) created from alpha-band (8 – 12 Hz) filtered scalp EEG data and BOLD time series calculated from regions of interest in left and right visual cortex, we examined the feasibility of integrating information contained in both these signals.

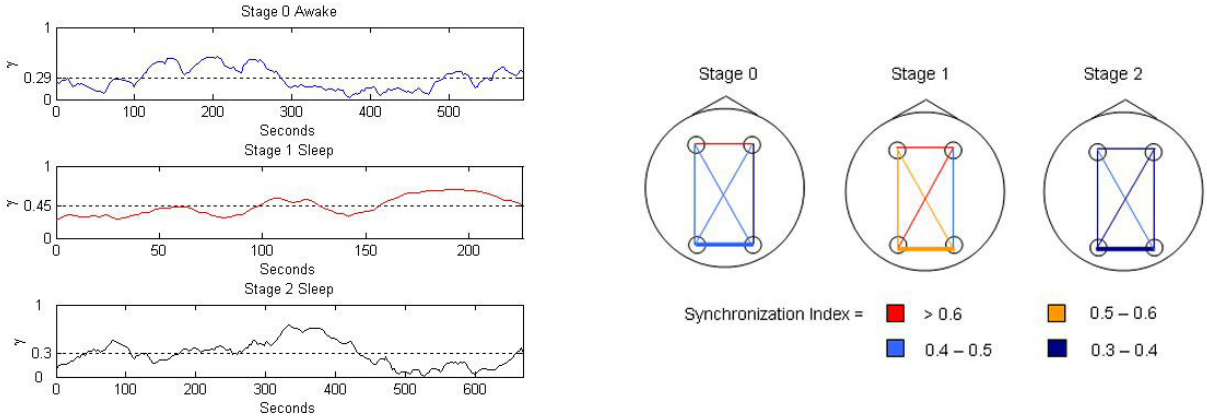

Figure 1
BOLD signal and low frequency EEG envelope data. (Left) BOLD synchronization index over time between left and right visual cortex. (Right) Regional synchronization using low frequency EEG.

Both the BOLD signal and the low frequency EEG envelope data from left and right visual cortices show increased synchronization in the descent into sleep (stage 1; Figure 1).

Conclusion

It has been suggested that low frequency oscillations (< 30 Hz) in scalp-recorded EEG organize spatially disparate regions [1] and data further suggests that slower rhythms can entrain such high frequency activity [2]. Recent data shows that low frequency oscillatory activity in the BOLD signal (< 1 Hz) correlates activity in functional neural networks. Based upon these data, we suggest that very low frequency oscillation (0.1 Hz) common to both EEG and BOLD fMRI can be used to link the temporal resolution of neurophysiological activity seen in EEG to the excellent spatial resolution of the BOLD signal to create a fuller picture of neural functional activity.

References

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