Title: A multiarea Hill-Tononi thalamocortical network model evaluated with proposed measures of consciousness

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Abstract: 1.33

The cellular and network mechanisms underlying brain states and conditions permitting or suppressing conscious experience remain elusive. Computational models of neuronal networks can help interpret experiments and generate testable predictions. We have implemented in the neural simulator NEST a ‘toy brain’ comprising left and right hemispheres, each with three cortical areas and associated thalamic nuclei. Each neuronal layer comprises hybrid conductance-based/integrate-and-fire neurons based on [1]. Intrahemispheric connectivities are based on [2], with modifications to synaptic weights to enhance the spread of a TMS-pulse response. Interhemispheric connectivities are based on [3]-[6]. For comparison with ECoG and EEG data, the principal output of the model is the local field potential (LFP) estimated as the sum of synaptic current magnitudes [7]. Similar to [1] and [2], transition from a wake-like state to a sleep-like state is effected by increasing the AMPA, persistent sodium, potassium leak and sodium/calcium-activated potassium conductances. Average cellular firing rates for wake,sleep are: 2.4 Hz (excitatory); 4.6 Hz (inhibitory). At the cell level, alternating depolarized UP and hyperpolarized DOWN states are evident in sleep, and these give rise to slow oscillations in the LFP, as observed experimentally. Various candidate measure of consciousness are found to differ between simulated wake and sleep: Lempel Ziv complexity, amplitude coalition entropy, synchrony coalition entropy [8], decoder based integrated information [9], geometric integrated information [10], integrated stochastic interaction [11], mutual information [3], and multi mutual integrated information [12].