Title:
Unconscious perception of visual stimuli in Blindsight patients from a Dynamic Functional Connectivity standpoint

The most insightful and direct access to non-conscious perception of visual signals is provided by studies of patients with lesions to the primary visual cortex (V1), resulting in a phenomenon called Blindsight. In this study, we implemented a Dynamic Functional Connectivity (DFC) analysis, to look at the brain dynamics and their relationship to Blindsight functions. Moreover, we evaluated the Effective Connectivity (EC) of each dynamical state through a whole brain modeling approach, in order to assess local differences in the brain functional structure of Blindsight patients.

Our DFC analysis involved 16 patients with right V1 lesions and 17 healthy subjects (HC). To assess the residual visual ability of the lesioned patients and categorize them into Blindsight positive (B+) and Blindsight negative (B-) we employed a behavioral task. Through a DFC analysis we defined a set of metastable states of brain dynamics. Then, we characterized how these attractors differ between the three groups, studying their dynamics and topological properties and evaluating their EC.

Based on clustering analysis of brain dynamics we found 4 metastable states. From a dynamical point of view, B+ show a higher permanence in the state related to the Default Mode Network (DMN). For what concerns B-, they exhibit a more probable self-transition within the somato-motor state. Looking at the topological properties of each state, we found an enhanced inter-hemispheric connectivity within the DMN state for B+. Moreover, looking at the integration of the information within the networks represented by each dynamical state, we observed an enhanced integration capability for B+ in the Global Signal (GS) state, i.e., a state of high synchronization of the activity throughout the brain. Thanks to the evaluation of the EC within each state, we observed an enhanced connectivity of the right posterior Thalamus with secondary visual areas within GS and DMN states, confirming the crucial role of subcortical structures in conveying visual information toward non-lesioned visual areas in Blindsight patients.