# A Theory of Information Processing for Large-Scale Brain Networks

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**Abstract:** How much information does a large-scale cortical network process when it's conscious and/or unconscious? Can the complexity of such networks be quantified and be coupled to brain function and consciousness? Recently, measures of network complexity such as integrated information have been proposed. However, we show that these approaches are computationally intractable for realistic brain networks. We propose alternative quantifications that allow precise computations for large-scale networks including their stochastic dynamics, plasticity and perturbations. Even for stable stationary dynamics our measure shows that the processed information of a realistic network sharply rises at the edge of criticality. In particular, we demonstrate that the specific topology of the human brain generates greater informational complexity compared to randomly rewired networks. We analyze to what extent these results and their associated measures are specific to levels of consciousness or simply a hallmark of how neuronal systems process information.