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Comment

Beyond localized and distributed accounts of brain functions Comment on "Understanding brain networks and brain organization" by Pessoa

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Recent evidence in cognitive neuroscience lends support to the idea that network models of brain architecture provide a privileged access to the understanding of the relation between brain organization and cognitive processes [1]. The core perspective holds that cognitive processes depend on the interactions among distributed neuronal populations and brain structures, and that the impact of a given region on behavior largely depends on its pattern of anatomical and functional connectivity [2,3].

This new avenue of inquiry stands at the intersection among different disciplines such as mathematics, computer science and neuroscience, and is eminently and comprehensively reviewed by Pessoa [4]. In addition, Pessoa's approach to brain networks goes beyond state-of-the-art in several innovative and challenging ways.

The most notable innovation concerns the emphasis on the multidimensional functional profile of a brain structure [5]. This provides an empirically funded platform to map structure to function in a many-to-many manner, as well as a heuristically useful perspective to overcome the longstanding struggle between localized and distributed accounts of brain functions [6,7]. In fact, the coexistence between segregation and integration emerges from the node's connectivity profiles and defines the node's functional fingerprint in a dynamic and context-dependent fashion [5].

Clearly, node's definition at the large scale [8] is an unresolved issue because clustering the brain in hierarchically organized sub-networks could not always have a univocal solution. Moreover, the convergence between parcellations based on anatomical and functional connections often remains ambiguous [9].

Lastly, because the same brain region is engaged in a range of processes depending on the network it is affiliated with in a specific moment and context [10], then the structure-function mapping can be resolved only considering the dynamic and context-dependent changes in the network architecture [11,12]. This perspective, although introducing a number of problems, such as a clearer definition of context and of time-scale, seems well suited to couple structure to function and to recast the brain in the environment. In fact, the opportunity to study exogenous and temporally defined

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perturbations of network dynamics due to sensory input or task-related activities fosters research to move beyond the traditional approach of partitioning brain networks on the base of task free or resting-state functional connectivity [13–15].

In summary, Pessoa gives a useful guideline for the future study of the brain networks. In addition the author proposes a panel of innovative techniques to characterize brain networks that make the review a good starting point for researchers interested in this field of study.

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