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Small-world organization of self-similar modules in functional brain networks MARIANO SIGMAN, Buenos Aires University, LAZAROS GALLOS, HERNAN MAKSE, City College of New York — The modular organization of the brain implies the parallel nature of brain computations. These modules have to remain functionally independent, but at the same time they need to be sufficiently connected to guarantee the unitary nature of brain perception. Small-world architectures have been suggested as probable structures explaining this behavior. However, there is intrinsic tension between shortcuts generating small-worlds and the persistence of modularity. In this talk, we study correlations between the activity in different brain areas. We suggest that the functional brain network formed by the percolation of strong links is highly modular. Contrary to the common view, modules are self-similar and therefore are very far from being small-world. Incorporating the weak ties to the network converts it into a small-world preserving an underlying backbone of well-defined modules. Weak ties are shown to follow a pattern that maximizes information transfer with minimal wiring costs. This architecture is reminiscent of the concept of weak-ties strength in social networks and provides a natural solution to the puzzle of efficient infomration flow in the highly modular structure of the brain.

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