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The role of symmetry in the regulation of brain dynamics. EVELYN TANG, CHAD GIUSTI, University of Pennsylvania, MATTHEW CIESLAK, SCOTT GRAFTON, University of California, Santa Barbara, DANIELLE BASSETT, University of Pennsylvania — Synchronous neural processes regulate a wide range of behaviors from attention to learning. Yet structural constraints on these processes are far from understood. We draw on new theoretical links between structural symmetries and the control of synchronous function, to offer a reconceptualization of the relationships between brain structure and function in human and non-human primates. By classifying 3-node motifs in macaque connectivity data, we find the most prevalent motifs can theoretically ensure a diversity of function including strict synchrony as well as control to arbitrary states. The least prevalent motifs are theoretically controllable to arbitrary states, which may not be desirable in a biological system. In humans, regions with high topological similarity of connections (a continuous notion related to symmetry) are most commonly found in fronto-parietal systems, which may account for their critical role in cognitive control. Collectively, our work underscores the role of symmetry and topological similarity in regulating dynamics of brain function.

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