Neural reuse in the functional organization of the brain: much more than mirrors

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Abstract
An emerging class of theories concerning the functional structure of the brain takes the reuse of neural circuitry for various cognitive purposes to be a central organizational principle. According to these theories, it is quite common for neural circuits established for one purpose to be exapted (exploited, recycled, redeployed) during evolution or normal development, and put to different uses, often without losing their original functions. The re-use of mirror system circuits for action understanding and social interaction more generally is one well known example of neural reuse, but there are many many other examples. This paper will review the evidence for neural reuse as a pervasive feature of brain organization, and discuss its implications for embodied cognition; our understanding of the nature of and relations between cognitive functions; and the evolution and development of the brain.

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