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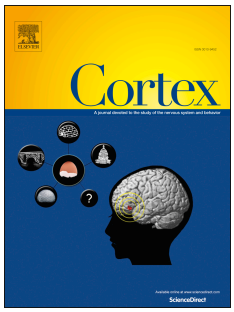

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Laurel S. Morris, Kwangyeol Baek, Valerie Voon

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Distinct cortico-striatal connections with subthalamic nucleus underlie facets of compulsivity

Laurel S Morris[1,2], Kwangyeol Baek[1], Valerie Voon[1,2,3]

1. Department of Psychiatry, University of Cambridge, Addenbrooke's Hospital, Cambridge CB2 0QQ, United Kingdom
2. Behavioural and Clinical Neuroscience Institute, University of Cambridge, Cambridge CB2 3EB, United Kingdom
3. Cambridgeshire and Peterborough NHS Foundation Trust, Cambridge, United Kingdom

Abstract

The capacity to flexibly respond to contextual changes is crucial to adapting to a dynamic environment. Compulsivity, or behavioural inflexibility, consists of heterogeneous subtypes with overlapping yet discrete neural substrates. The subthalamic nucleus (STN) mediates the switch from automatic to controlled processing to slow, break or stop behaviour when necessary. Rodent STN lesions or inactivation are linked with perseveration or repetitive, compulsive responding. However, there are few studies examining the role of latent STN-centric neural networks and compulsive behaviour in healthy individuals. We therefore aimed to characterize the relationship between measures of compulsivity (goal-directed and habit learning, perseveration, and self-reported obsessive – compulsive symptoms) and the intrinsic resting state network of the STN. We scanned 77 healthy controls using a multi-echo resting state functional MRI sequence analyzed using independent components analysis (ME-ICA) with enhanced signal-to-noise ratio to examine small subcortical structures. Goal directed model-based behaviour was associated with higher connectivity of STN with medial orbitofrontal cortex and ventral striatum and more habitual model-free learning was associated with STN connectivity with hippocampus and dorsal anterior cingulate cortex. Perseveration was associated with reduced connectivity between STN and premotor cortex and finally, higher obsessive – compulsive inventory scores were associated with reduced STN connectivity with dorsolateral prefrontal cortex. We highlight unique contributions of diffuse cortico-striatal functional connections with STN in dissociable measures of compulsivity. These findings are relevant to the development of potential biomarkers of treatment response in neurosurgical procedures targeting the STN for neurological and psychiatric disorders.