Title: Identifying Flexible Hubs: A Novel Mechanism for Flexible Cognitive Control

Authors: Michael W. Cole, Joset A. Etzel, & Todd S. Braver

The rapid flexibility of the human brain is impressive. For instance, we recently demonstrated that humans are able to learn novel tasks in seconds. The common proficiency of healthy adults at using complex new technologies (e.g., computers, 'smart' phones) further demonstrates the brain's ability to reconfigure to a variety of possible arbitrary states. We postulate that such flexible cognitive control arises in part from what we term 'flexible hubs' – highly connected regions that can flexibly change their connectivity patterns depending on task demands. We present a novel graph theoretic method for identifying putative flexible hubs – globally reconfigured connectivity (GRC). GRC uses functional connectivity MRI to identify regions with the most brain-wide connectivity changes among tasks. We used GRC to identify regions showing high connectivity variation across 64 unique tasks. One such putative flexible hub was a recently identified portion of dorsolateral prefrontal cortex (DLPFC) whose global connectivity at rest predicts general fluid intelligence. This finding suggests high DLPFC global connectivity at rest may allow for a large number of potential connectivity patterns to be used during tasks – increasing the flexibility of this region's connectivity and of the ability to implement cognitive control according to a variety of potential task demands.