Session 724 - Human Executive Functioning

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724.05 - Fmri adaptation vs pattern analysis: Evaluating methods for measuring human PFC representational geometry and dimensionality

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Abstract
The human prefrontal cortex (PFC) is necessary for the expression of flexible behavior and the activity of its neurons is known to code a variety of task variables. However, PFC representational geometry and its relationship to flexibility remain poorly understood. An important property of this geometry is dimensionality. High-dimensional representations of task variables may support flexibility in a neural network by providing a basis set for implementing rapid transitions between different task states. In highly trained macaques, lateral PFC representations of task variables approach maximum dimensionality and predict success on the task. In humans, the measurement of PFC representational geometry has been hampered by the relatively low reliability of fMRI BOLD activity patterns and the difficulty of decoding their information content. fMRI adaptation can potentially circumvent these problems by leveraging neuron-level repetition suppression to recover geometry and estimate dimensionality. Here we systematically evaluate fMRI adaptation and multi-voxel pattern analysis (MVPA) methods for their efficacy in providing reliable estimates of representational geometry and dimensionality across different regions of the brain. Participants were asked to solve a 3-dimensional, audio-visual parity classification task over five fMRI sessions. Leveraging a large amount of within-participant data, we estimated all pair-wise multi-voxel pattern distances and pair-wise repetition suppression effects in parcels across the brain. Additionally, we estimated representational dimensionality in each parcel using both multi-voxel pattern distances and repetition suppression effects. We report the reliability and cross-method correspondence of these two approaches to studying representational geometry in PFC and other regions across the human brain.

Abstract Citation