

Classification-based functional specialization of medial frontal cortex

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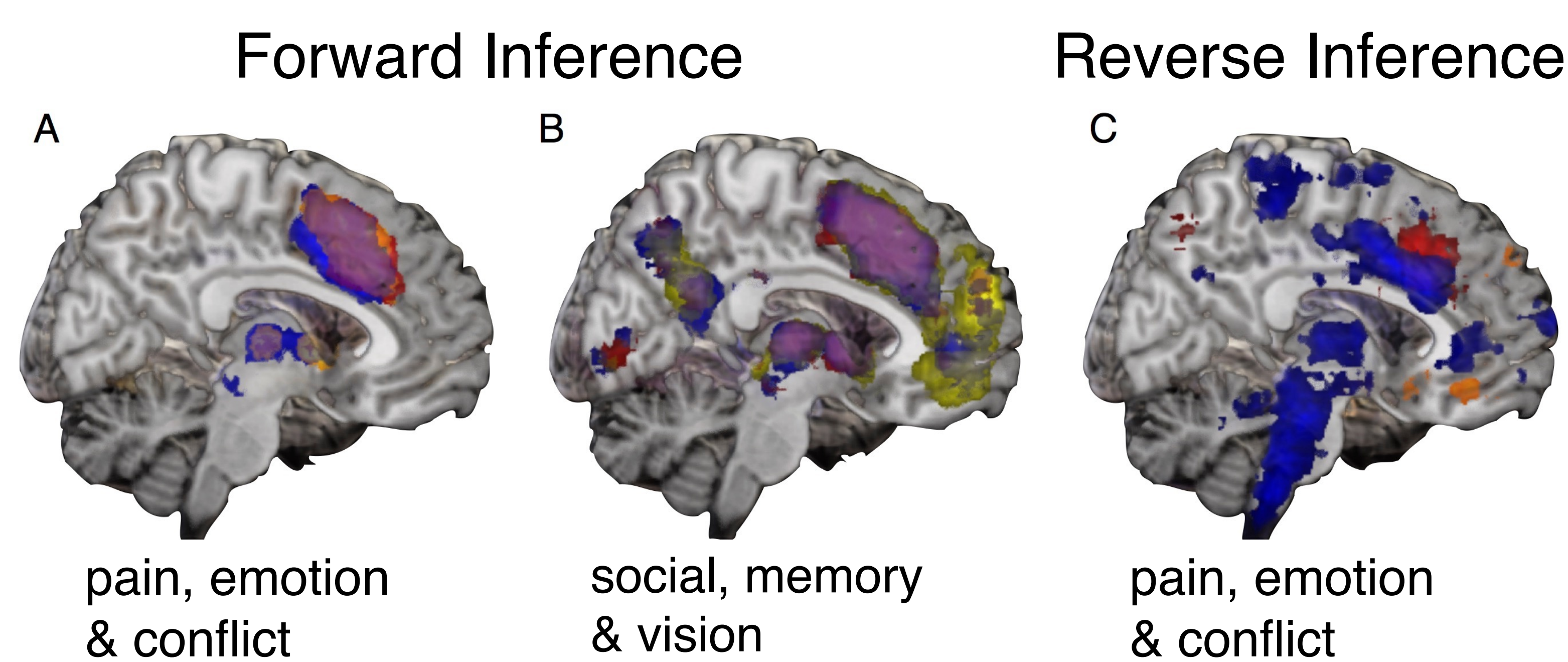


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Introduction

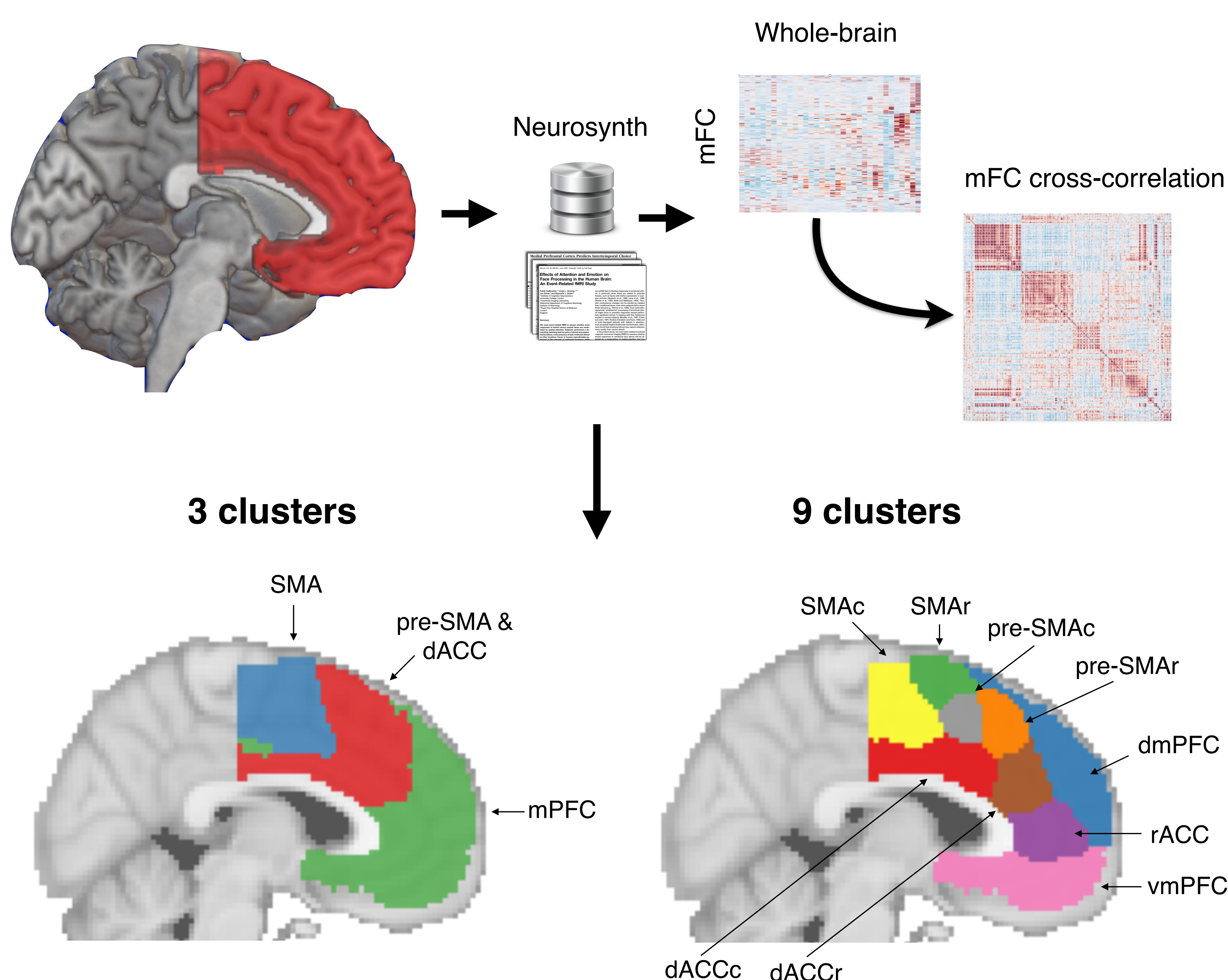
- Medial frontal cortex is active across many studies and supports a wide range of processes
- While there have been some meta-analyses of medial frontal cortex function, there have been no large-scale efforts that look at the *entire medial frontal cortex* and a *broad range of cognitive functions*, rather than specific subsets relevant to a specific literature
- Furthermore, some meta-analyses ignore the problem of reverse inference, which is particularly problematic mFC's high activation rate.



- Here, we apply a set of machine learning methods to a large-scale database of fMRI studies (Neurosynth) to:
 - 1) identify functionally dissociable sub-regions of mFC
 - 2) characterize their functional specialization and
 - 3) determine how specifically each region was associated with these cognitive processes

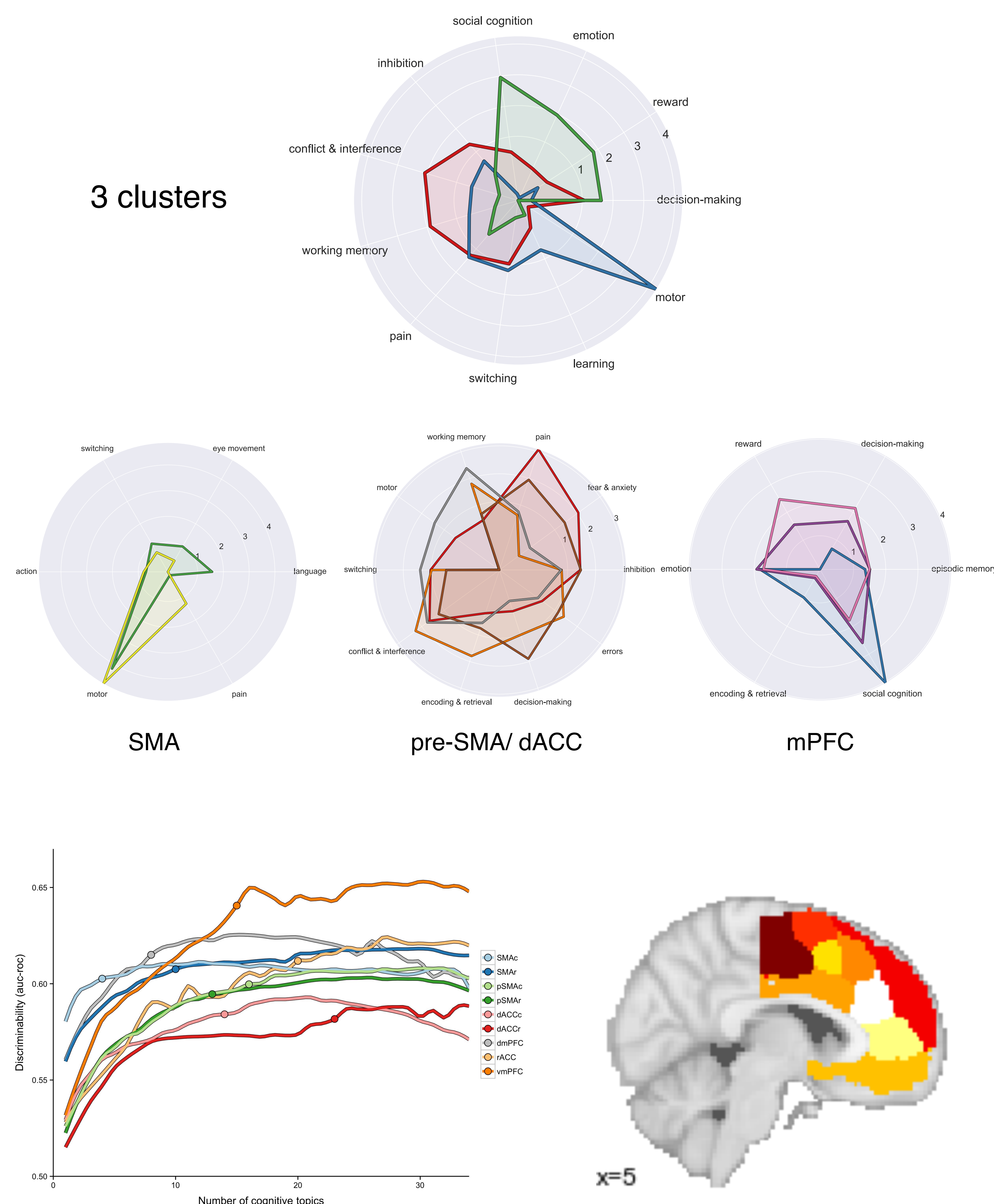
Parcellation of medial frontal cortex using meta-analytic coactivation

- Neurosynth (neurosynth.org): ~10000 fMRI studies¹
- Topic model of word frequencies in papers - semantics²



Functional specialization classification

- We classified if studies in the database activated each parcel based on the cognitive processes mentioned in the body of the articles in order to determine the functional specialization of mFC.



Conclusions

- The medial frontal cortex can be organized into three broad regions
- mPFC is vastly different from SMA and dACC
- dACC and SMA work to eventually output motor actions while mPFC is more involved with internally driven cognitive function
- Within each of these regions there is fine-grained functional specialization
 - For example, within dACC/pre-SMA, there is clear distinction between more affective (dACC) and more “cognitive” (pre-SMA) portions
 - pre-SMA is important for conflict resolution and EF, perhaps more so than dACC.
- rostral dACC and rACC may show the greatest functional complexity (e.g. diversity), while motor regions are low

References

1. Yarkoni, T., Poldrack, R. A., Nichols, T. E., Van Essen, D. C., & Wager, T. D. (2011). Large-scale automated synthesis of human functional neuroimaging data. *Nature Methods*
2. Poldrack, R. A., Mumford, J. A., Schonberg, T., Kalar, D., Barman, B., & Yarkoni, T. (2012). Discovering Relations Between Mind, Brain, and Mental Disorders Using Topic Mapping. *PLoS Computational Biology*.