Frontoparietal contributions to strategic criterion shifts during recognition memory

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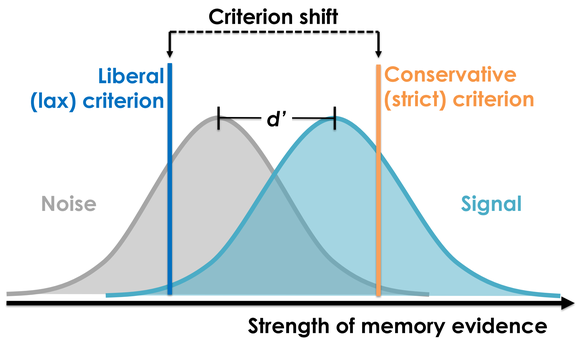
Introduction

Memories are imperfect. When faced with uncertain evidence, one must weigh the available information against a *decision criterion*. **Signal detection theory** offers a representative framework for quantifying both: 1) the ability to discriminate between old and new information (*d'*), and 2) the extent to which one is monitoring the decision evidence (*C*).



In situations of *varying uncertainty* (e.g. changing target likelihoods), performance might be aided by *flexible adaptation* of the decision criterion: we refer to this as **strategic criterion shifting.**

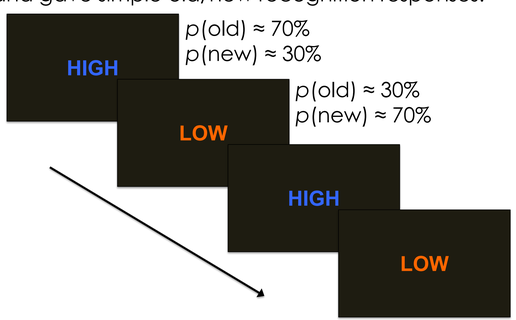
There are vast individual differences in these behaviors (Aminoff et al., 2012), with evidence to suggest that the tendency to be more liberal or more conservative on average is stable across time and different memory tasks (Frithsen et al., 2017; Kantner & Lindsay, 2012, 2014). However, the neural mechanisms underlying strategic criterion shifts have been underexplored.

Here, we present data from a large sample of healthy adults (*N* = 100) performing a recognition memory task during fMRI scanning in order to elucidate the neural substrates of on-line criterion shifting vs. the maintenance of a decision criterion.

Recognition Memory Task

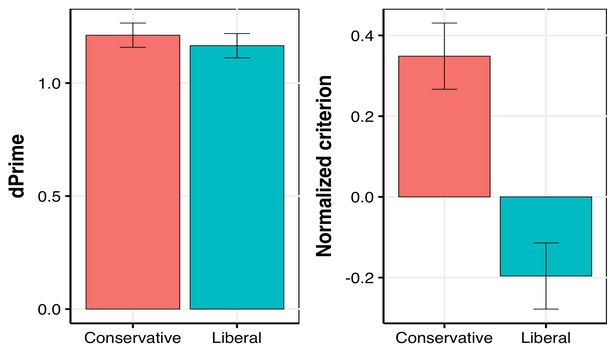
Encoding phase: 3 lists of 51 words each.

Test phase: 3 runs of 102 items each, alternating high (*liberal*; 70% old) and low (*conservative*; 30% old) target probability blocks (5-7 words/block). Probability conditions indicated by stimuli presented in **BLUE** or **ORANGE** font (colors counterbalanced). Participants were made explicitly aware of target contingencies and gave simple old/new recognition responses.

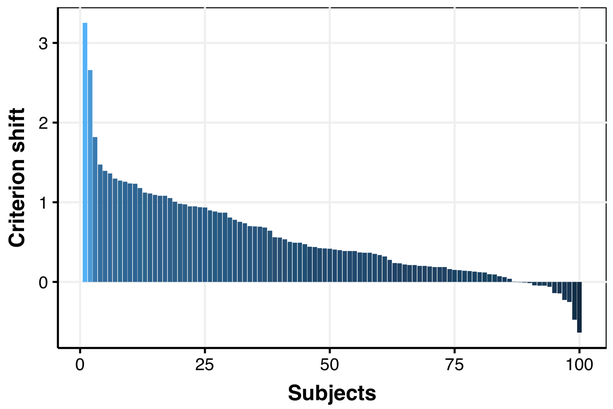


Behavioral Results

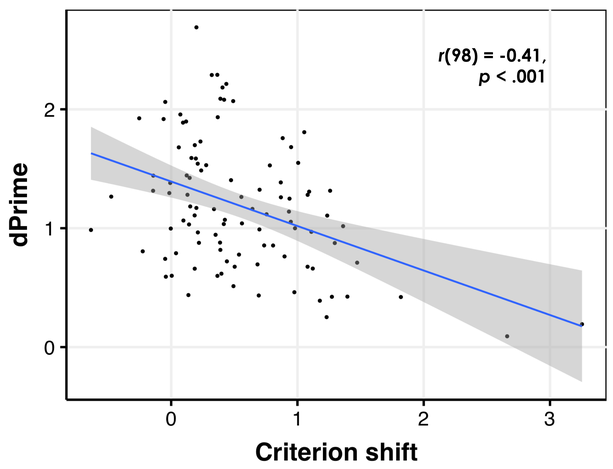
MEAN DISCRIMINABILITY AND CRITERION PLACEMENT IN LOW (CONSERVATIVE) AND HIGH (LIBERAL) TARGET PROBABILITY CONDITIONS



VAST INDIVIDUAL DIFFERENCES IN THE MAGNITUDE OF CRITERION SHIFTINNG



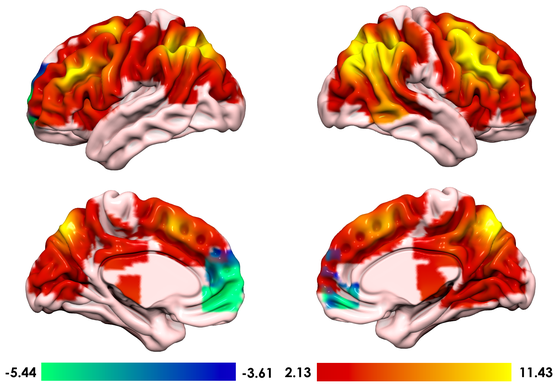
OVERALL PERFORMANCE (DISCRIMINIABILITY) WAS INVERSELY RELATED TO DEGREES OF CRITERION SHIFTING



Mass-Univariate Results

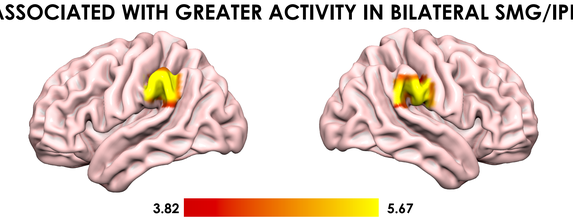
SWITCH > SAME

ADAPTING VS. MAINTAINING A DECISION CRITERION RECRUITS A WIDE SWATH OF FRONTOPARIETAL REGIONS



CONSERVATIVE SWITCH > LIBERAL SWITCH

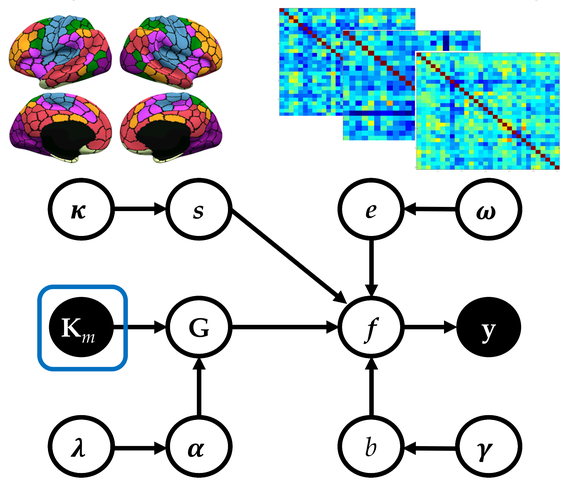
SWITCHING TO A CONSERVATIVE DECISION CRITERION IS ASSOCIATED WITH GREATER ACTIVITY IN BILATERAL SMG/IPL



Multivariate Pattern Analyses

SPARSE BAYESIAN MULTIPLE-KERNEL LEARNING

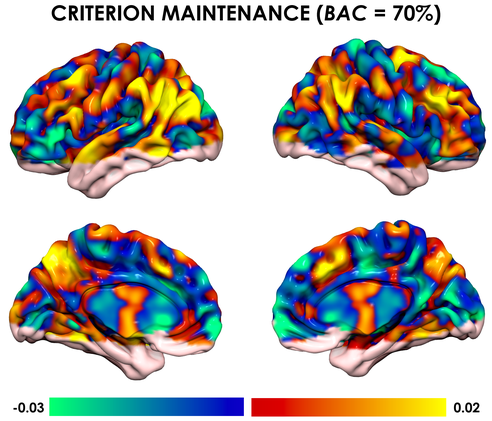
SBMKL offers a fully-probabilistic approach to classification (Gönen, 2016). We parcel the brain into 400 regions defined by the Schaefer atlas, build feature space representations (linear kernels) of switch/same activity in each region, and train a model to identify patterns that distinguish switching vs. maintaining a criterion. Importantly, this considers both *shared representations* of information across regions and the *unique contributions* of each region.



Classifying Switch vs. Same

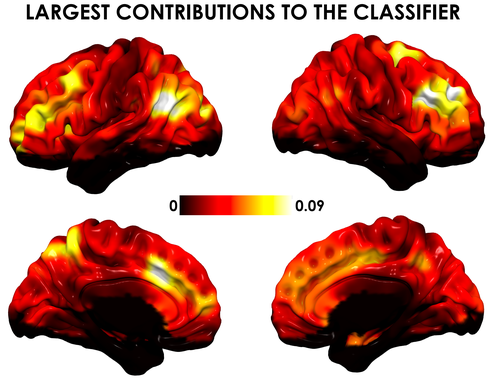
CROSS-VALIDATED MULTIVARIATE WEIGHT MAP

SBMKL DISTINGUISHED BETWEEN CRITERION SHIFTING VS. CRITERION MAINTENANCE (*BAC* = 70%)



KERNEL WEIGHTS: REGIONAL 'IMPORTANCE' MAP

FRONTOPARIETAL NODES OF THE CONTROL, DEFAULT MODE, AND ATTENTION/SALIENCE NETWORKS HAD THE LARGEST CONTRIBUTIONS TO THE CLASSIFIER



Summary

A broad network of frontoparietal regions contributes to strategic criterion shifts during recognition memory. Interestingly, however, inter-individual variation in shifting activity did not explain individual differences in shifting behavior—it is therefore crucial for future work to parse out decisional vs. memory-related components of these signals and how they might account for behavior.

References

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