



Functional Connectivity of Category-Specific Visual Regions During Rest is Modulated by Preceding Cognitive Processes

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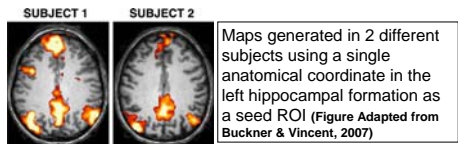
INTRODUCTION

> **Functional Connectivity (FC):** Structured patterns of low-frequency neural activity during rest reflect functional connectivity of dissociable brain systems.

(Biswal et al., 1995; Fox & Raichle, 2007)

> **fcMRI Region of Interest (ROI) Analysis:** Correlating spontaneous fluctuations in blood-oxygen-level dependent (BOLD) fMRI signal in a given seed ROI with all other brain voxels reveals distinct functional-anatomic networks.

> fcMRI can be used for functional localization and mapping of individual differences of these networks, typically using a given anatomical coordinate as a seed ROI, e.g.:



> The functional relevance of FC is not known, but it has been hypothesized that it may "reflect neural functions that consolidate the past, stabilize brain ensembles, and prepare us for the future". (Buckner & Vincent, 2007)

> RATIONALE AND HYPOTHESES:

1. We hypothesized that using individually defined functional ROIs as seed regions for fcMRI could increase specificity of functional network mapping across individuals.

2. If FC reflects processes such as consolidation and/or stabilization of neural ensembles, then it should be affected by recent experience, i.e., preceding cognitive processes.

METHODS & RESULTS

Subjects

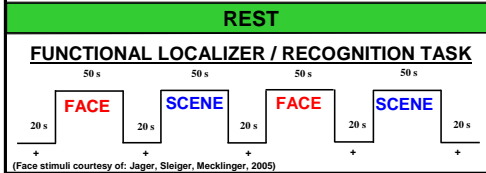
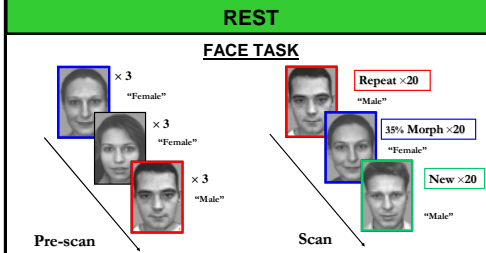
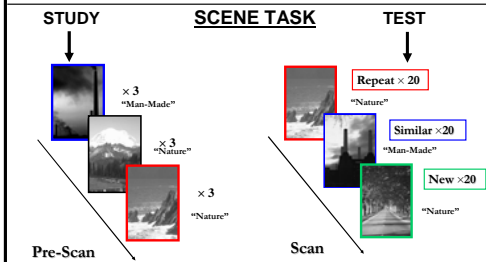
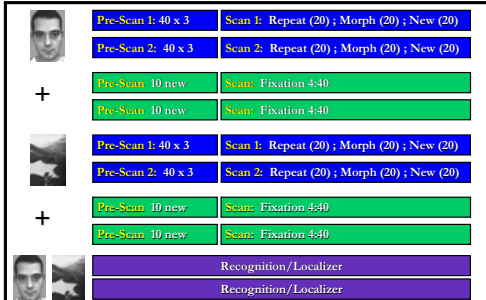
30 right-handed healthy young participants (17 male, mean age = 24.4 ± 3.7 yrs)
fMRI

Images collected on a Siemens Trio 3 Tesla scanner with 12-channel coil.
Functional images were acquired during rest runs in 4 sets of 112 axial images (36 × 4 mm isotropic contiguous voxels; TR = 2.5 s;); 2 rest runs followed a face classification task; two rest runs followed a scene classification task; order was counterbalanced across subjects.

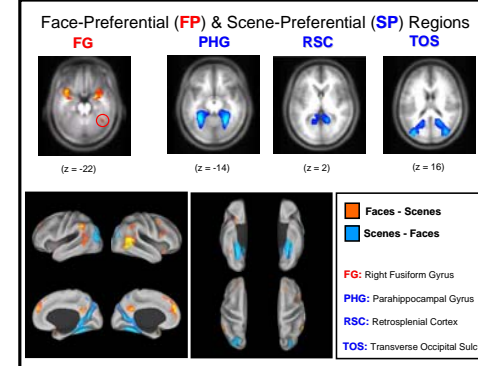
Task-based functional localizer runs acquired in 2 sets of 138 axial images (4 mm isotropic contiguous voxels; TR = 2.5 s; block design (50 s task; 20 s fix)

Statistical analyses conducted using FSL, fcMRI, and SPM2 software.

Study Design Overview

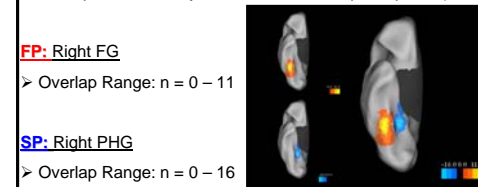


Functionally Defined ROIs: Group Level



Distribution & Overlap of FP & SP Regions

> Overlap of individually defined ROIs for all participants (n=30)

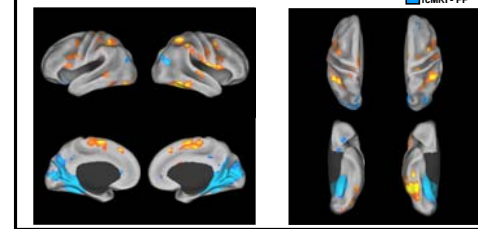


Functional Connectivity of FP & SP Regions

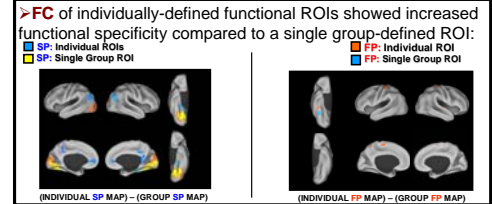
> FC of FP and SP was functionally-specific:

FP Connectivity: Contralateral FG, Dorsal Attention System

SP Connectivity: PHG, RSC, TOS

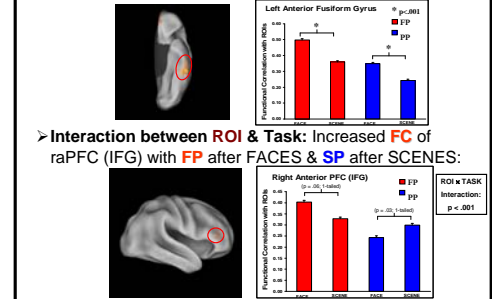


Group vs. Individually Defined ROIs



FC Modulated by Prior Cognitive Task

> Main effect of TASK: Increased FC of contralateral (left) anterior fusiform/inferior temporal region with both FP & SP after FACES vs. SCENES:



CONCLUSIONS

> Using individually defined functional ROIs as seeds for fcMRI analysis reliably increased functional specificity of functional network maps across individuals.

> These functionally specific patterns of FC during rest were modulated by the preceding cognitive task.

> These results provide preliminary evidence that FC during rest may be affected by recent cognitive experiences in functionally relevant brain networks.

References:

Biswal B, Yetkin FZ, Haughton VM, & Hyde JS (1995) Functional connectivity in the motor cortex of resting human brain using echo-planar MRI. *Magn Reson Med*, 34, 537-41.
 Fox MD & Raichle ME (2007) Spontaneous fluctuations in brain activity observed with functional magnetic resonance imaging. *Nat Rev Neurosci*, 8, 700-11.
 Buckner RL & Vincent JL (2007) Unrest at rest: Default activity and spontaneous network correlations. *Neuroimage*, 37, 1091-6.
 Jaeger T, Sailer KH, & Mecklinger A (2005) Picture database of morphed faces (MoFA); Technical Report. Psydok Online. URL: <http://psydok.sub.uni-saarland.de/volltexte/2005/505/>

This work was supported by NIH Grant MH060941 (DLS); and NIH Grant AG021910 & the Howard Hughes Medical Institute (RLB)