



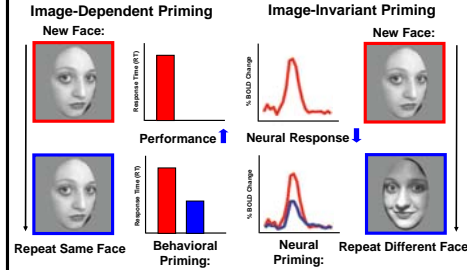
# Exposure to Variable Images of Unfamiliar Faces Improves Subsequent Recognition and is Associated with Image-Invariant Neural Priming Across Distributed Brain Regions



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## INTRODUCTION

- > The ability of humans to recognize familiar faces across variable viewing conditions is remarkable, and far superior to performance for unfamiliar faces
- > Exposure to variable views of faces may be necessary to build flexible face representations that facilitate recognition
- > Face processing occurs across distributed brain regions
- > **Repetition Priming:**
  - Useful tool for tracking the development of neural representations across brain regions



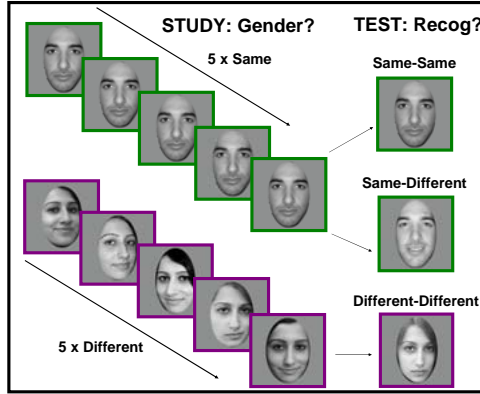
## > RATIONALE AND HYPOTHESES:

1. Exposure to multiple variable images of a face should facilitate formation of a flexible, abstract representation, improving subsequent face recognition.
2. A technique sensitive to coordinated activity across brain networks should reveal image-invariant neural priming for repeated unfamiliar faces. (cf. Davies-Thompson, et al., 2009)

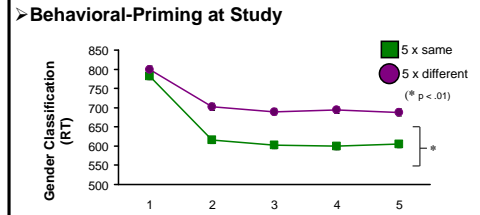
## METHODS & RESULTS

- Participants:**
- 17 right-handed healthy young participants (7 women, mean age = 22.4 ± 2.9 yrs)
- fMRI Acquisition:**
- > Images collected on a Siemens Trio 3 Tesla scanner with 12-channel head-coil.
  - > 8 event-related runs each consisted of:
    - Study Phase: Blocks of 5 consecutive repeated same (n=12) or different (n=8) faces
    - Test Phase: same-same; same-different; different-different; novel face (n=4 each)
    - Null-trials were randomly interspersed across both Study and Test phases
- fMRI Analysis:**
- Partial Least Squares (PLS: McIntosh, Chau & Protzner, 2004)**
- Determines a set of orthogonal latent variables that optimally relate the BOLD signal covariance across the brain with the experimental design
  - Statistical significance determined through permutation testing (500 permutations)
  - Reliability determined by bootstrap resampling with replacement (100 samples)

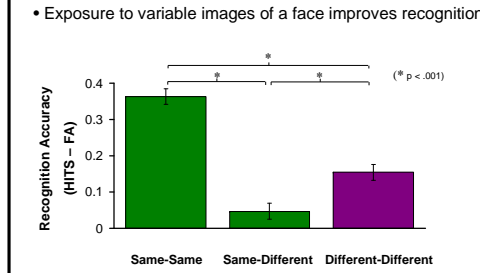
## Experimental Procedure



## Behavioral Performance



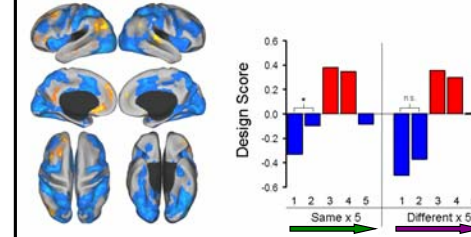
## > Recognition Performance at Test



## Task PLS: Study (Gender Classification)

### > Differential Neural-Priming for Repeated Same vs. Different Faces

- > **1st Latent Variable:** Dissociated repetitions & conditions
  - 55.4% of covariance explained ( $p < 0.001$ )
  - Early  $\downarrow$  activity in ventral visual & dorsal attention regions
  - Greater initial priming for same vs. different exemplars
  - Later  $\uparrow$  activity in memory related regions with repetition



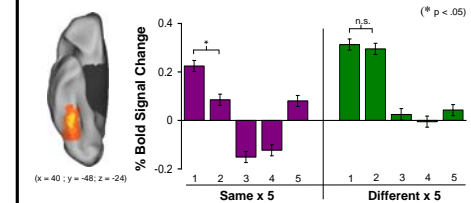
### > Behavioral PLS:

- Regions that explicitly covaried as a function of RT included left dorsolateral PFC & anterior temporal cortex

## ROI Analysis: Right Fusiform Gyrus

### > Differential Repetition Suppression in FFA for Repeated Same vs. Different Faces

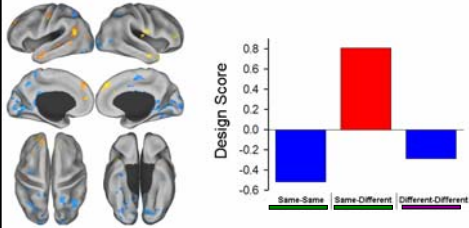
- > **ANOVA:** Main effects of Condition ( $p < 0.001$ ) & Repetition ( $p < 0.001$ ); Interaction ( $p < 0.005$ )
- Neural priming for same & different repeated exemplars
- Earlier and greater priming for same vs. different



## Task PLS: Test (Recognition)

### > Differential Neural Activity for Correct Face-Recognition Depending on Prior Study Condition

- > **1st Latent Variable:** Dissociated HITS for "same-different" condition from other 2 conditions
  - 58.4% covariance explained ( $p < 0.05$ )
  - Same-same and different-different recognition associated with rapid, automatic retrieval activity
  - Same-different recognition associated slower, effortful retrieval activity



## CONCLUSIONS

- > Behavioral & neural measures revealed image-invariant priming for repeated unfamiliar faces.
- > For repeated identical face-images, behavioral & neural priming were increased & neural priming had an earlier onset, relative to repeated different faces.
- > Exposure to variable images of faces facilitated subsequent face recognition.
- > Image-invariant neural priming occurred across a distributed network of brain regions
- > **Exposure to variable images of an unfamiliar face leads to formation of an abstract or image-invariant representation, distributed across a network of brain regions, that facilitates subsequent face recognition.**

References:  
 Davies-Thompson J., Gouws A. & Andrews T.J. *Neuropsychologia* 47, 1627-1635 (2009).  
 McIntosh A.R., Chau W.K. & Protzner A.B. *NeuroImage*, 23, 764-775 (2004).  
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