

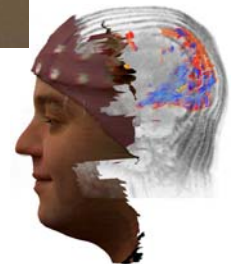
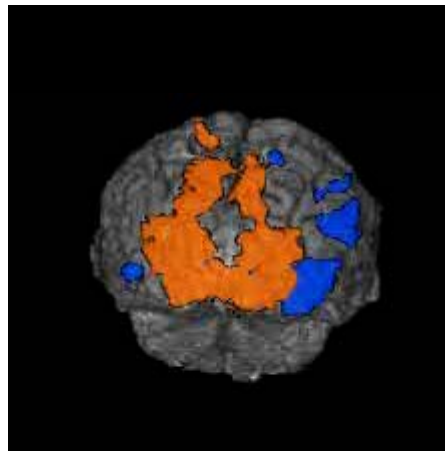
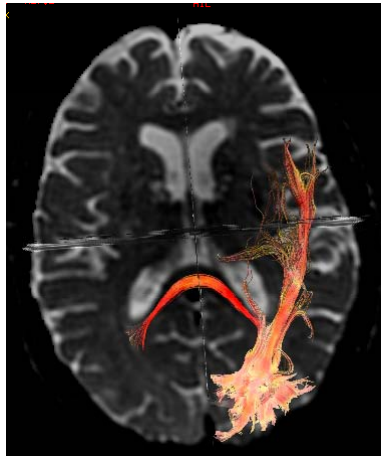
Cluster Analysis

-- Simultaneous inferences

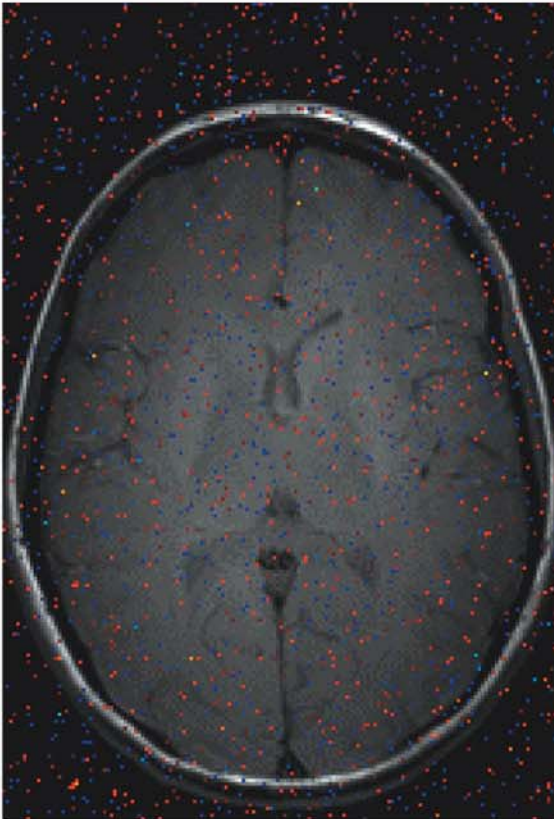
David C. Zhu, Ph.D.

Cognitive Imaging Research Center

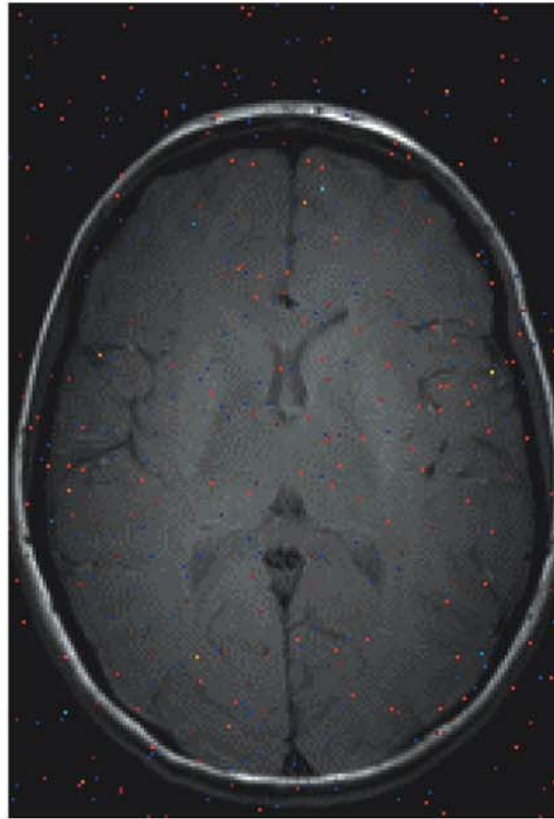
Departments of Radiology and Psychology



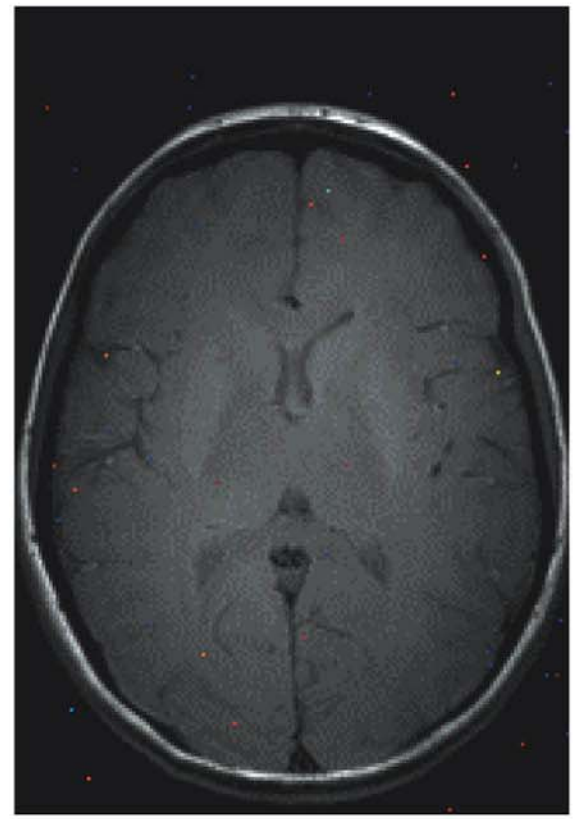
(A)



(B)

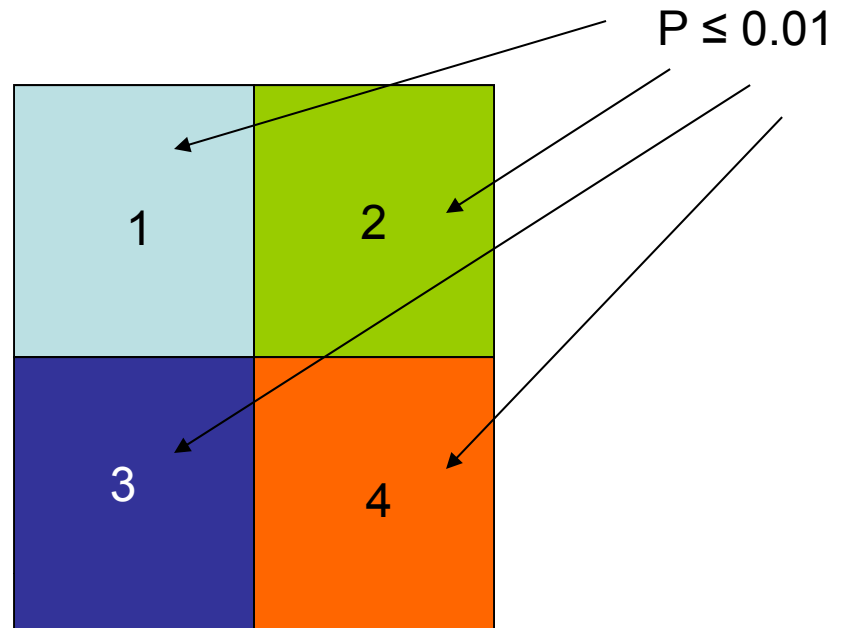
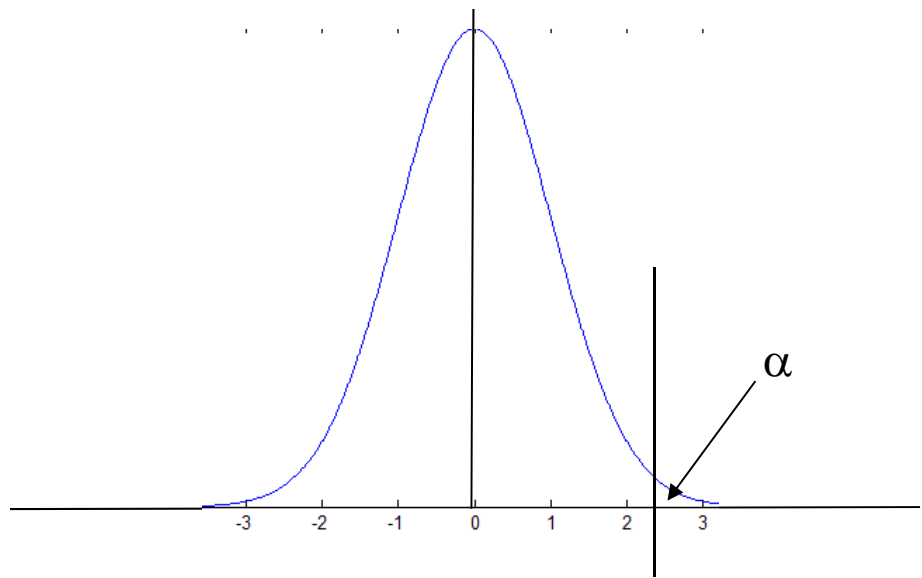


(C)



Bonferroni Correction: Assuming independent voxels.

$$\alpha_{\text{bon}} = \alpha/n$$



For each voxel, $\alpha = 0.01$, and
 $P(\text{no Type I error}) = P(\text{true negative}) = 1 - \alpha = 0.99$

For all four voxels together,

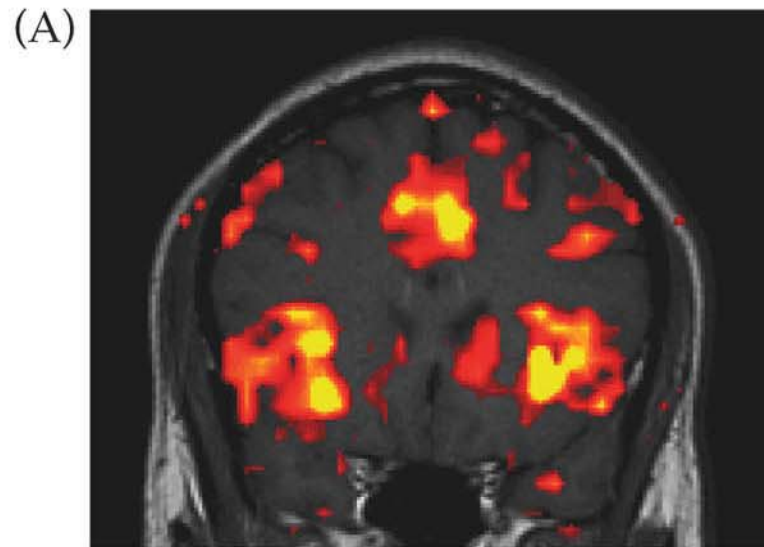
$P(\text{no Type I error}) = P(\text{true negative}) = 0.99^4 = 0.96$

$\alpha = 1 - P(\text{no Type I error}) = 1 - 0.96 = 0.04$ (the corrected P value)

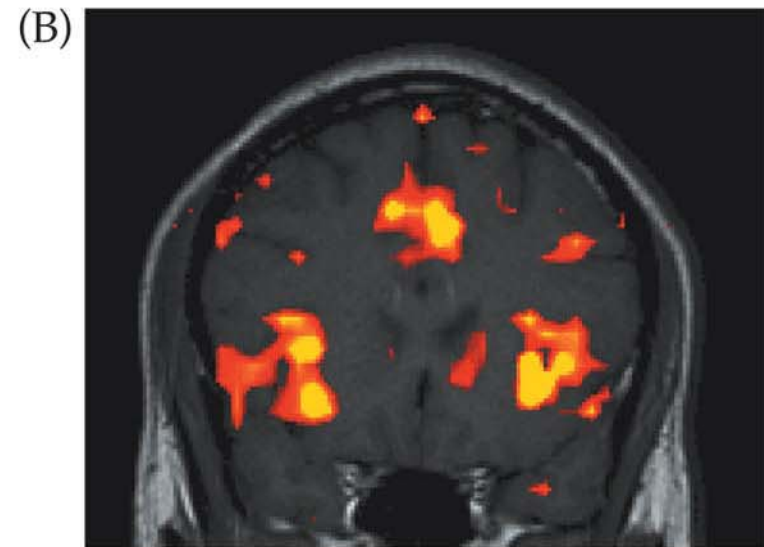
If there are ~ 4000 voxels in the brain,

$P(\text{no Type I error}) = P(\text{true negative}) = (1 - \alpha)^{4000} = 0.99^{4000} = 3.47 \times 10^{-18}$

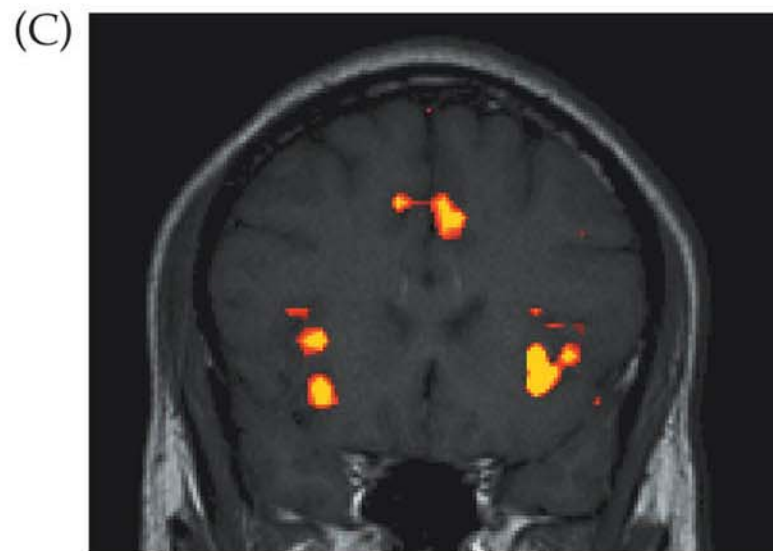
$\alpha = 1 - P(\text{no Type I error}) = 1 - 3.47 \times 10^{-18} = 1$ (the corrected P value)



$t = 2.10, P < 0.05$ (uncorrected)



$t = 3.60, P < 0.001$ (uncorrected)



$t = 7.15, P < 0.05$ (Bonferroni corrected)

Cluster Analysis

Monte Carlo Simulation

ROI Analysis

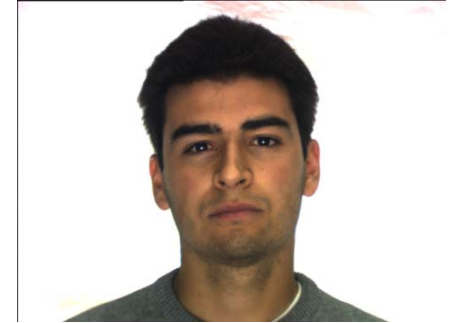
- Anatomical based ROI analysis

- Functional based ROI analysis

} Test specific hypotheses

Henderson JM, Larson CL, Zhu DC. Cortical activation to indoor versus outdoor scenes: an fMRI study. *Exp Brain Res.* 2007;179:75-84.

160 unique faces



160 unique indoor pictures



160 unique outdoor pictures



Anatomical based ROI

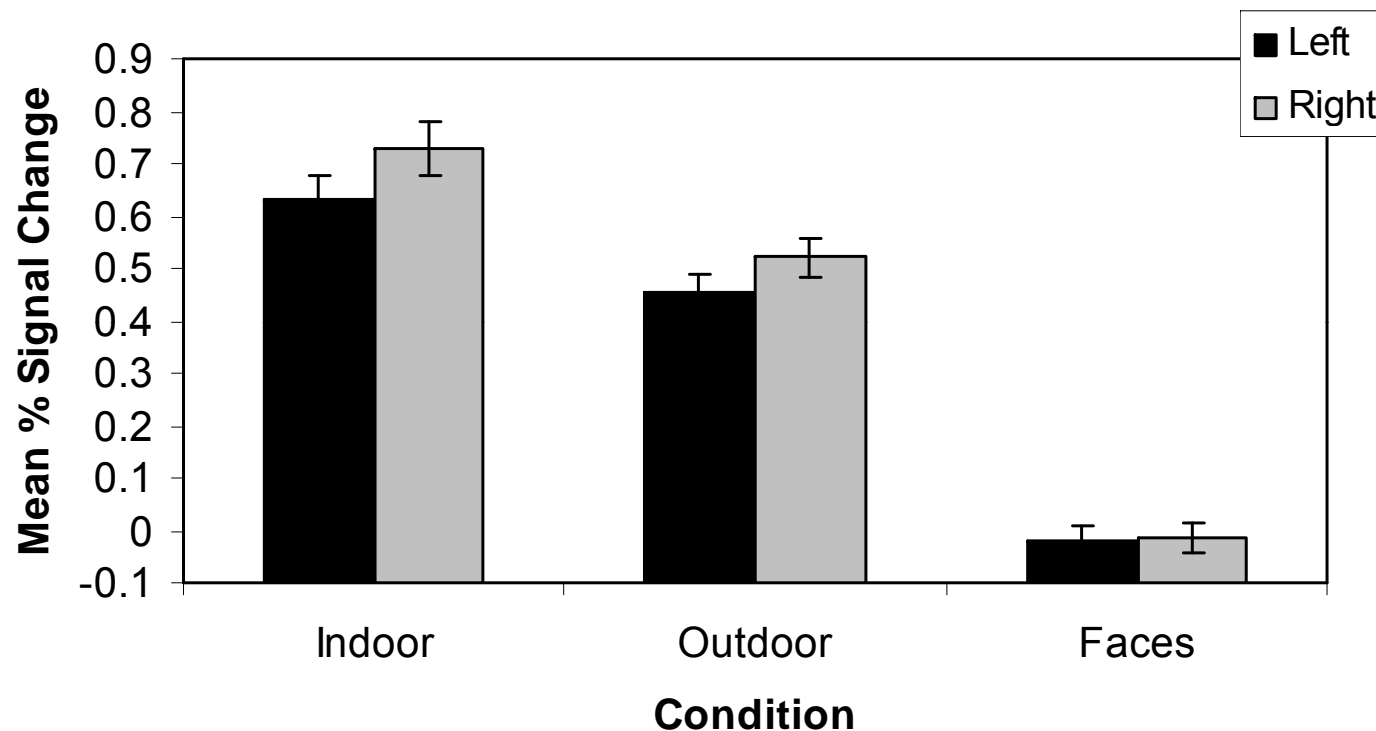
Retrosplenial Cortex = Brodmann Areas 29 + 30

Functional ROI

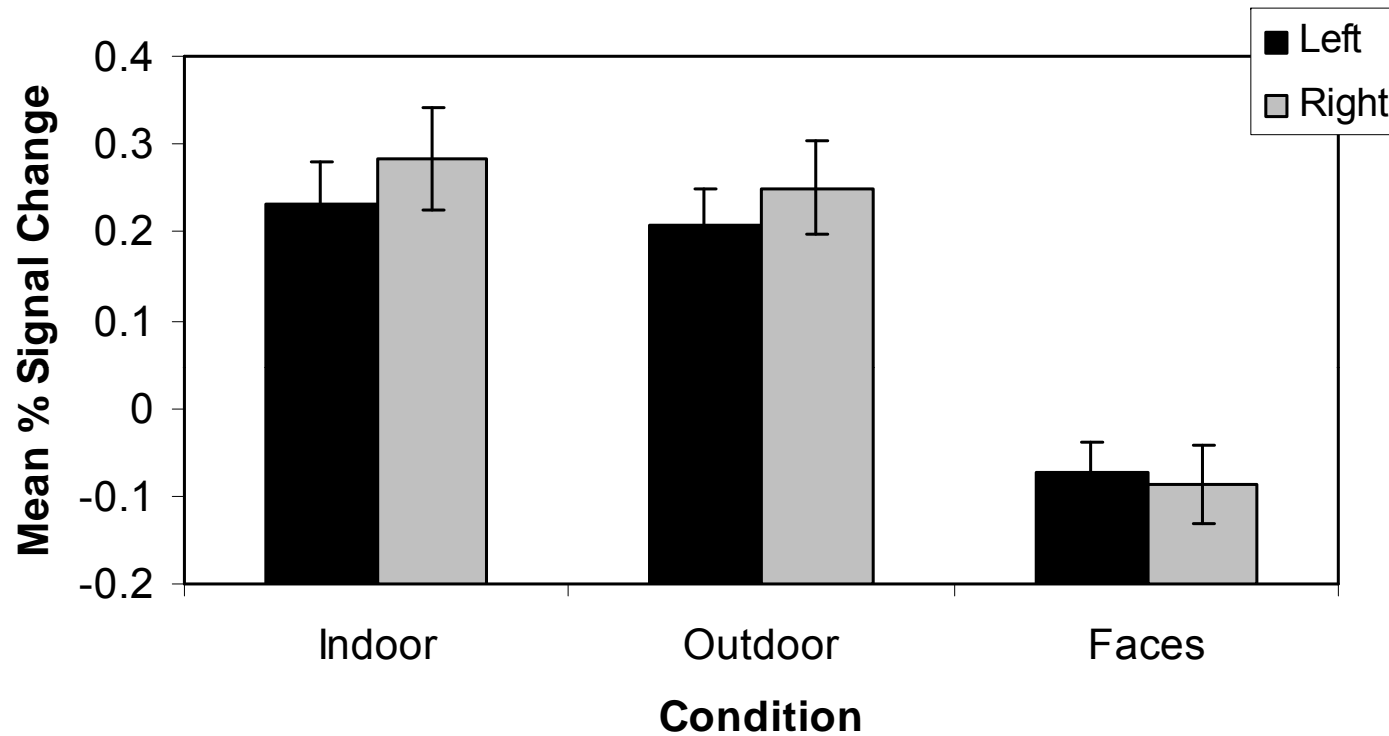
PPA ROI = (Indoor + Outdoor – 2 x Face)
in the parahippocampus area.

General steps to extract data using AFNI for ROI analysis:

1. Convert to % signal change for each condition.
2. Draw ROI:
 - (a) by hand.
 - (b) using Talairach coordinate system.
 - (c) based on functional results.
3. Get the mean % signal change at the ROI.



Mean percent signal change (and SEM) across all voxels in the PPA ROI for 17 subjects as a function of Image Condition and Hemisphere.



Mean percent signal change (and SEM) across all voxels in the RSC ROI for 17 subjects as a function of Image Condition and Hemisphere.