

# Parahippocampal fMRI Activity is Modulated by Scene Type

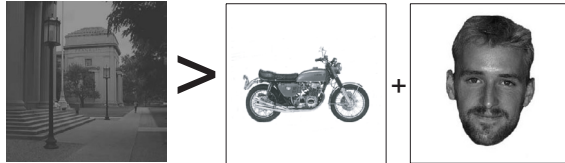
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## INTRODUCTION

Activity in the Parahippocampal Place Area (PPA):



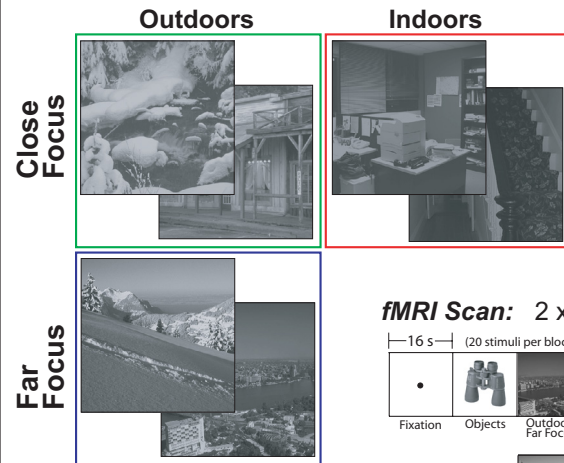
(Epstein & Kanwisher, 1998)

- Not affected by subject's familiarity with the location
- Reduced by subsequent presentations of the same scene
- Responds when a stimulus conveys information about spatial layout (Epstein & et al., 1999)

**Question:** What counts as a 'place' for the 'place area?'

More specifically, is PPA activity modulated by the **degree of depth** present in the scene and whether the scene is **enclosed (indoors) or outdoors?**

## METHODS



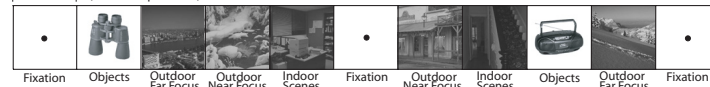
+ Objects

The images were shown to the subject using a mirror and back-projection screen in the scanner, subtending approximately 11° of visual angle (300x300 pixel tif format).

The root-mean-squared (RMS) contrast of each scene stimulus was equated across images and scaled to 30%. In addition, the global spectral frequency content of the images was examined and found not to differ across scene types (see RESULTS).

**fMRI Scan:** 2 x

16 s (20 stimuli per block)



**Task:** Image repetition detection ("1-back" task)

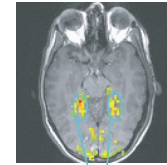
**Subjects:** Four normal adults subjects with normal or corrected vision. Median age, 30.25 years, two left-handed, two right-handed, two female, two male. Head motion was minimized by use of a bite bar for all subjects.

**BOLD fMRI Imaging Parameters:** Siemens 3T Allegra head-only scanner with Nova Systems head and surface coils. TR = 2s, TE = 30ms, Flip Angle = 90°.

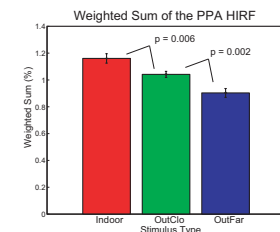
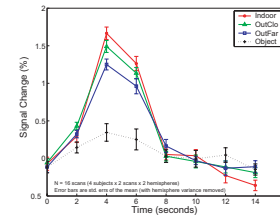
## RESULTS

- ROI's were selected based on cluster-level significance of a whole-brain (GLM) analysis for one scan per subject:

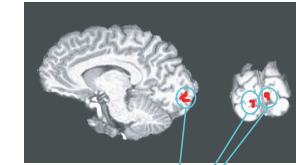
**SCENES > OBJECTS**  
in the Parahippocampal Gyrus



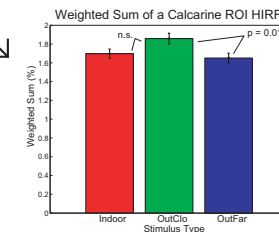
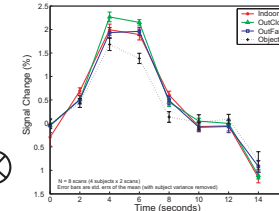
PPA



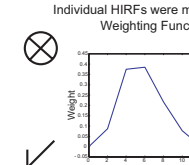
**OBJECTS > REST**  
in the posterior Calcarine Sulcus



Calcarine ROI



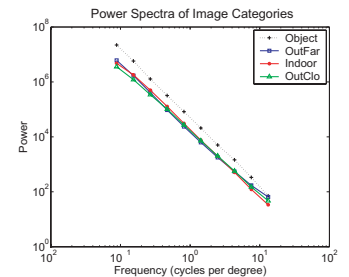
The extracted timeseries from these ROI's were used to estimate the Hemodynamic Impulse Response Functions (HIRFs) for each stimulus type.



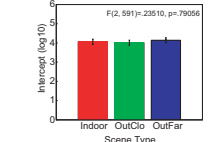
... and summed to produce a single estimate of percent signal change.

## Power Analysis

Do the scene categories contain differences in the energy of certain spatial frequency bands which can account for the observed pattern of the PPA BOLD signal?



Power Does Not Differ by Scene Type



- Scene Type (categorical variable) does **not** significantly predict overall power (intercept).

- Individual F-tests on each frequency band yield no significant differences between scene type at the  $\alpha = 0.05$  (corrected) level.

## CONCLUSIONS

- BOLD activity in the PPA is:
- greater for indoor than outdoor scenes
  - greater for close than far focus scenes

This modulation is not explained by early cortical activity or spectral power.

**Conjecture for future research:** It is possible that viewing outdoor scenes and vistas (far focus) produces greater activity in the parahippocampal gyrus *anterior* to the PPA. This conjecture is based on our prior finding that there is high preference for vistas and natural scenes (Vessel & Biederman, 2001) and these types of scenes activate the anterior parahippocampal gyrus, an area with a high density of mu-opioid receptors.

## REFERENCES

- Epstein, R., Harris, A., Stanley, D. & Kanwisher, N. (1999) The parahippocampal place area: recognition, navigation, or encoding? *Neuron*, 23: 115-125.
- Epstein, R. & Kanwisher, N. (1998) A cortical representation of the local visual environment. *Nature*, 392: 598-601.
- Vessel, E. & Biederman, I. (2001) Why do we prefer looking at some scenes rather than others? Paper presented at OPAM conference in Orlando, Florida.

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