The role of the parietal cortex in feature binding in visual search

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The role of the parietal cortex in feature binding in visual search

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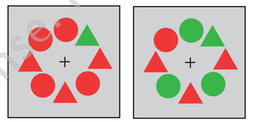
Background

Feature search is typically faster and more efficient compared to conjunction search.[1]

The neural basis for this difference is not well understood.

- TMS and patient studies implicate right angular gyrus[2,3]
- fMRI studies implicate dorsal parietal areas[4]



Can we distinguish dorsal and ventral parietal involvement in visual search?

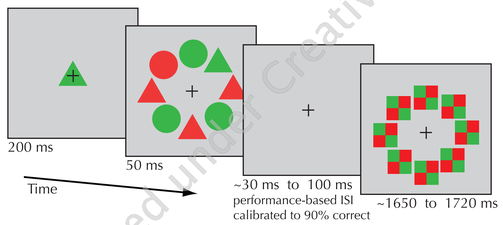
Special design features:

- Matched task difficulty for feature and conjunction search (equivalent behavioral performance)
- Anatomically and visuotopically defined ROIs

Methods

Task — target present or absent?

Sample trial:



ROI Demarcation

IPS 0-5 visuotopically mapped

Right angular gyrus anatomically defined

No spatial smoothing was performed for quantitative analysis.

fMRI Data Acquisition

Visuotopic mapping

- 12 runs pRF mapping
- 3mm isotropic voxels
- 22 slices, perpendicular to calcarine sulcus

Visual search

- 3mm isotropic voxels
- 30 horizontal slices

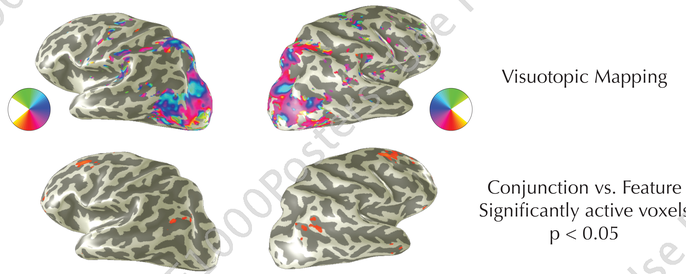
Experiment 1

Conjunction search vs. feature search

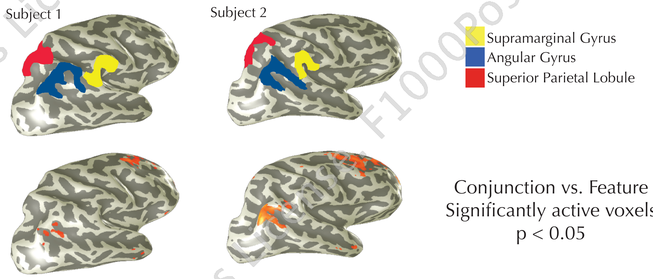
3 right-handed subjects

5-8 runs per subject (alternating blocks of each search type)

Results compared to visuotopic mapping (subject 1)



Results compared to anatomical mapping (subjects 1 & 2)



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4 Shafritz KM, Gore JC, Marois R. The role of the parietal cortex in visual feature binding. Proc Natl Acad Sci USA 2002;99:10917–22.

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Experiment 2

Search vs. passive viewing (separate runs for feature and conjunction search)

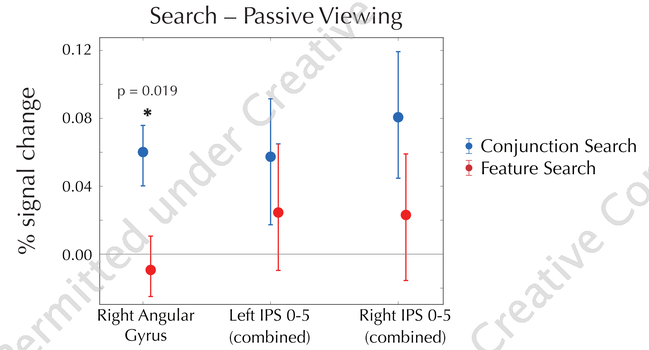
6 right-handed subjects

4-6 runs per search type, per subject (alternating blocks of search and passive viewing)

Results

The right angular gyrus is significantly more active in conjunction compared to feature search.

There is no significant difference between search types for dorsal areas (IPS 0-5).



Overall Conclusions

The right angular gyrus plays a larger role in conjoining multiple features during visual search compared to dorsal parietal areas such as IPS.

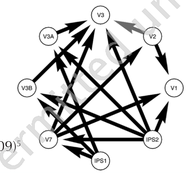
Future Directions

What is the role of the angular gyrus in feature conjunction?

- Top-down vs. bottom-up processing
- Links to higher order areas vs. early visual areas

We can answer this question with functional connectivity analysis.

Lauritzen, et. al. (2009)[5]



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