Anterior Prefrontal Cortex and Source Recollection

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Recollecting Source Information

Internal vs. External

Johnson et al. (1993), Schacter et al. (1998):

Recollection of contextual details surrounding an episode can be distinguished by internal/external dichotomy.

For example:

- Internal – cognitive operations engaged during encoding
- External – perceptual details such as spatial location

Neuroimaging of Source Memory

Internal: Task Source Memory

Rugg et al. (1999), Dobbins et al. (2002):

– Prefrontal cortex, including APFC

Neuroimaging of Source Memory

Internal: Task Source Memory

Rugg et al. (1999), Dobbins et al. (2002):

– Prefrontal cortex, including APFC

External: Position Source Memory

Ranganath et al. (2000), Cansino et al. (2002):

– Prefrontal cortex, including APFC

Nyberg et al. (1996), Henson et al. (1999):

– Prefrontal cortex, not including APFC

A Role for APFC?

Christoff & Gabrieli (2000), Burgess et al. (2003):

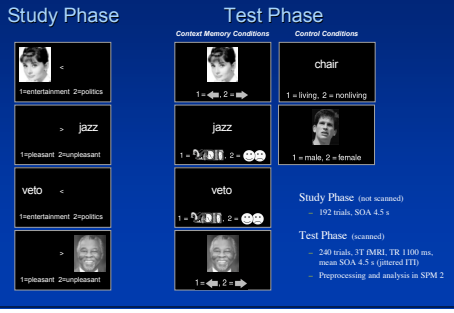
APFC may be involved in evaluating 'self-generated' information

Prediction

Recollection of 'internal' and 'external' source may be associated with differential engagement of APFC

⇨ A direct comparison may reveal greater activation in APFC for task source than position source recollection

Experiment Design



Study Phase (not scanned)

– 192 trials, SOA 4.5 s

Test Phase (scanned)

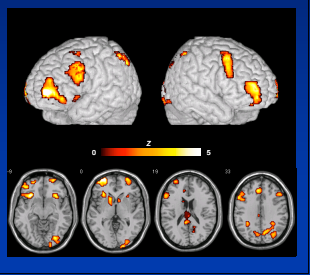
– 240 trials, 3T fMRI, TR 1100 ms, mean SOA 4.5 s (jittered ITI)

– Preprocessing and analysis in SPM 2

fMRI Data

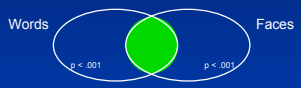
Source Memory > Control
(Averaging over stimulus type and source type)

- Bilateral APFC
- Left VLPFC
- Bilateral DLPFC
- Bilateral Insula/VLPFC
- Medial DLPFC/ACC



fMRI Data Analysis Logic

Inclusive Masking over Stimulus Type



NB: Pairwise contrasts are independent so joint probability threshold in mask can be equated to $p < 0.000001$

See, e.g., Allan et al. (2000), Cabeza et al. (2002), etc.

fMRI Data

Task Source > Control
(Inclusive masking over stimulus type)

- Bilateral APFC
- Left VLPFC
- Bilateral DLPFC
- Bilateral Insula/VLPFC
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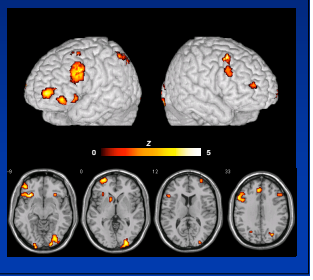
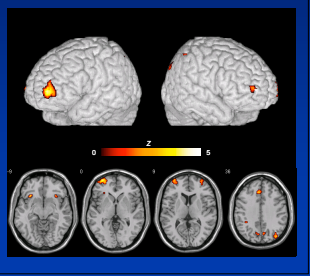


fMRI Data

Position Source > Control
(Inclusive masking over stimulus type)

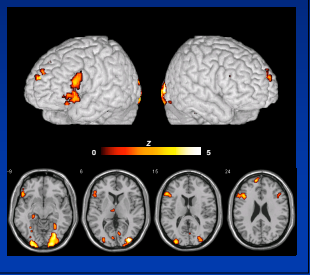
- Bilateral APFC
- Bilateral Insula/VLPFC
- Medial DLPFC/ACC



fMRI Data

Task Source > Position Source
(Inclusive masking over stimulus type)

- Left APFC
- Bilateral VLPFC
- Left MTL

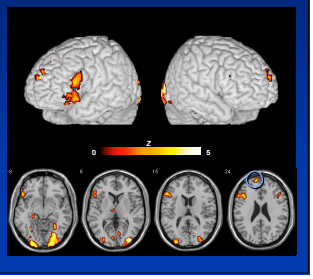


fMRI Data

Task Source > Position Source
(Inclusive masking over stimulus type)

- Left APFC
- Bilateral VLPFC
- Left MTL

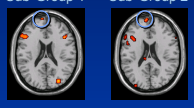
How reliable is this effect?



Reliability of Left APFC Effect

Split-Half Analysis

Sub-Group 1 Sub-Group 2



Sub-Group	Coords	Z
Sub-Group 1	-15 66 21	4.0
Sub-Group 2	-9 63 21	3.1

Task Difficulty Analysis

No correlation between RT and BOLD signal

r = 0.16, n.s.

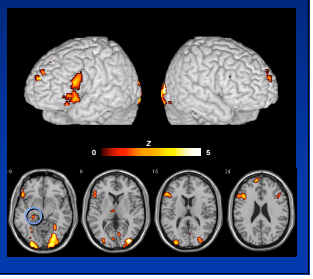
fMRI Data

Task Source > Position Source

(Inclusive masking over stimulus type)

- Left APFC
- Bilateral VLPFC
- Left MTL

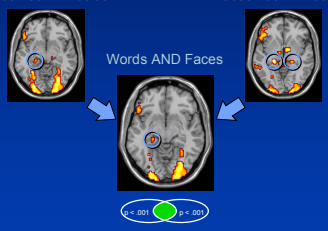
Why is MTL activation only seen on Left?



Stimulus Lateralization in MTL

Words Task > Position

Faces Task > Position



Conclusions

- Anterior PFC involved in recollection of both task source and position source memory.
- A medial region of left APFC shows significantly greater activation during task than position source recollection
- MTL also greater activation during task than position source, differentially modulated by stimulus type (L words, B faces).