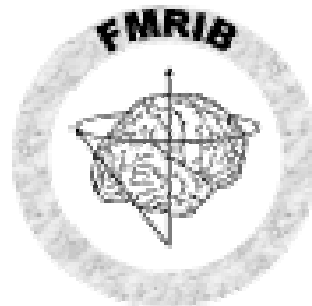


An fMRI study of fluid analogies: Towards an understanding of creative intelligence

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Experimental design features

- *Copycat* letter strings as an operationalisation of fluid analogy-making
- Not use a correct-incorrect response paradigm
- Instead, employ a multiple plausibility - preferred response paradigm
first fMRI study to do so
- Parametricise analogical depth for analysis

Broad/ Weak Experimental Hypothesis

That fluid analogy-making tasks will activate specific regions of frontal cortex that are common to those of previous inferential reasoning tasks.

Specific Experimental Hypothesis

There will be a positive relationship between analogical depth response and measures of intelligence.

Experimental setup

Subjects: 12 right-handed volunteers (4 M, 8 F; age range 18 to 54 years)

IQ estimates: National Adult Reading Test (NART) 2nd Edition (range 108-128)

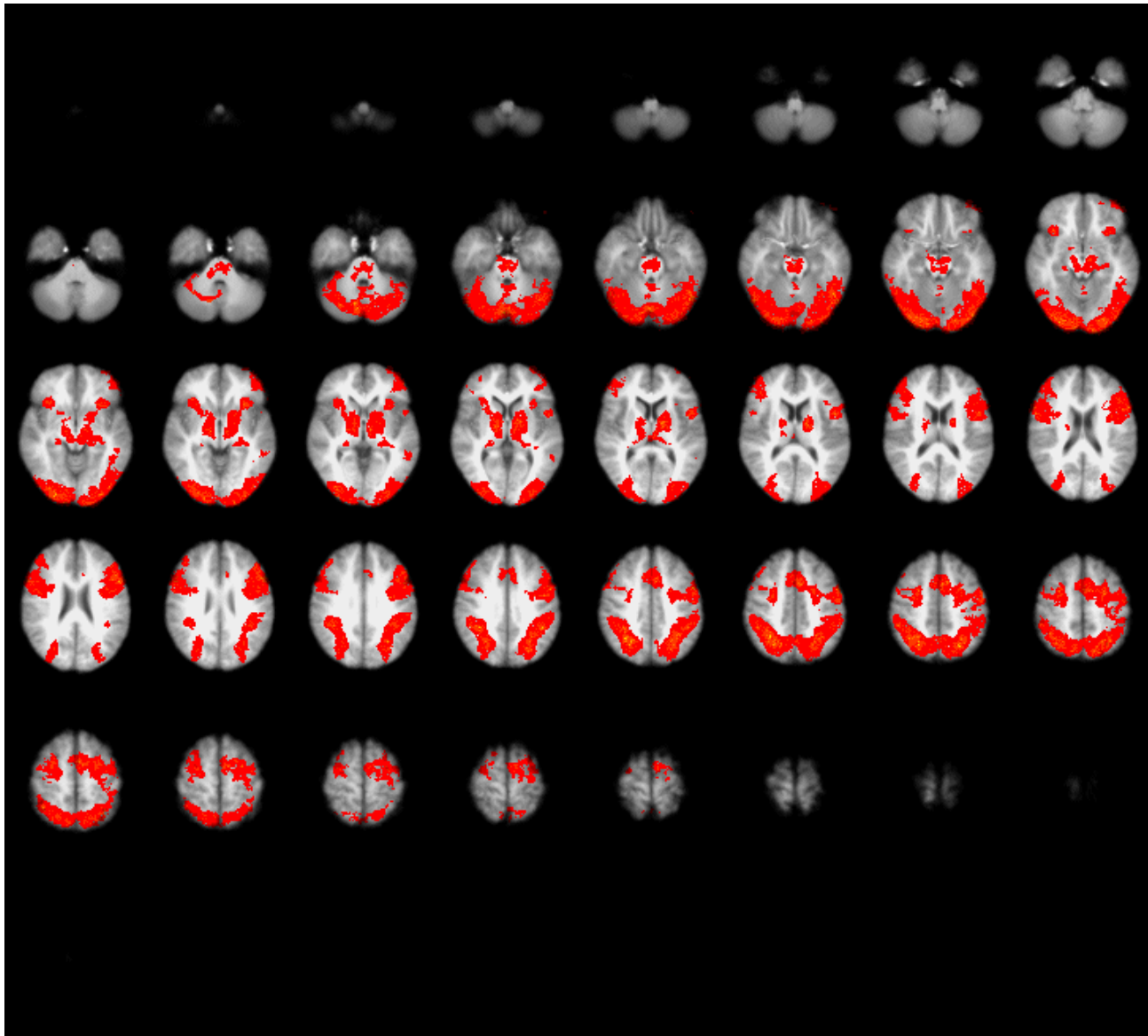
Analogy stimuli: 30 fluid letter strings from *Copycat* interleaved by 25 perfect-match letter strings

Practice: 5 items of both types of letter strings *in situ* for participant familiarisation and to reduce learning effects during testing

abcm \Rightarrow abcn, rijk \Rightarrow ?

(1) rijk (2) rijl

(3) sijk (4) sijl



group map: high ADR activations

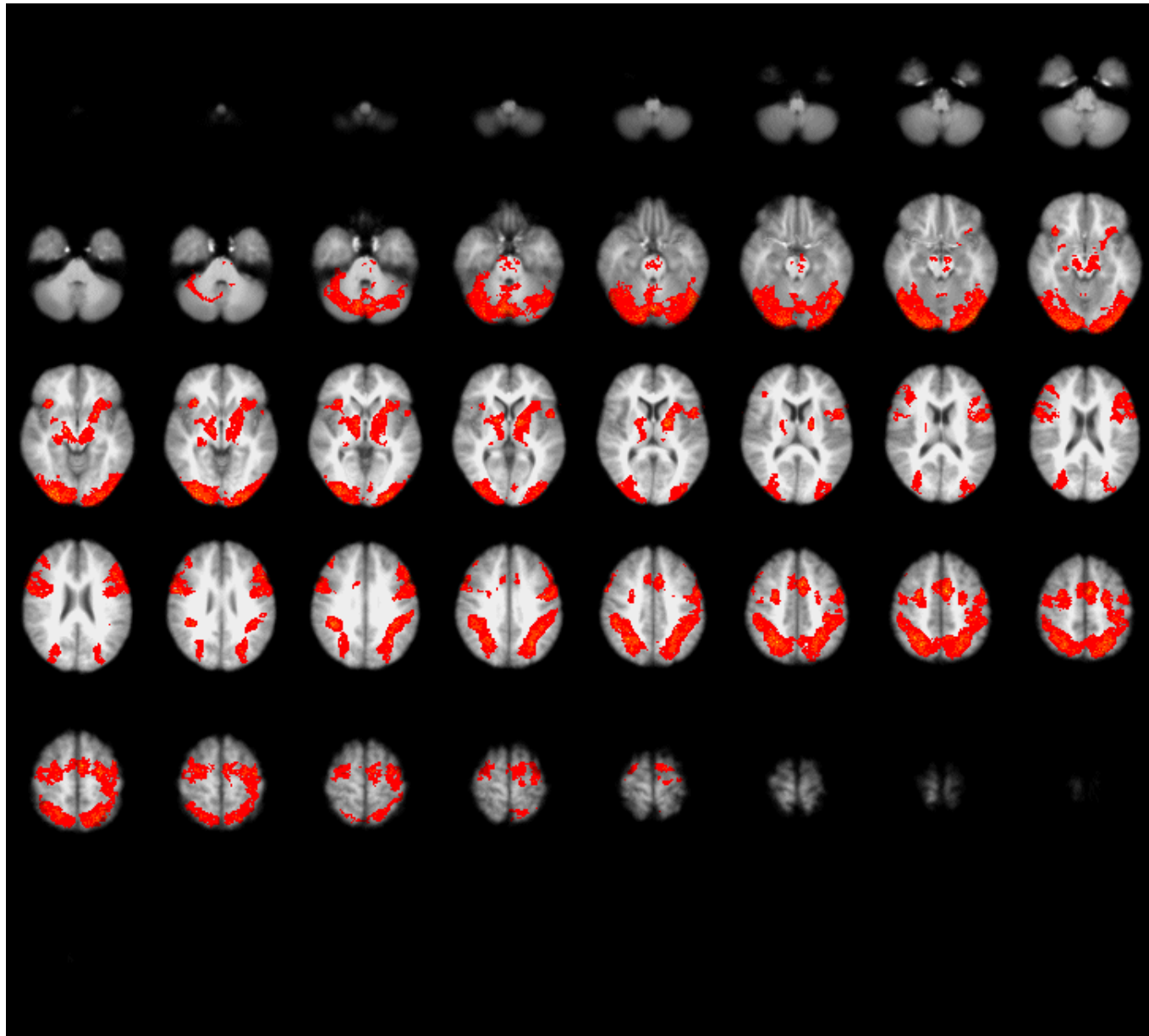
abd \Rightarrow abd, ij1 \Rightarrow ?

(1) ij2

(2) ijk

(3) ij1

(4) jkl

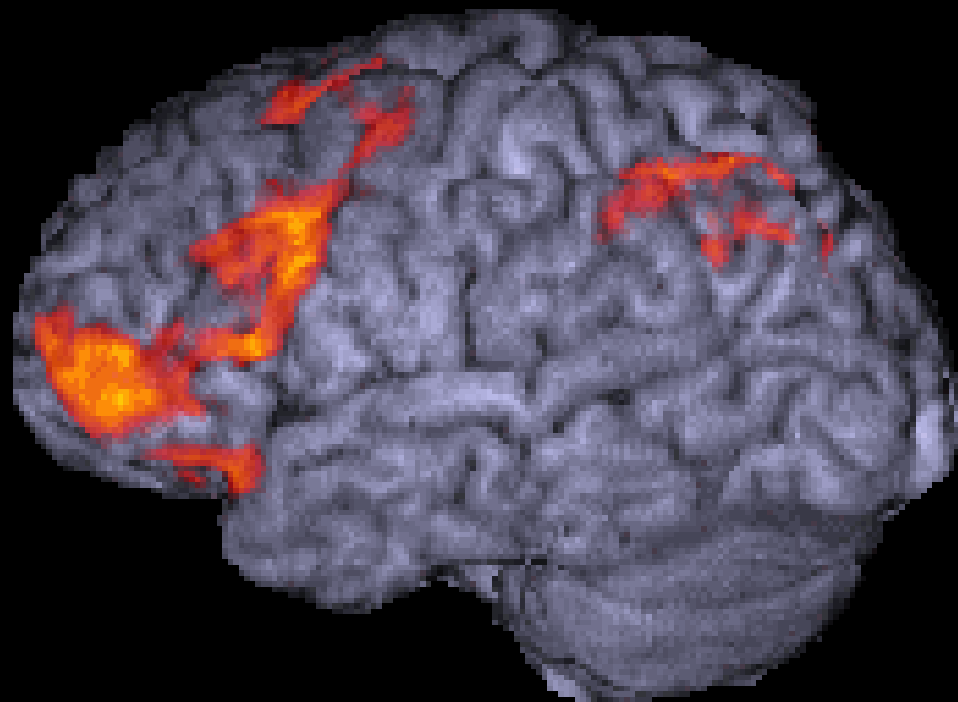


group map: low ADR activations

Neuroimaging analysis to test the broad hypothesis

GLM with planned contrasts [-1 0 1] of ADR
histogram [low medium high]

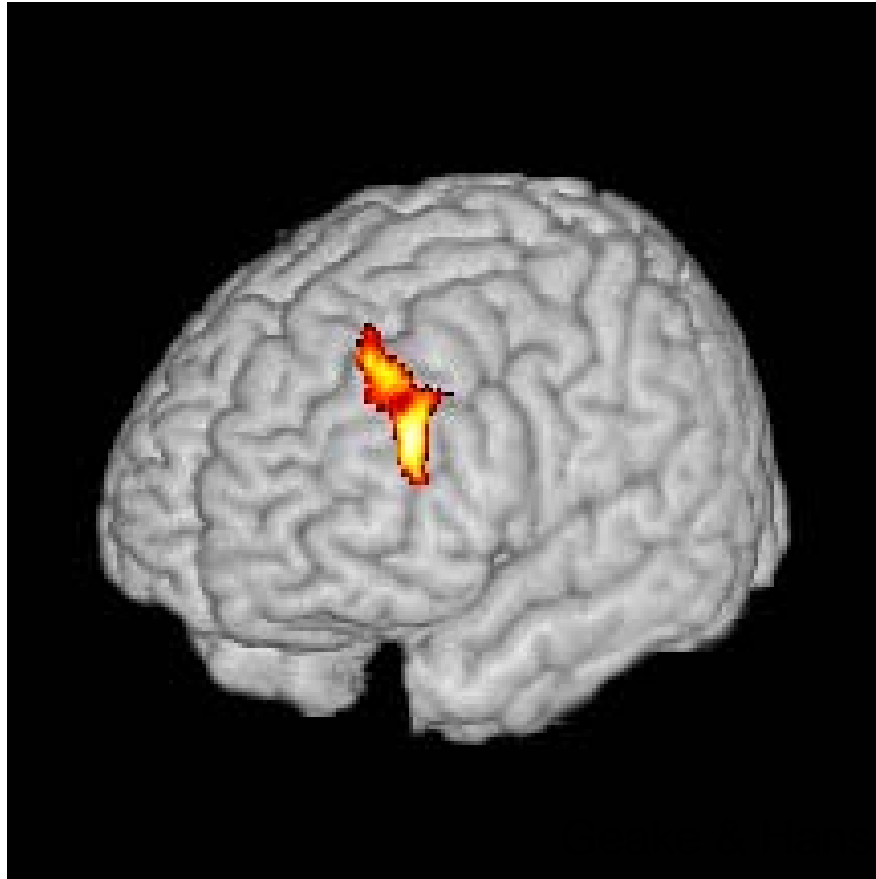
Significant activations by BOLD response
voxel threshold $Z > 2.3$, cluster $p < 0.05$



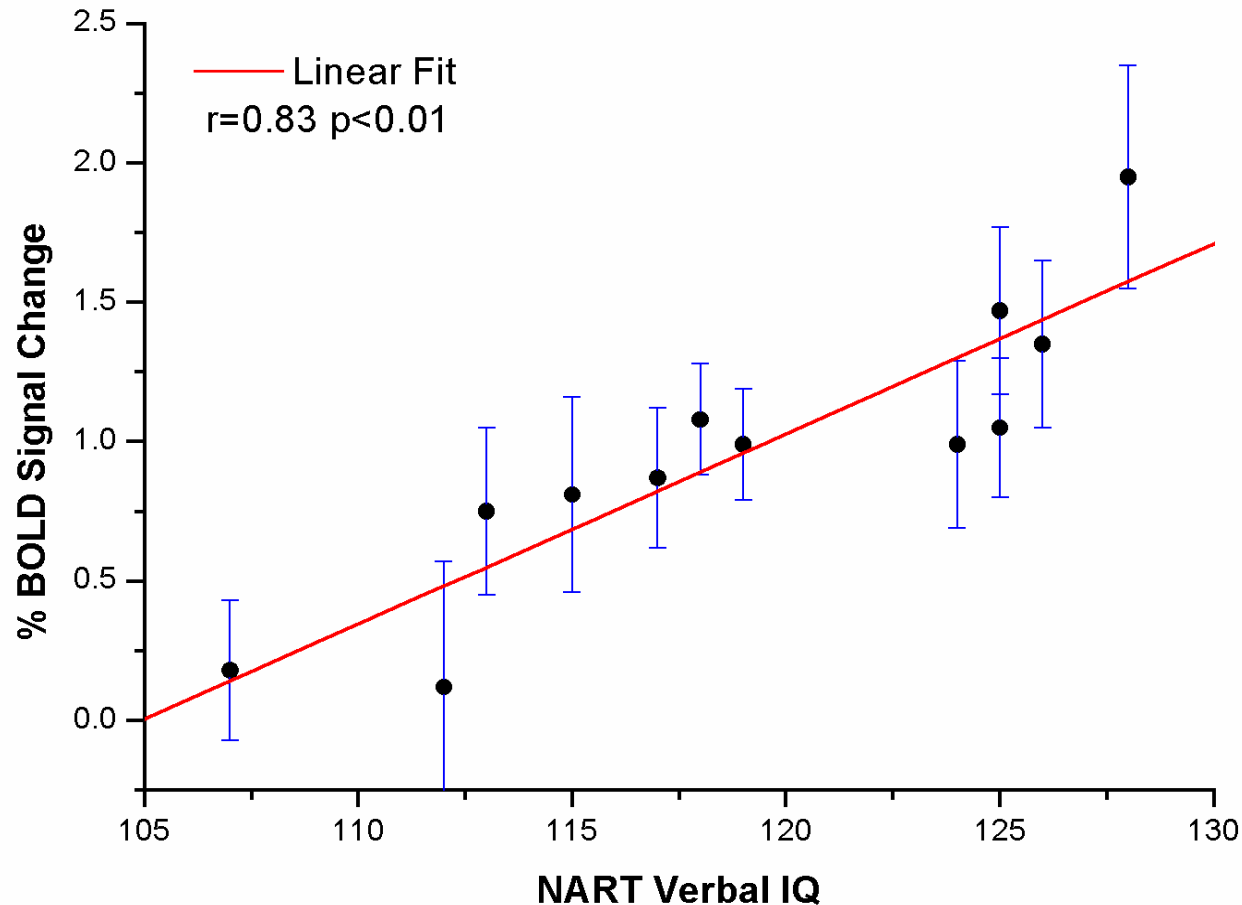
Higher-order analysis to test the specific hypothesis

Enter NART score as an additional global
covariate in the main ADR-based GLM
analysis

Two areas of left frontal cortex
(working memory)
where neural activity during
analogising correlates with verbal IQ



IQ predicts neural activation in region for working memory BA 46/9



Conclusions

- This experiment demonstrated the viability of using a multiple-plausibility self-paced fMRI design to investigate neural correlates of fluid letter string analogy-making.
- We found patterns of frontal activations which were similar to those activation patterns found in previous studies into the neural correlates of general high intelligence and analogical reasoning in particular.

- An ROI analysis in left BA 9 and 45/46 shows a significant linear relationship between IQ and %BOLD change on the fluid analogy task, consistent with previous interpretations of this area as mediating executive functioning under high working memory load.
- This result supports the pivotal role of analogising in intelligent behaviour, especially intelligent behaviour incorporating elements of creativity through the adaptive reorganisation and restructuring of novel information.