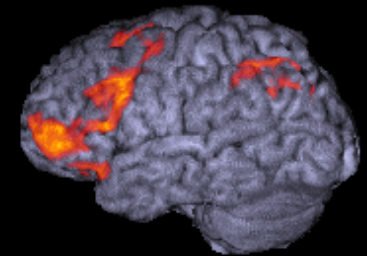


Giftedness and the brain

Day 2

Session 2: 1200-1330

- What is the neural basis of creativity?
 - fMRI of fluid analogies
 - neuropsychology of creative intelligence
- How could we teach to optimise creative intelligence?



Neural correlates of creative intelligence

How does the brain generate insights, crack jokes, compose wonderful tunes, solve difficult problems, think up interesting research questions, write poetry ... ?

General Rationale

How is high creative intelligence mediated through brain structure and function?

Specific Rationale

A characteristic of good teachers and scholars is their ability to create analogies for explanation and clarification.

Intelligence as analogy-making

A native talent for perceiving analogies is
... the leading fact in genius of every order.

William James, *The Principles of Psychology* (1890/1950,
p. 530)

Creative intelligence

Full-scale creativity consists in having a keen sense for what is interesting, following it recursively, applying it at the meta-level, and modifying it accordingly.

(Hofstadter in Mitchell, 1993, p.240)

The *modus operandi* of creativity is analogising

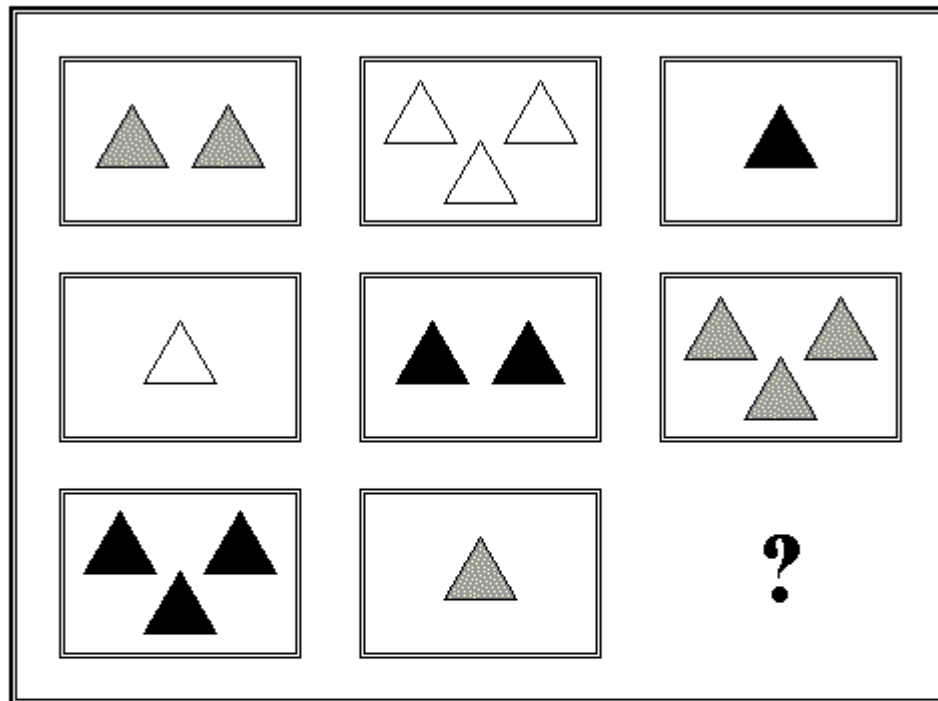
Neural correlates of analogy making

Raven's Progressive Matrices (RPM)

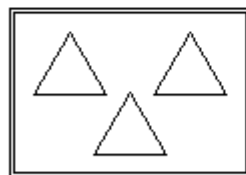
culture-free test of abstract reasoning ?

high correlation with performance IQ

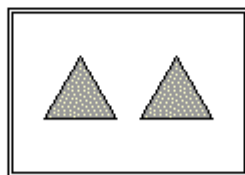
Which answer fits in the missing space to complete the pattern?



1



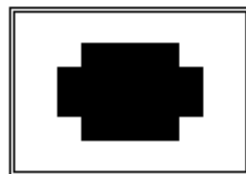
2



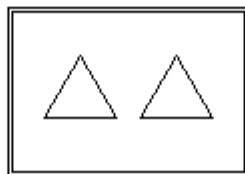
3



4



5



6



Neural correlates of analogy making

	Prabhakaran <i>et al.</i> , 1997	Wharton <i>et al.</i> , 2000	Christoff <i>et al.</i> , 2001	Kroger <i>et al.</i> , 2002	Luo <i>et al.</i> , 2003
BA	RPM fMRI bilateral	shapes PET left only	RPM fMRI L, R	RPM fMRI bilateral, L R	verbal fMRI L, R
pre- frontal	6, 9, 44, 45, 46	L6, 8, 10, 44, 45, 46, 47	L6, L10, L44 R9, R46	6, 44, 47, R9, R9/46, L9/10//46	R11, R47, L45
temporal	19, 21, 37	L22, R42	NR	na	L22, 37
parietal	7, 39, 40	L40	NR	7	na

Conceptual limitations?

- All previous analogy experiments employed a **correct – incorrect** paradigm
- Life ain't so simple
- Real-life analogies are fuzzy, or fluid

Hofstadter's fluid analogies: cities

What's the Melbourne of the USA?

What's the Bendigo of the USA?

What's the Bendigo of Melbourne?

What's the Melbourne of Bendigo?

What's the Melbourne of Melbourne?

What's the Bendigo of Bendigo?

Hofstadter's fluid analogies:

Copycat

AI program using *Slipnet* architecture

Solution choice is a probabilistic response to competing workspace (bottom-up) and conceptual (top-down) pressures (codelet weights)

Letter string analogies 1

If $abc \Rightarrow abd$, then $ijk \Rightarrow ?$

ijl

ijd

Letter string analogies 2

abc \Rightarrow abd, pqqrrr \Rightarrow ?

pqqrrd

pqqrrs

pqqsss

pqqssss

Human responses (N=74, Burns, 1996)

abc => abd, kji => ?

12 different responses:

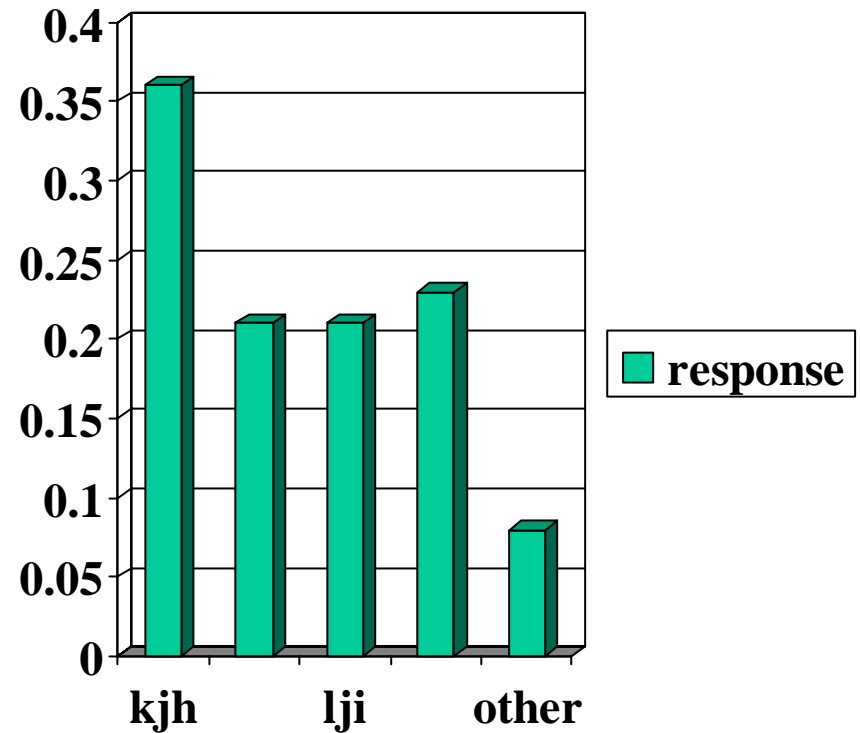
kjh

kjj

lji

ijl

8 others



Human responses (N=74, Burns, 1996)

abc => abd, mrrjjj => ?

20 different responses:

mrrkkk

mrrjjk

mrsjjk

jjmrr

16 others

