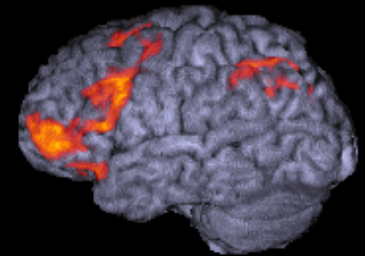


# Giftedness and the brain

## 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?



# An Investigation of Creative Intelligence and its Application to the Education of Gifted Children

Funded by the Sir John Templeton  
Foundation

*John Geake & Claire Dodson*  
*Oxford Brookes University*

# Primary purpose of the award

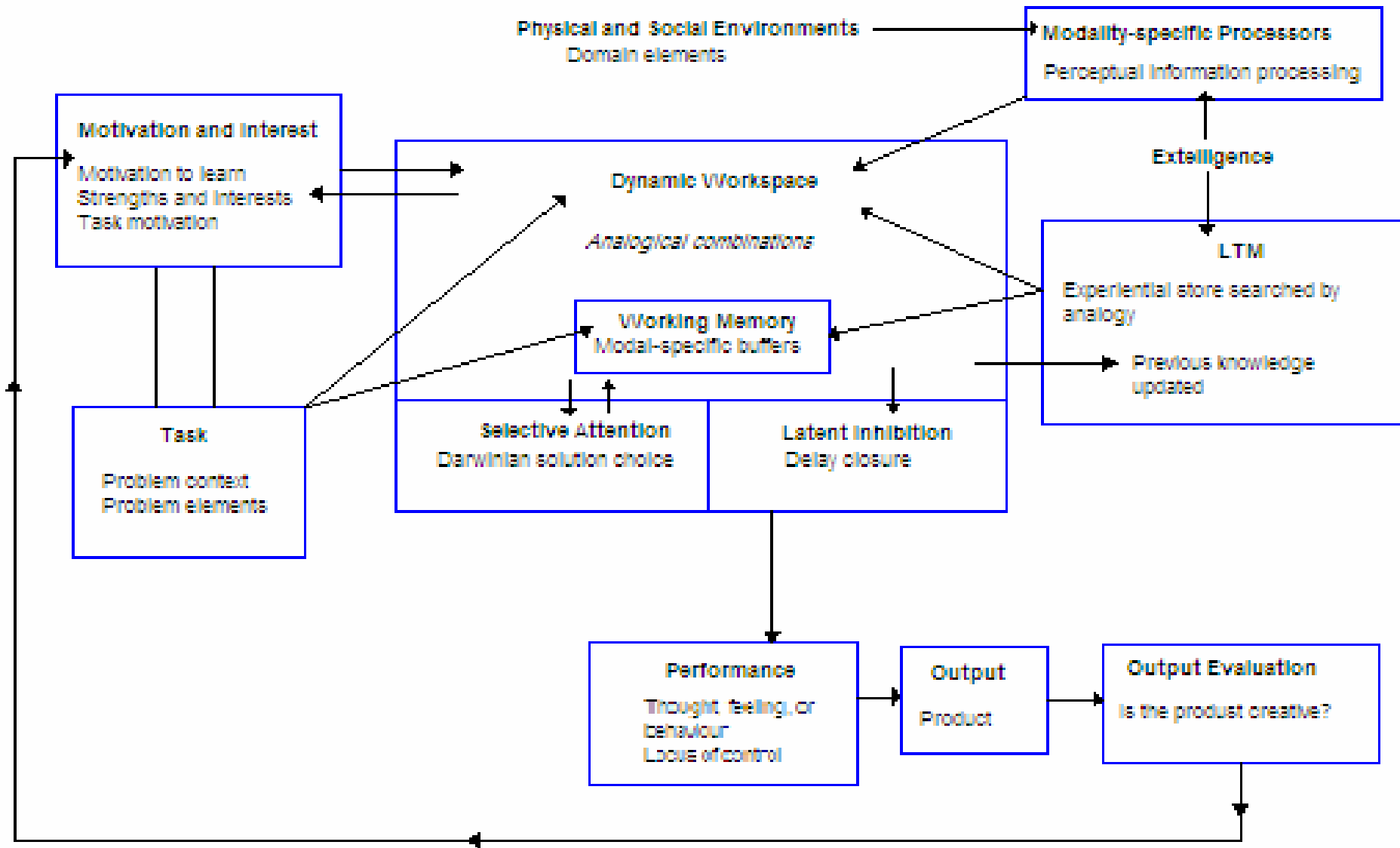
The purpose of this award is to produce a model of the creative intelligence of gifted children which, being informed by cutting edge cognitive neuroscientific research, will be of considerable interest to other researchers and teachers in the field of gifted education, and related fields.

# Rationale

One of the more endearing characteristics of gifted children is their ability to employ their superior intelligence creatively, as in original solutions to problems, elegant mathematical proofs, musical compositions, works of art, poetry and fiction, and an often bizarre sense of humour.

As teachers, such creative intelligence underscores our belief that there is more to giftedness than can be captured by IQ tests, or high SAT scores.

# Neuropsychological model of creative intelligence



# Internal or External Context

*External* context includes extrinsic goals and problems.

*Internal* context arises from tasks that require the mental representation, maintenance, and updating of context information in order to exert control over thoughts and behaviour.

Because contextual information must be kept on-line in an active state, and be accessible and be able to influence processing, it is a component of WM within the dynamic workspace.

# Dynamic Workspace

To account for controlled information processing, the brain is now thought to have, along side specialised processors, ‘a distributed neural system or ‘workspace’ with long-distance connectivity that can potentially interconnect multiple specialised brain areas in a co-ordinated, though variable manner’.

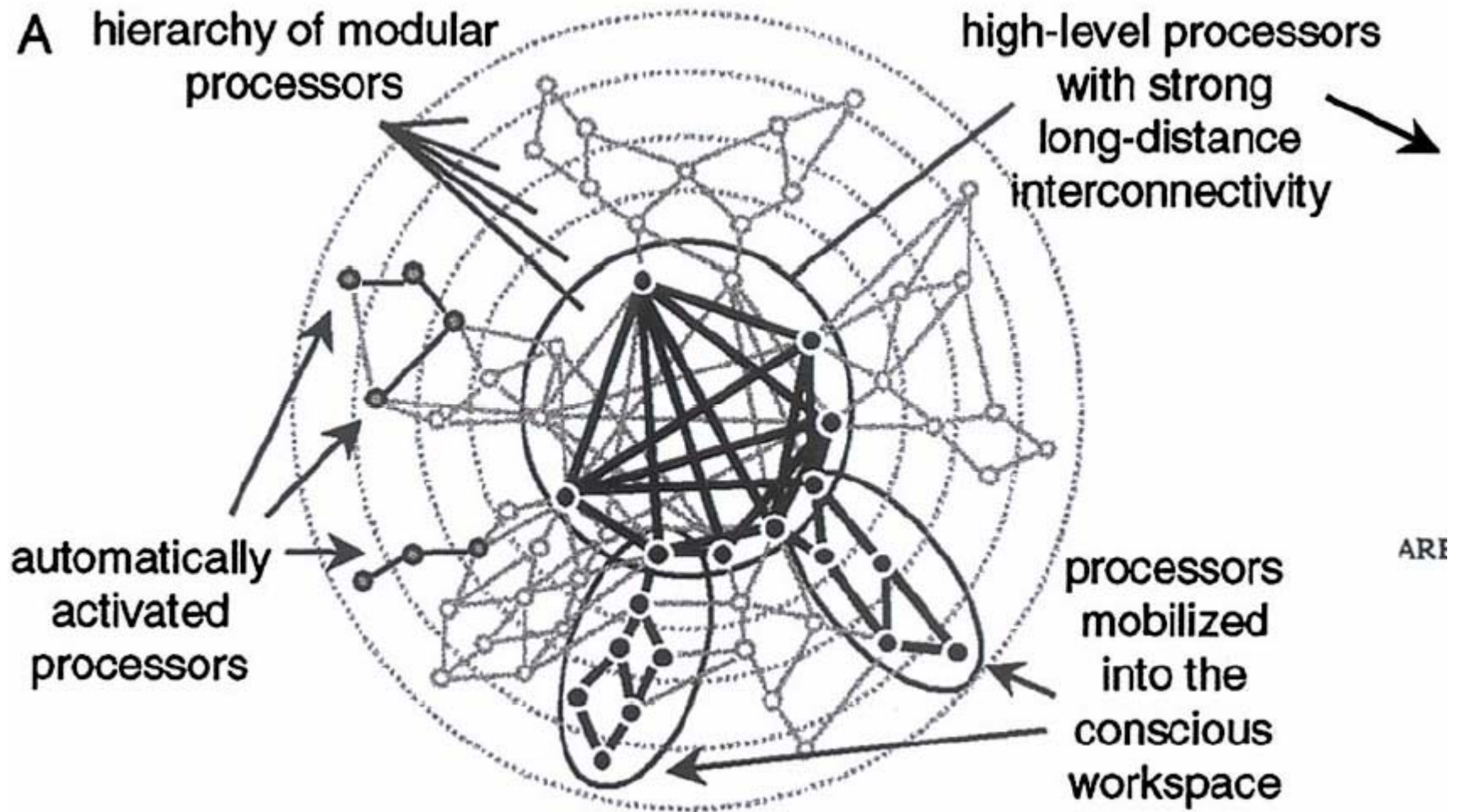
This dynamic workspace provides a common “communication protocol”, which allows communication between modular systems that do not directly interconnect.

# Dynamic Workspace cont.

The cognitive psychological construct of WM is subserved by the functions of the dynamic workspace.

Attentional processes allow for the temporary activation of informational circuits, fluctuations in which depend on the processing modules required, and the information available within those processing modules, at any given time.

# Global Workspace Model



Dehaene, S., Kerszberg, M. & Changeux, J-P. (1998).

# Fluid analogising

Possible inter-relationships between problem and context are explored by fluid analogising, the cognitive correlate of neural synchronisation of information into the dynamic workspace, with the resultant variance iteratively creating temporary solutions in WM.

Creatively intelligent individuals, with a greater neural activation in WM, consider more analogical combinations. An fMRI study has shown that activation of an area of PFC associated with WM (BA 9/46) is positively correlated with individual levels of intelligence during analogical reasoning task.

# Fluid analogising cont.

At a neural level, an activation pattern that coincides with the current state of the dynamic workspace will be 'reinforced' and kept, and may enter conscious awareness. Patterns of activation that do not connect sufficiently with the current state will not be so reinforced.

# Latent inhibition

Recent studies have found a significant relationship between the various indicators of creativity and reduced latent inhibition.

Creative insights lie along trajectories within putative solution spaces. Latent inhibition, relatively depressed in creatively intelligent individuals, enables holding on-line, rather than rejecting *a priori*, a greater number of creative insights or solution trajectories.

Intellectually creative people are characteristically highly task-motivated, so continually refresh their WM with the problem, context and candidate solutions.

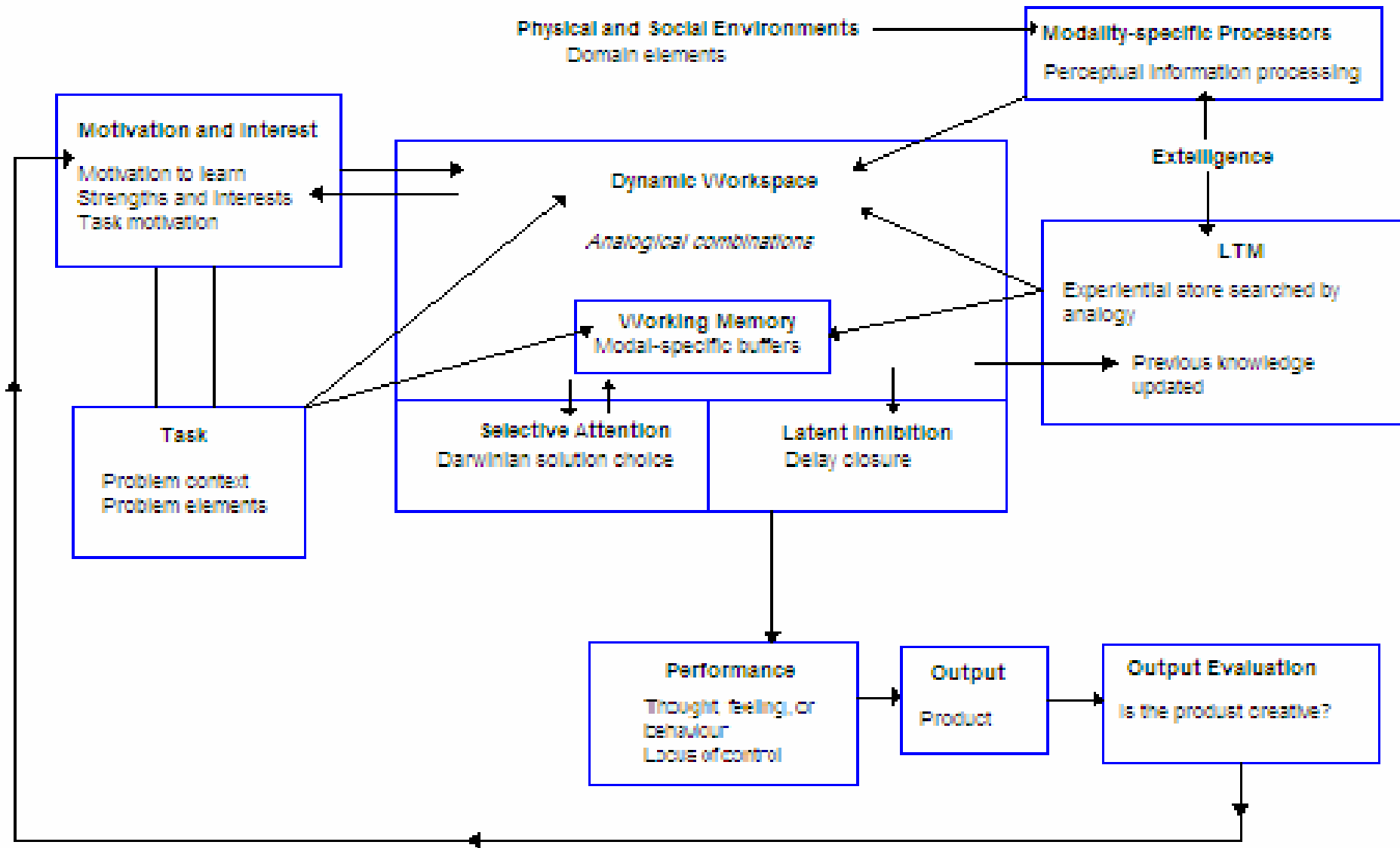
# Survival of the fittest solutions

Putative insights or solutions created by analogical combinations are evaluatively weighted via the PFC function of selective attention.

Selection criteria are both hedonic and knowledge-based. This is consistent with findings that enhanced capacity of WM is associated with increasing familiarity as a result of acquired experience. This in turn leads to an increase in processing speed, assumed to be due largely to the development of enhanced connections between and within neural systems.

Not all possible solutions or insights, however, are necessarily creative. Creativity requires the output to be externally judged as both original and functional.

# Neuropsychological model of creative intelligence



# Modelling creative intelligence: Some implications for pedagogy

- Explicitly seek analogies between different subject areas
- Solicit multiple solutions to problems
- Delay closure on solutions to problems
- Critique proposed products / solutions for utility and social acceptability