Introduction to Cognitive Science

(3a: fMRI)

fMRI

- Functional Magnetic Resonance Imaging
  - FMRI scanner creates a powerful magnetic field, which can detect increases in blood oxygen (oxy and deoxygenated blood behave differently)
  - This difference is known as the BOLD signal (blood oxygen level dependent contrast)
  - In the early 1990s, new version, event-related fMRI
    - Basic idea: measure the BOLD signal for individual rapid occuring neural events
    - This is possible because the hemodynamic response behaves linearly: hemodynamic response adds up to previous hemodynamic responses (for earlier events in a time series)
    - Makes possible the study of short-term events

How well does brain activity predict which vis. Experiences will be remered
1998 Brewer et al.

- One of the first fMRI studies to use the event-related design
- Are there any neural markers that predict how well are things remembered?
- Are some part more active when forming memories
- Not asking which areas are active in memories or remembering, but in forming

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- Experiment: 96 indoor and outdoor pictures over four trials
- Subjects were asked only to identify whether it was an indoor or outdoor picture
- After: subjects were given an unanticipated memory test, 128 pictures, including the 96 ones, and asked to identify which ones they saw before

How well does brain activity predict which vis. Experiences will be remered
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- Memory test allowed the experimenters to categorize:
  - Remembered
  - Familiar
  - Forgotter
- Next step was to try and find patters of neural activity associated with each level

BOLD generated just by looking

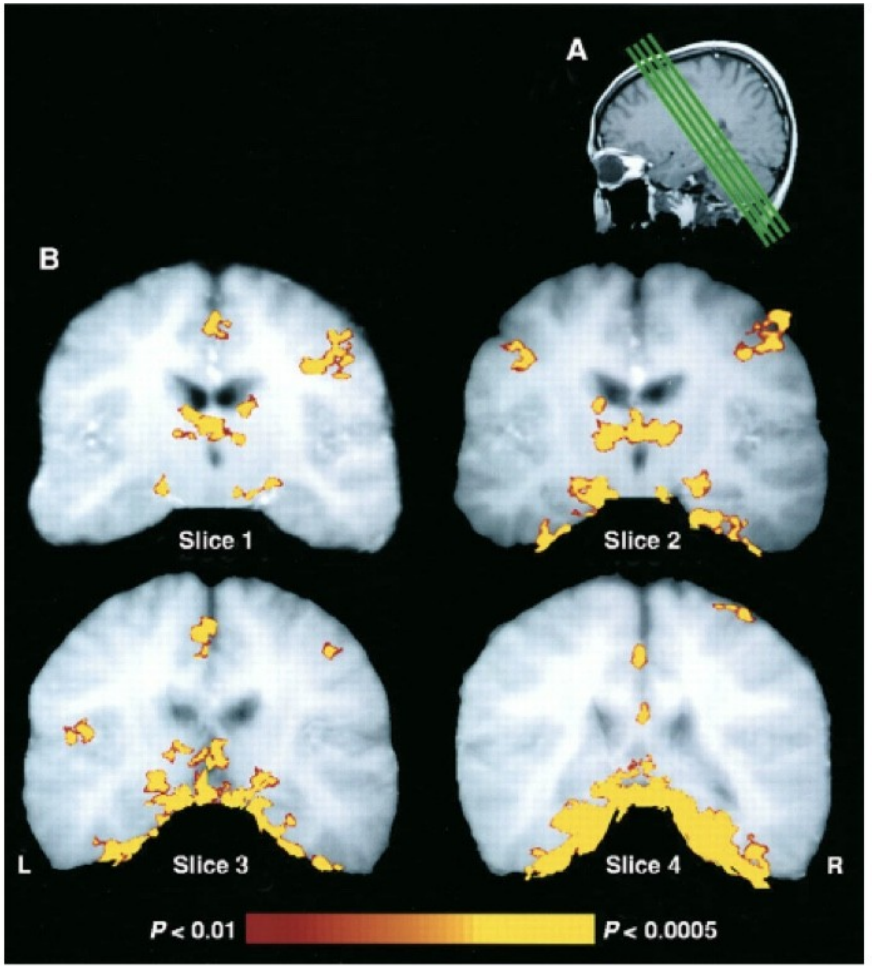

Figure 3.11 Neural area showing activity when subjects looked at pictures.

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- Which one of those are responsible for coding visual experiences into memories?
- Second map: brain areas where activities were correlated with memory perfomance
- Those are the areas which were active on remembered pictures, medium active on familiar and inactive on forgotten (at the time the memory was formed!)
  - Not a subsequent scan but the difference between scans on pictures in the first stage

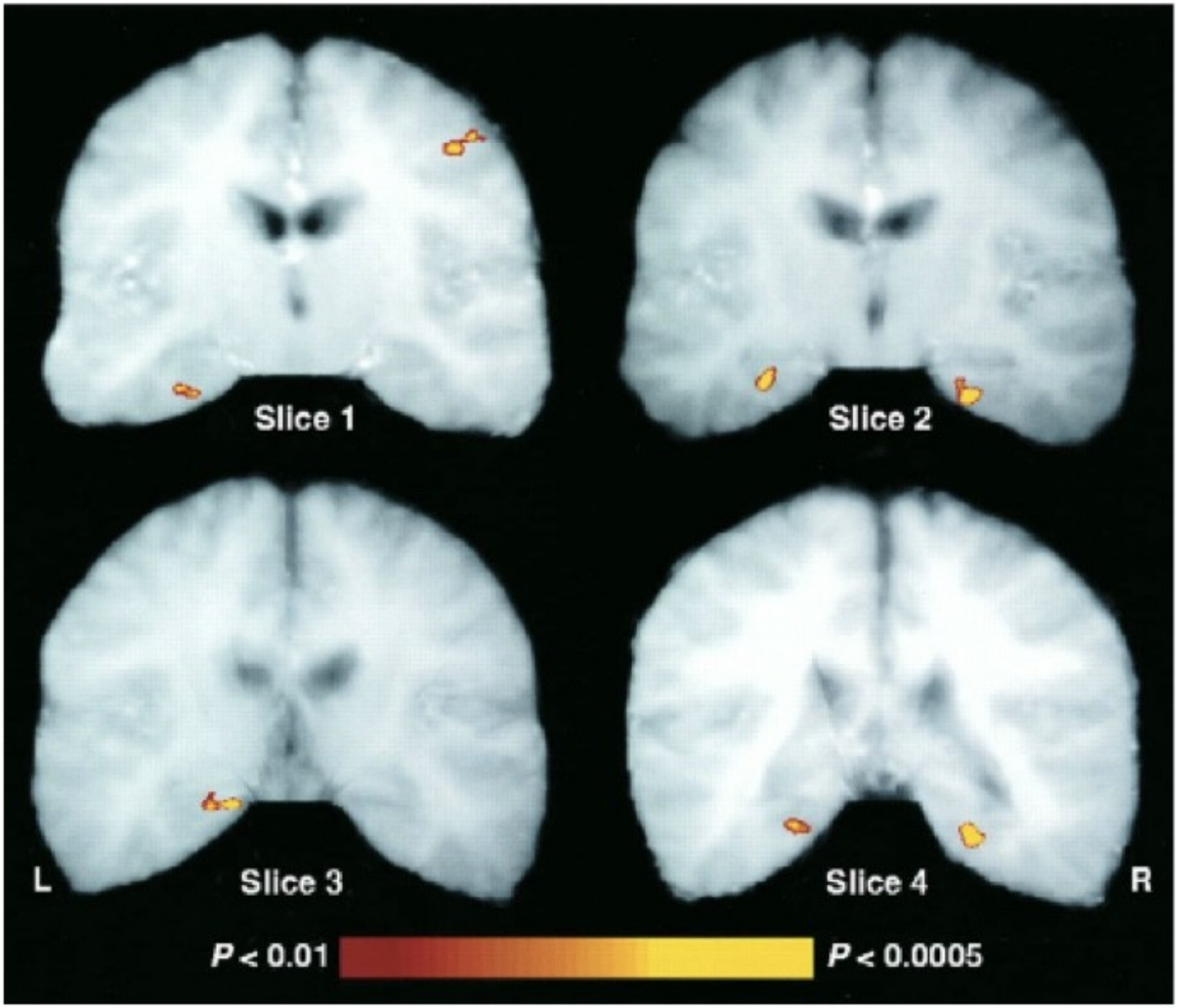

Figure 3.12 Neural areas where activation is correlated with levels of memory performance.

Neural correlates of the BOLD signal

- We know very little about what those scans measure and the cognitive activity that is going on while scans are made
- What sort of neuronal activity generates the BOLD contrast?
- Comaprison of human fMRI data with single cell recording from monkeys
- Rees-Friston-Koch hypothesis: The BOLD response directly reflects the average firing rate of neurons in the relevant brain area