

Long-term memory

- Linked to the functions of
 - prefrontal cortex
 - medial temporal lobe (including hippocampus)
- Different kinds of long-term memory
 - declarative (explicit memory; things that we can describe)
 - procedural (implicit memory; things that we are good at)
- Prefrontal cortex
 - extensively involved in declarative memory
 - minimally involved in procedural memory

Procedural memory

E.g.:
the memory of how to bicycle

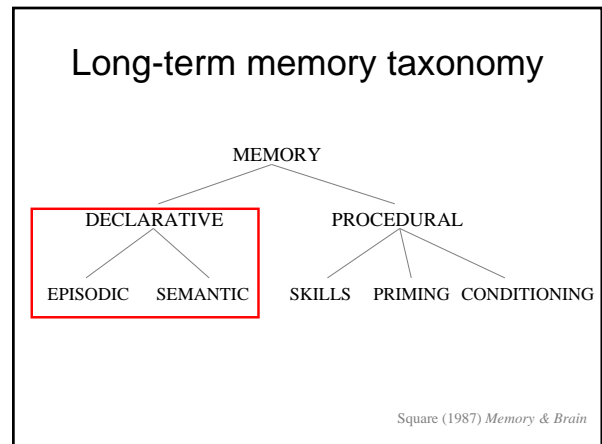
- automatized
- "once learned, never forgotten"
- no need for conscious effort and attention

Declarative memory

Kinds of declarative memory:

Episodic
- memories that are temporally associated with particular episodes of one's life

Semantic
- knowledge of the world: facts, concepts, vocabulary



PFC and declarative memory

- PFC patients have difficulties both in
 - recall (retrieval)
 - remembering (encoding)
- Neuroimaging
 - all declarative memory tests activate PFC
 - tasks on which patients are impaired activate more anterior regions

Remembering vs recalling

Study list: **Encoding** Test list: **Recognition**

“Shallow” vs “Deep” memory encoding

CAR chair
bird DOG

Buckner & Koutstaal (1998) PNAS

Episodic memory tests

- **Free recall**
recall & describe something without help or prompts
- **Cued recall**
recall something after a hint (cue or prompt) has been given
- **Recognition**
recognize (“yes or no?”) whether something happened previously

Famous Faces Test

- **Free recall**
Who is this person?
- **Cued recall**
He was a pop singer, British, leader of a famous group.
- **Recognition**
*Michael Dukakis
Bob Kennedy
Mick Jagger
John Lennon*

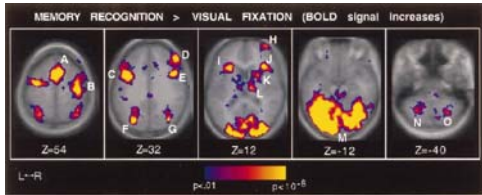
Memory impairment after PFC lesions

Legend: —■— Frontal patients; - - -▲- - Control subjects.

Mangels, Gershberg, Shimamura, & Knight (1996) *Neuropsychology*

Recognition

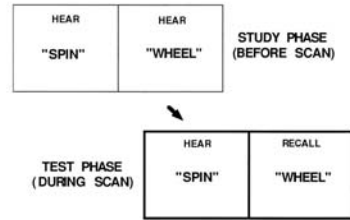
Task: decide whether each word in a list has been presented during the study



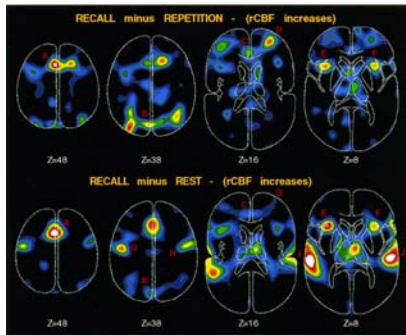
Buckner et al., (1998) *NeuroImage*

Cued recall: paired associates

Task: recall the word that was associated with "spin" during study phase

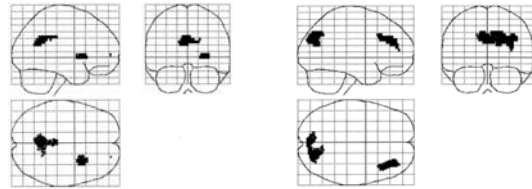


Cued recall: paired associates



Buckner et al., (1996) *J. Neurosci.*

Cued recall vs Free recall

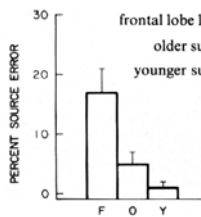


Cued recall (paired associates)

Free recall

Fletcher et al., (1998) *Brain*

Source memory



- memory for **facts** vs memory for **source**
- **Memory for source:** *where* and *when* a fact was learned

Janowsky et al., (1989) *Neuropsychologia*

Metamemory

- Knowledge about
 - one's memory capabilities
 - strategies that can aid memory
- Impaired after prefrontal lesions
- Confabulation
 - endorsing, explaining, and justifying false memories

Confabulation: Patient interview

- Q. Can you tell me a little bit about yourself? How old are you?
A. *I'm 40, 42, pardon me, 62.*
- Q. Are you married or single?
A. *Married.*
- Q. How long have you been married?
A. *About 4 months.*
- Q. What's your wife's name?
A. *Martha*
- Q. How many children do you have?
A. *Four. (He laughs) Not bad for 4 months!*
- Q. How old are your children?
A. *The eldest is 32, his name is Bob, and the youngest is 22, his name is Joe.* (These answers are close to the actual age of the boys.)

Confabulation: Patient interview

- Q. How did you get these children in 4 months?
A. *They're adopted.*
- Q. Who adopted them?
A. *Martha and I.*
- Q. Immediately after you got married you wanted to adopt these older children?
A. *Before we were married we adopted one of them, two of them. The eldest girl Brenda and Bob, and Joe and Diana since we were married.*
- Q. Does it all sound a little strange to you, what you are saying?
A. (He Laughs) *I think it is a little strange.*
- Q. Your record says that you've been married for over 30 years. does that sound more reasonable to you?
A. *No.*
- Q. Do you really believe that you've been married for 4 months?
A. *Yes.*

Memory and Working-with-memory

A component process model of PFC contribution to memory

- Moscovitch, 1992, J. Cognit. Neurosci.

Conscious recollection: 2 components

- associative (memory)
- strategic (working-with-memory)