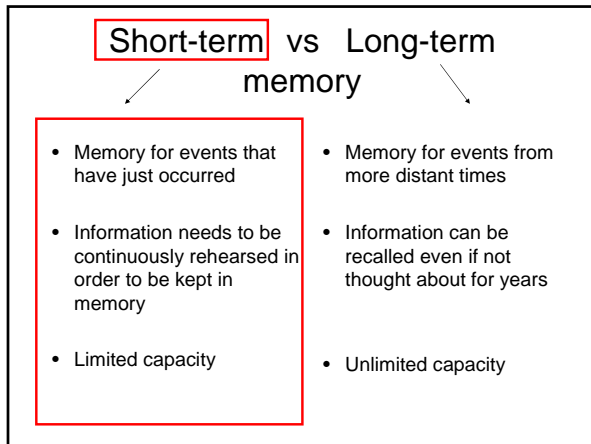
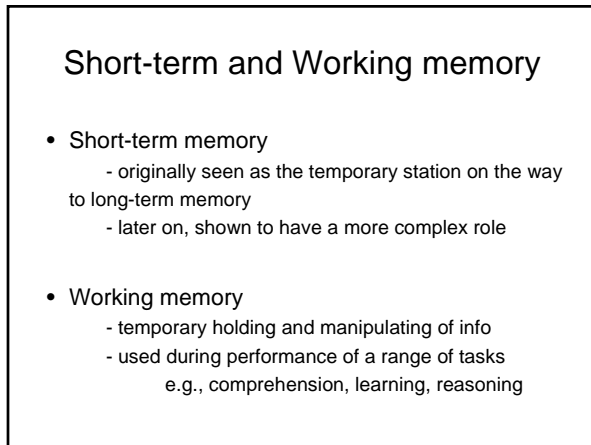


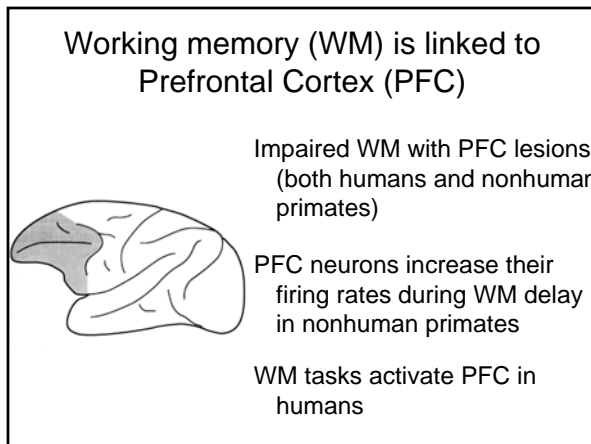


Clive

- Profound memory impairment
 - Long-term memory
"robbed of knowledge of his own life"
 - Short-term (working) memory
"moment to moment consciousness", "time vacuum"
"relate yourself to the past and project yourself into the future"
- Certain aspects of mental life preserved
 - Procedural memory (skills)
 - Emotions

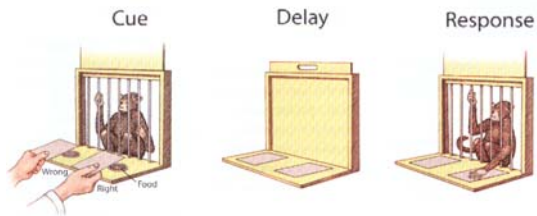




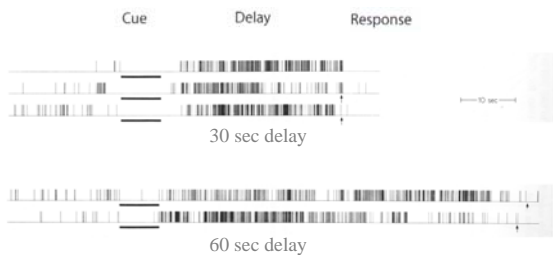


- Working memory as keeping something in mind during a delay

Delayed matching-to-sample



Activity of a prefrontal unit during delayed-response trials

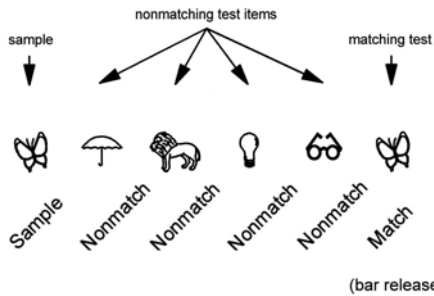


From Fuster and Alexander, 1971

Working Memory

- Working memory as keeping something in mind during a delay
With distractors during the delay

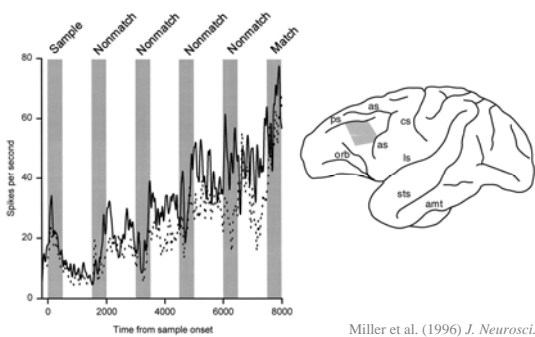
Delayed matching to sample task



0.5 sec. stimulus presentation
1 sec. delays

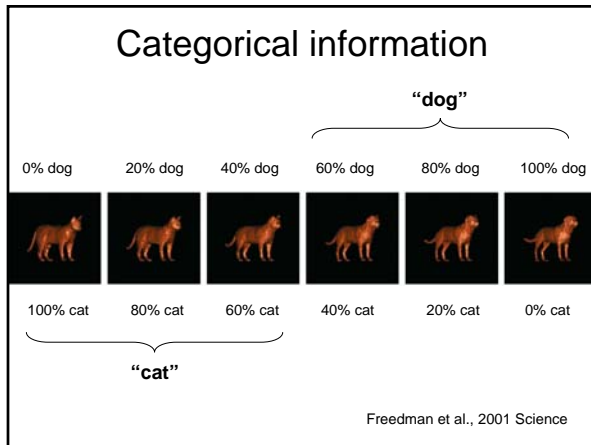
Miller et al. (1996) *J. Neurosci.*

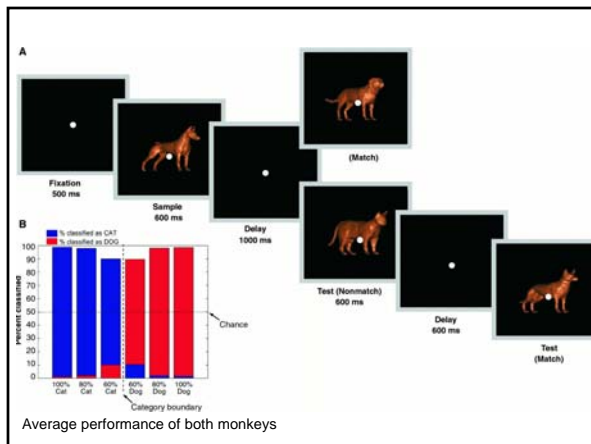
Activity of a prefrontal neurons during a delayed matching to sample task

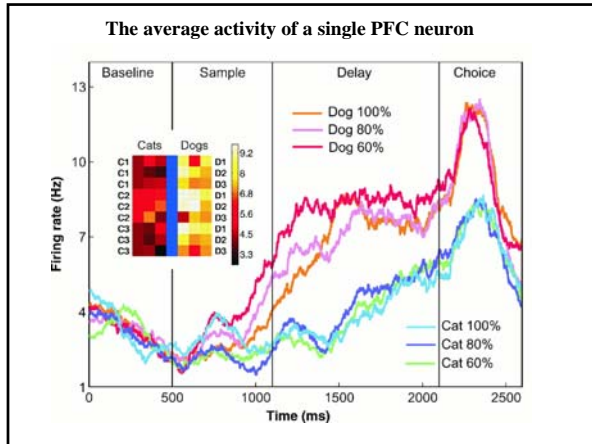


Working Memory

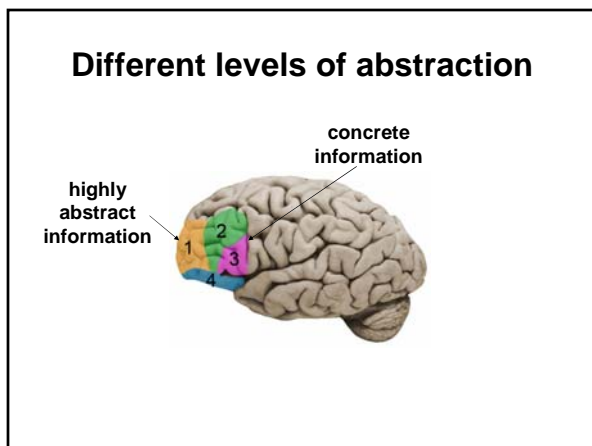
- Working memory as keeping something in mind during a delay
 With distractors during delay
- **What kind of information can prefrontal neurons maintain?**







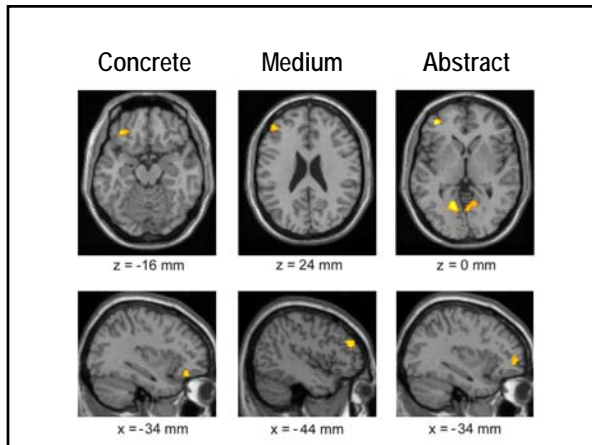
- Working memory as keeping something in mind during a delay
 With distractors during delay
- What kind of information can prefrontal neurons maintain
 concrete (objects), as well as
 abstract (categories)

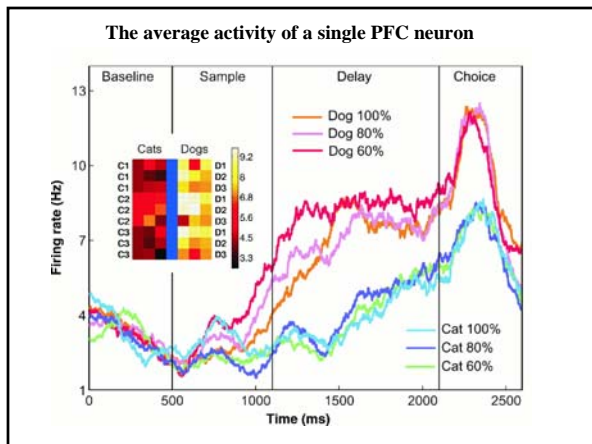


Verbal problem solving task: anagrams

Abstract	Medium	Concrete
A P e a l p	D n c a e	D k e s
H m a r	T p i r	F o d o
G a c r e	S n g o	B o l t e t

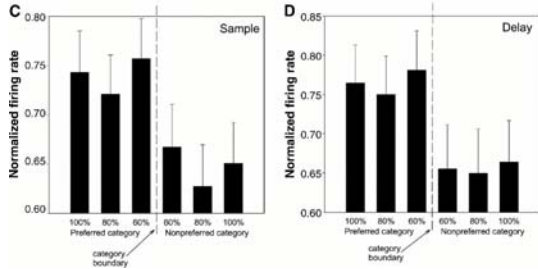
Christoff et al. (2009) Brain Research



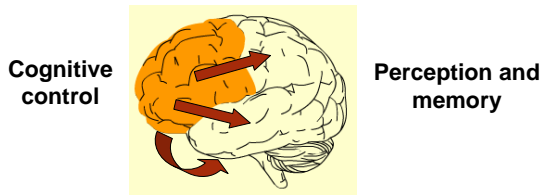


PFC neurons code memory information categorically

... both during the "Sample" and "Delay" intervals



The prefrontal cortex (PFC)

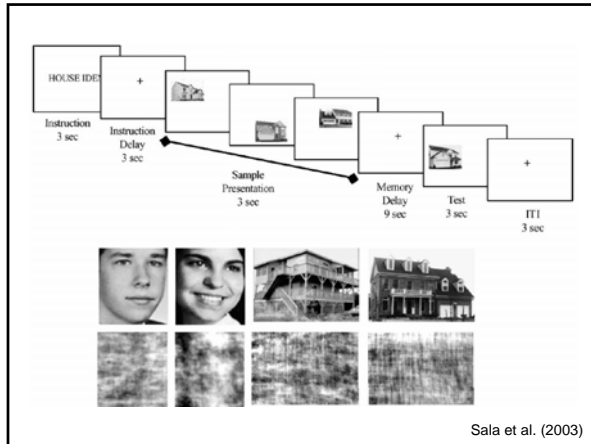


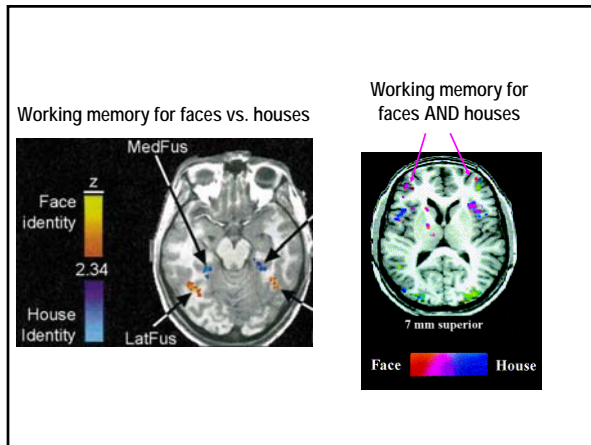
PFC biases neural processes occurring in posterior brain regions

Cognitive control

- Considered one of PFC's primary functions
- Helps us to engage in selective attention (e.g., looking for your friend whose wearing a red jacket)
- Implemented by increasing the gain of sensory or motor neurons that are engaged by task- or goal-relevant elements in the external environment

Working Memory





The prefrontal cortex serves to

- Actively maintain patterns of activity that represent goals and the means to achieve them
- Provide bias signals throughout the rest of the brain, e.g.
 - Sensory modalities
 - Memory retrieval
 - Emotional evaluation
- Guide the flow of neural activity along pathways that establish the appropriate mappings between inputs, internal states, and outputs needed to perform a given task
