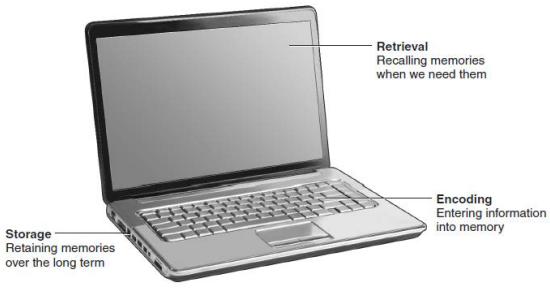
Memory

PSYC 313 - Lecture 10
Dr. J. Nicol

Memory

- The processes involved in retaining, retrieving, and using information about stimuli, images, events, ideas, and skills after the original information is no longer present
- For many years theorizing in cognitive psychology focused on the process through which information was perceived and was then moved into memory storage—that is, it was focused on the process of acquiring information
- According to the information-processing models of memory—much like a computer does—we encode information, store information, and retrieve information

Information-processing models of memory are analogous to a computer

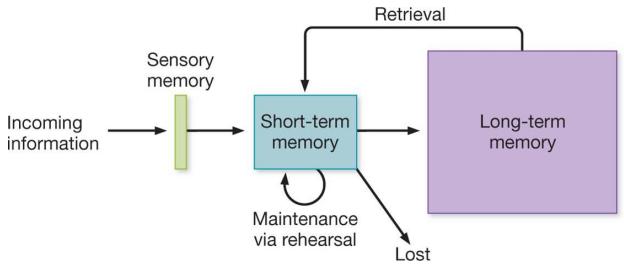


Encoding *allows us to enter information into our brain;* ***storage*** *allows us to retain the information over the long-term; and* ***retrieval*** *enables us to call up the information as we need it*

The Modal Model of Memory

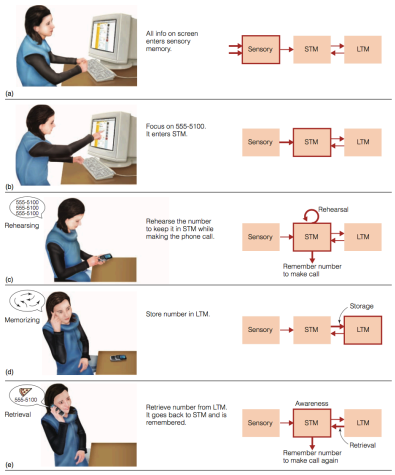
- An example of an information-processing model of memory—it proposes that storage takes place in three interacting memory systems
- According to this model, before information can be consolidated in memory it must pass through three stages of mental processing
- The three stages are called the structural features of the model

The Modal Model of Memory



Atkinson & Shiffrin (1968)

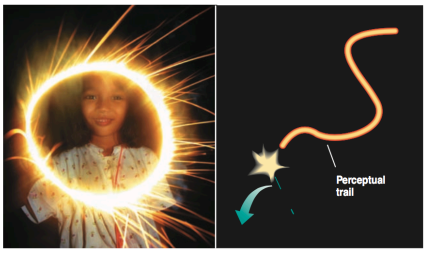
Operation of the modal model's structural and control processes



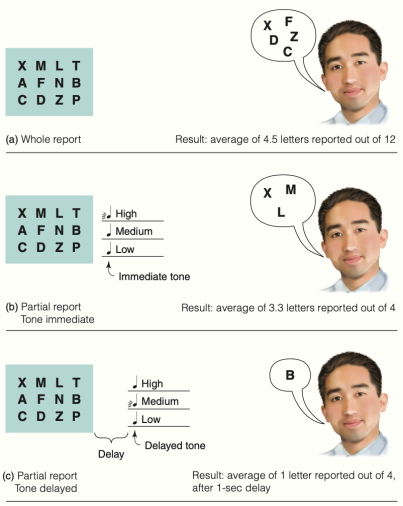
Sensory Memory

- Preserves information in its original sensory form for a fraction of a second
- Allows us to react to a stimulus for a brief period of time as if the stimulus was still present (McBurney & Collings, 1984)
- The memory is brief but can be extremely useful in reacting to changing situations
- In the case of vision, people really perceive an afterimage rather than the actual stimulus

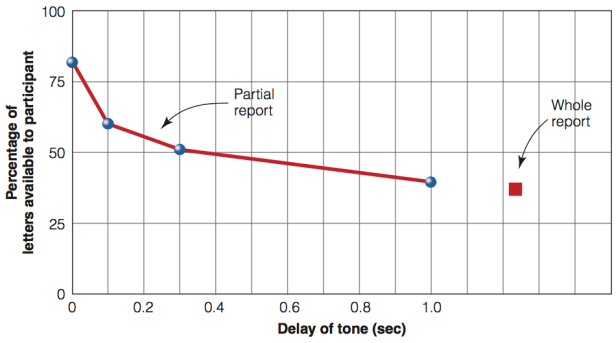
Sensory memory *is the brief retention of the effects of sensory stimulation*



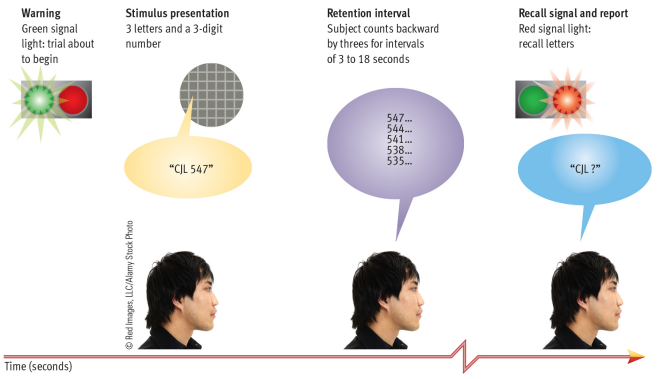
What Happens?	What Is on the Screen?	What Do You Perceive?
Film frame 1 is projected.	Picture 1	Picture 1
Shutter closes and film moves to the next frame.	Darkness	Picture 1 (persistence of vision)
Shutter opens and film frame 2 is projected.	Picture 2	Picture 2*



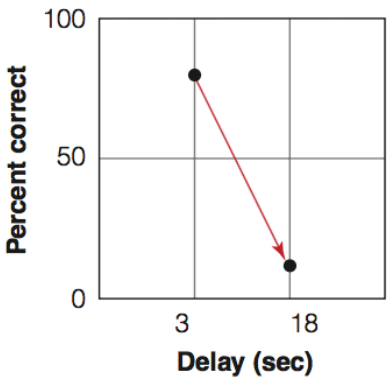
Sperling (1960)



Sperling (1960)



Peterson & Peterson (1959)



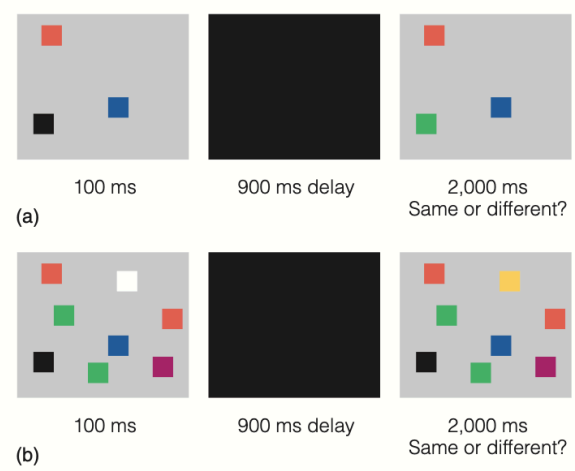
Peterson & Peterson (1959)

According to measurements of digit span the average capacity of STM is about 7 ± 2 items (Miller, 1956)

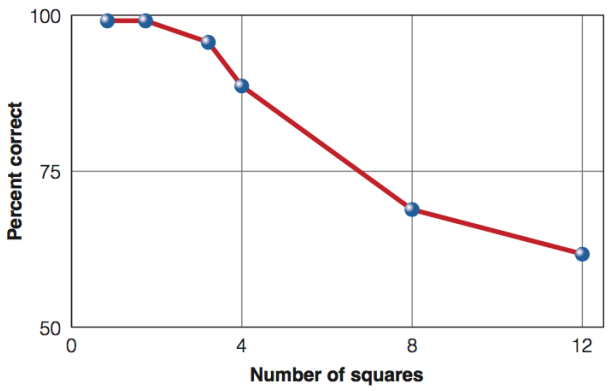
2 1 4 9
3 9 6 7 8
6 4 9 7 8 4
7 3 8 2 0 1 5
8 4 2 6 4 1 3 2
4 8 2 3 9 2 8 0 7
5 8 5 2 9 8 4 6 3 7

Short-Term Memory

- According to early research that measured of digit span, the average capacity of STM is about 7 ± 2 items (Miller, 1956)
- However, more recent estimates of STM capacity suggest that it is closer to 4 items (Cowan, 2001)

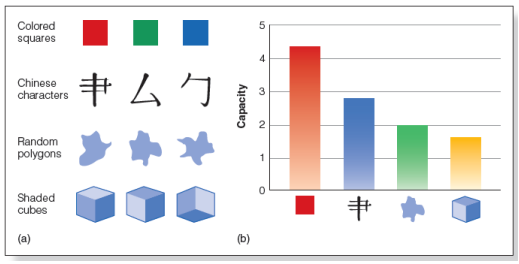


Luck & Vogel (1997)



Luck & Vogel (1997)

Some researchers argue that it is better to describe the capacity STM in terms of the "amount of information" that can be retained rather than the "number of items"

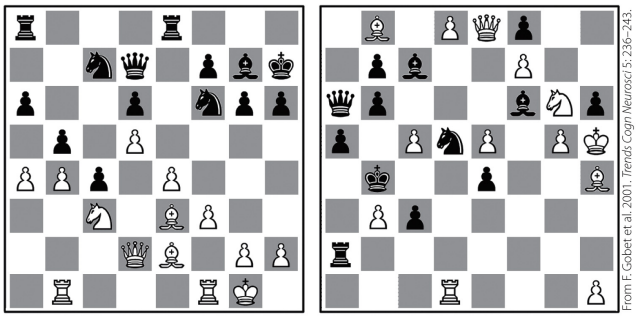


Participants' ability to make the same/different judgment depended on the complexity of the stimuli in STM

Alvarez & Cavanagh (2004)

Short-Term Memory

- According to some researchers, the capacity of STM has historically been overestimated because the researchers have failed to take steps to prevent rehearsal or *chunking* by participants
- It has long been known that you can increase your STM capacity by combining stimuli into larger, possibly higher-order units, called *chunks* (Simon, 1974)
- Chunking is the process of combining small units of information into larger more meaningful units

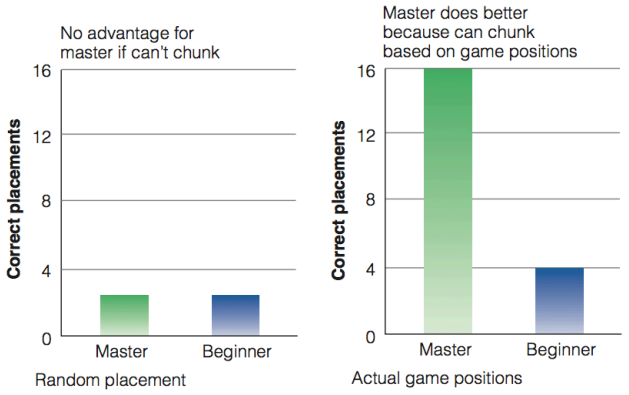


From F. Gobet et al. 2001. *Trends Cogn Neurosci* 5: 236–243.

Master's game
Experts recall the entire position almost perfectly, but novices perform poorly.

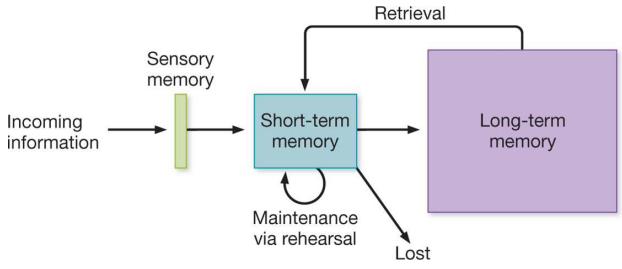
Random position
There is no difference in recall of random positions between experts and novices.

Chase & Simon (1973)



Chase & Simon (1973)

The Modal Model of Memory



Atkinson & Shiffrin (1968)

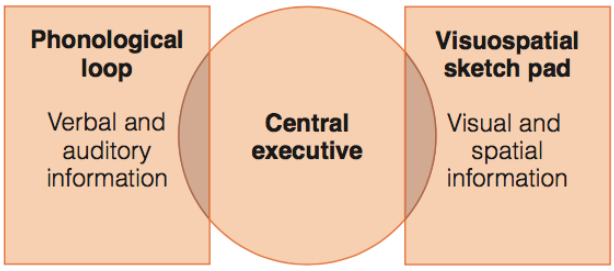
Working Memory

- Baddeley (1986) contends that a STM process must exist that is dynamic and that would comprise a number of components that can function independently of one another—because we can multitask
- Accordingly, he proposed a more complex, modularized model of short-term memory that characterizes it as "working memory"
- He describes working memory as a limited capacity storage system that temporarily maintains and stores information by providing an interface between perception, memory, and action (Baddeley, 2003)

Differences Between WM and STM

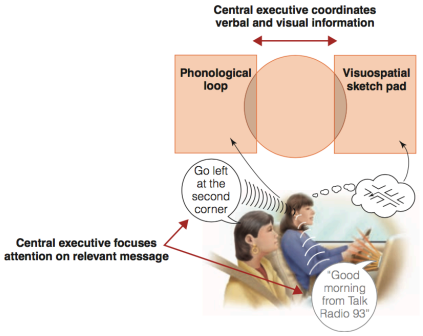
- STM is concerned with the temporary storage of information, whereas WM is concerned with the manipulation of information
- STM consists of a single component, whereas WM memory consists of multiple components

Three Components of Working Memory



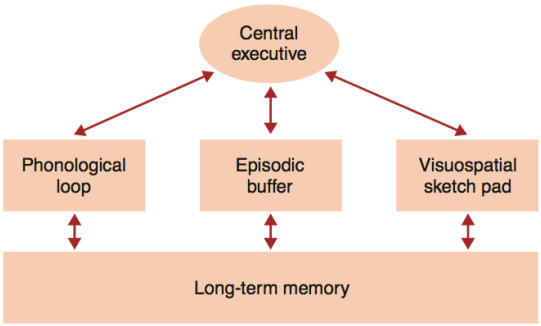
Baddeley & Hitch (1974)

Tasks processed by the phonological loop and visuospatial sketchpad are coordinated by the central executive



The central executive allocates attention in working memory by deciding how attention will be divided across tasks, and how attention will be switched back-and-forth across tasks

The episodic buffer can store information (providing extra capacity) and is connected to LTM (making the exchange between WM and LTM possible)

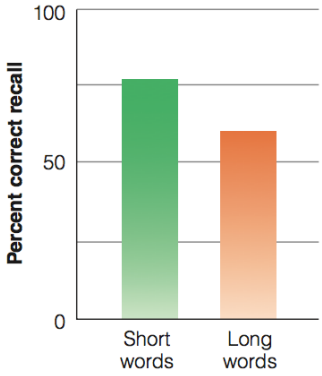


Baddeley et al. (2009)

The Phonological Loop

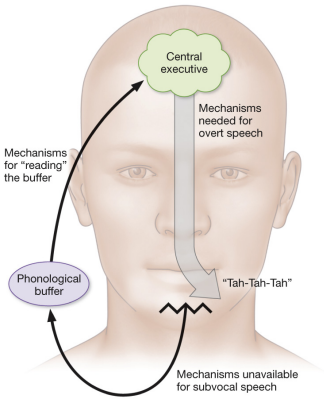
- Research has revealed several phenomena that support the existence of phonological loop—specifically the idea that there is a component of working-memory that is specialized for language
- ***Phonological similarity effect:*** the confusion—during recall—of letters or words that sound familiar, but that don't necessarily look similar (e.g., confusing F instead of S, but not confusing F for E)

Word length effect— memory for lists of words is better for short words than for long words because it takes longer to rehearse long words and to reproduce them during recall

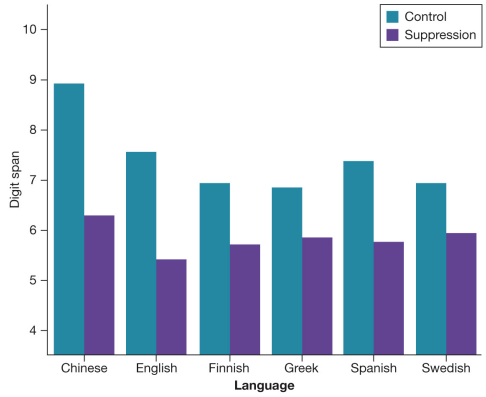


Baddeley et al. (1984)

The effect of concurrent articulation on the rehearsal of information in the phonological loop

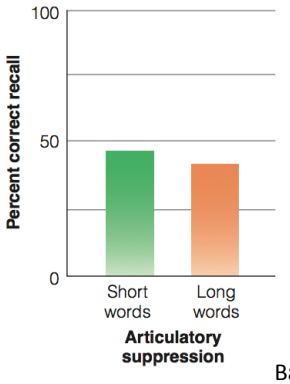


Articulatory suppression of the phonological loop by concurrent articulation decreases working memory span

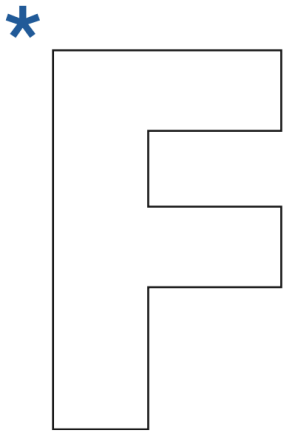


Chincotta & Underwood (1997)

Concurrent articulation which causes articulatory suppression and interferes with rehearsal in the phonological loop also eliminates the word length effect



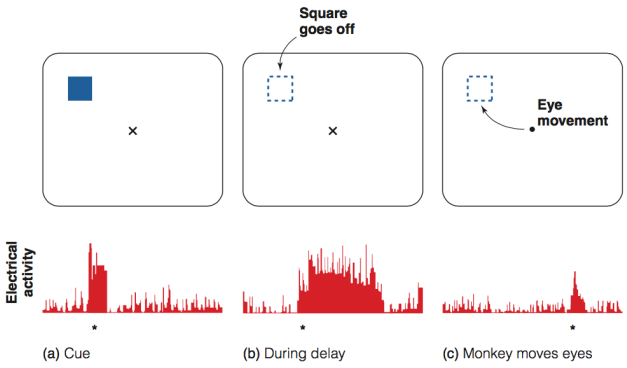
Baddeley et al. (1984)



Brooks (1968)

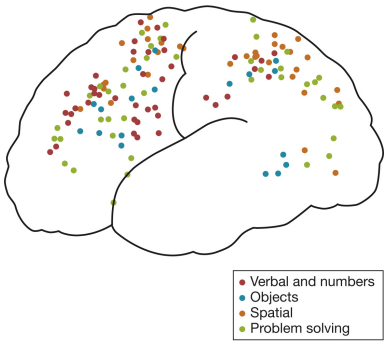
Delayed response task—the monkey must remember where the food is uncover the correct tray to obtain the reward

Goldman-Rakic (1992)



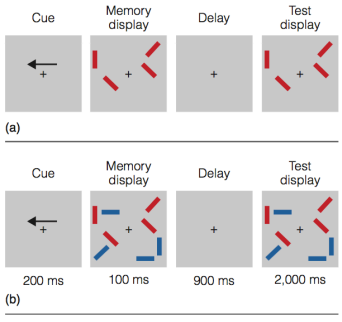
Funahashi et al. (1989)

In addition to the prefrontal cortex, other areas of the frontal lobe and areas in the parietal lobe and cerebellum are involved in working memory



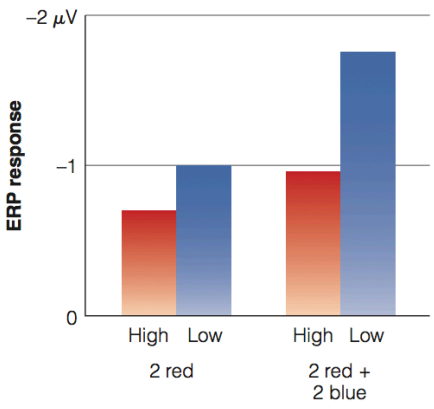
Cabeza & Nyberg (2000)

The task is to indicate if the red rectangles on the cued side are the same or different in the memory and test displays



Participants were told to ignore the blue rectangles on trials when they were present

Vogel et al. (2005)



Vogel et al. (2005)