

## Lecture # 5

# Memory



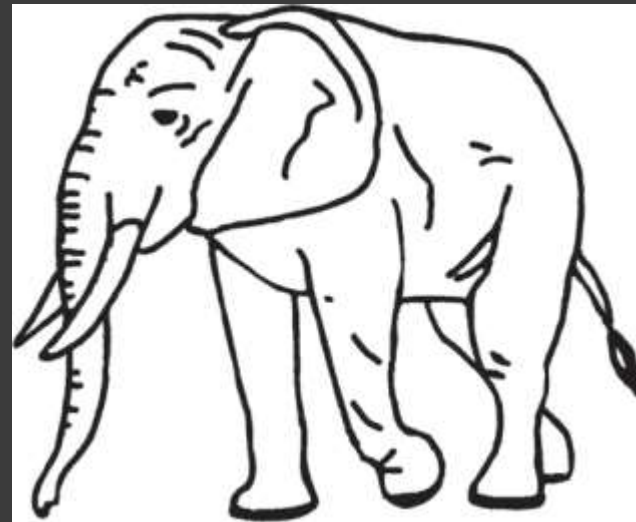
Presented By  
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Clinical Psychologist

# Memory

- ◎ “*Memory is the process of maintaining information over time.*” (Matlin, 2005)
- ◎ “***Memory*** is the means by which we draw on our past experiences in order to use this information in the present.’ (Sternberg, 1999)

# The Phenomena of Memory

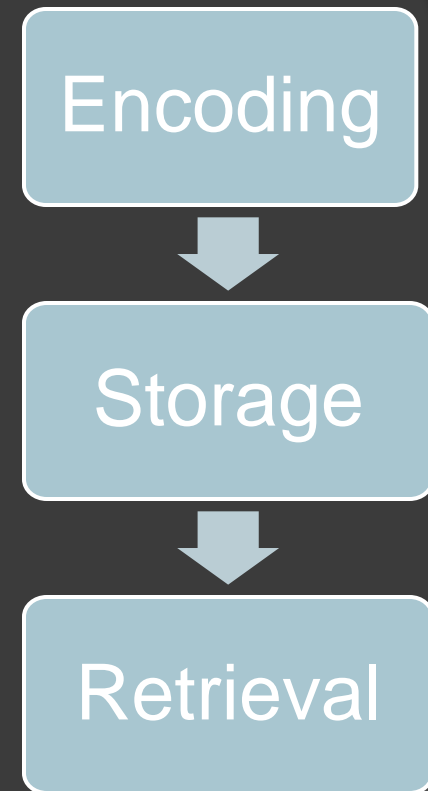
- Memory is the persistence of learning over time. It is our ability to store and retrieve information.
- Human memory can be pretty amazing



People who were shown the whole image 17 years before were more likely to identify the fragment

# How Memory works?

- Psychologists think of memory as involving three processes
  - Encoding
    - The set of mental operations that people perform on sensory information to convert that information into a form that is usable in the brain's storage systems.
  - Storage
    - Holding onto information for some period of time.
  - Retrieval
    - Getting information that is in storage into a form that can be used



# Models of Memory

## ◎ Atkinson-Shiffrin Model

- Also known as, Multi-stage Model
- Consists of three different, interacting memory systems
  - Sensory Memory
    - Stimuli are recorded by our senses and held briefly in sensory memory.
  - Short-term Memory
    - Some of this information is processed into short-term memory and encoded through rehearsal .
  - Long-term Memory
    - Information then moves into long-term memory where it can be retrieved later.

# Atkinson-Shiffrin Model



Sensory memory registers incoming information, allowing your brain to capture for a fleeting moment a sea of faces.

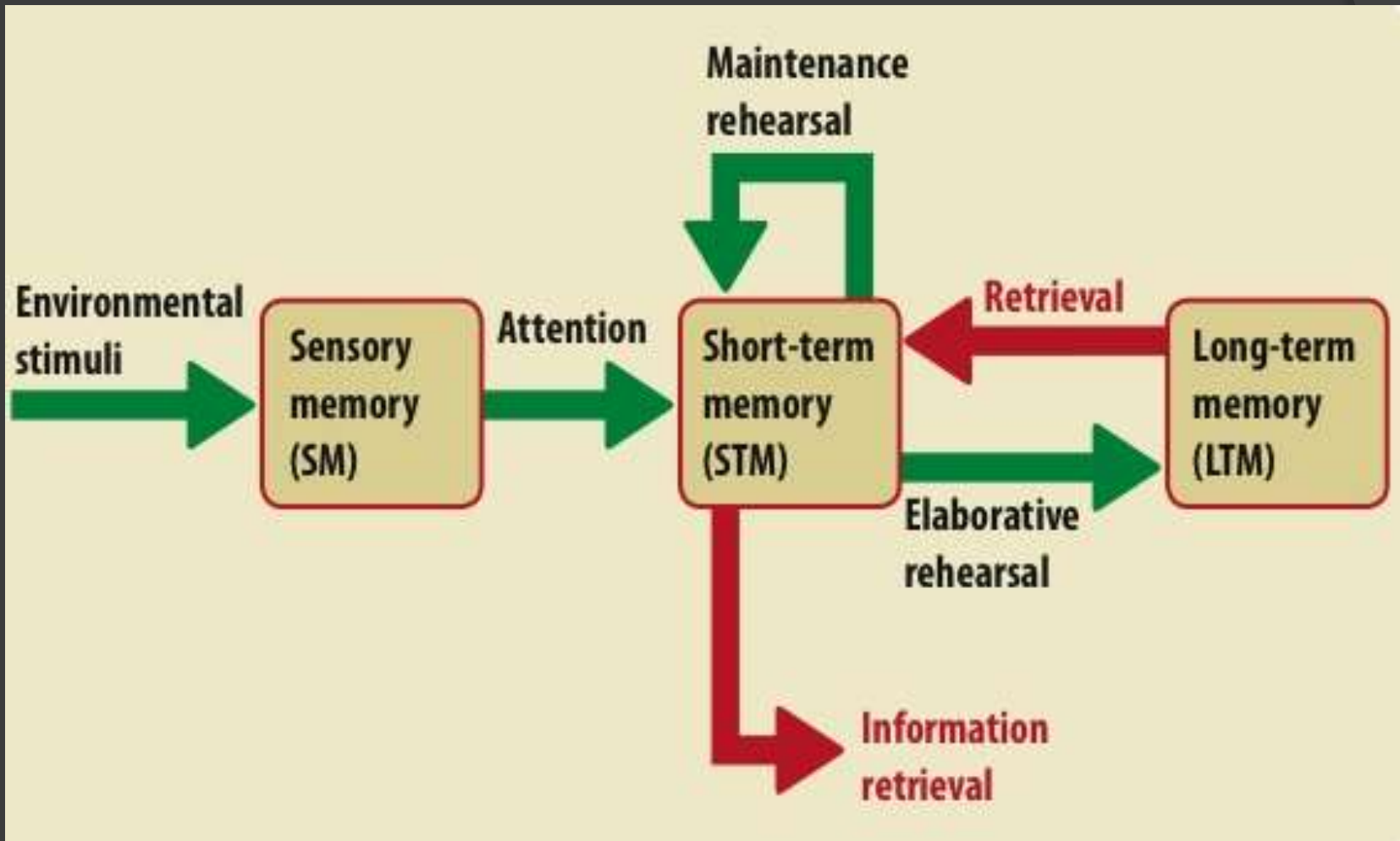


We pay attention to and encode important or novel stimuli—in this case an angry face in the crowd.



If we stare at the face long enough (rehearsal), or if we're sufficiently disturbed by it (it's deemed "important"), we will encode it for long-term storage, and we may, an hour later, be able to call up an image of the face.

# Atkinson-Shiffrin Model contd...





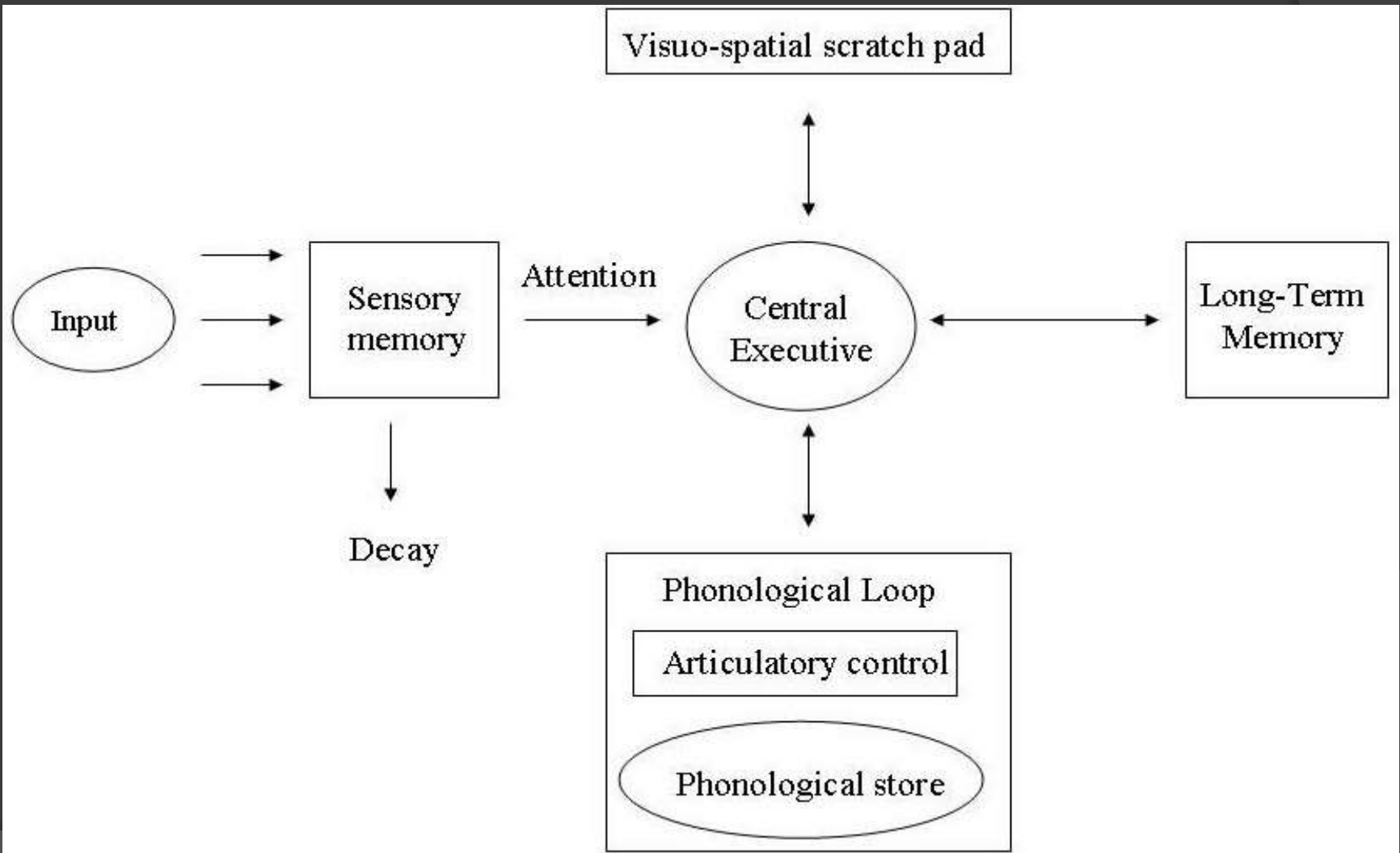
# Models of Memory contd..

## ◎ Working Memory Model

- Instead of all information going into one single store, there are different systems for different types of information
- It Consists of three different systems
  - **Central Executive:** Drives the whole system (e.g. the boss of working memory) and allocates data to the subsystems (VSS & PL). It also deals with cognitive tasks such as mental arithmetic and problem solving.
  - **Visuo-Spatial Sketch Pad** (inner eye): Stores and processes information in a visual or spatial form. The VSS is used for navigation.
  - The **phonological loop** is the part of working memory that deals with spoken and written material. It can be used to remember a phone number.



# Working Memory Model

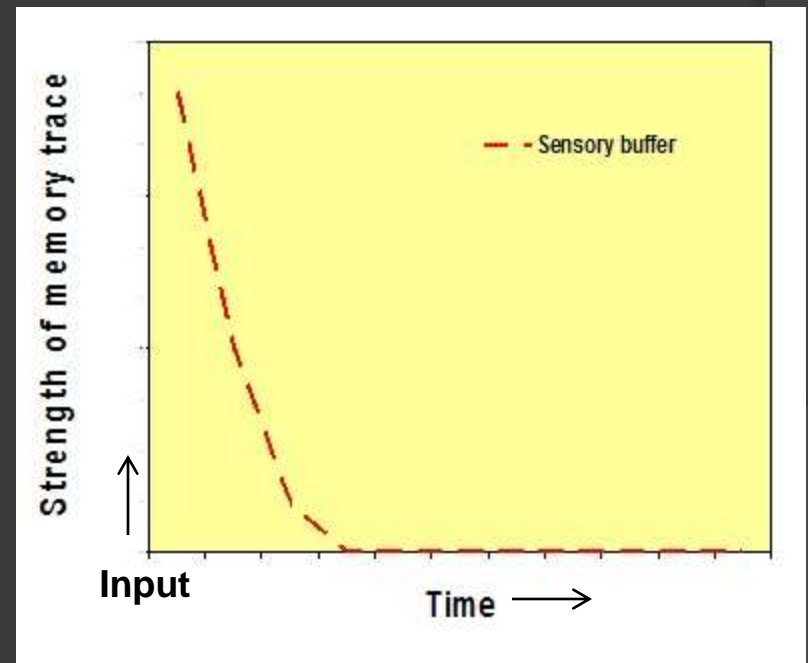


# Sensory Memory

- The immediate, initial recording of sensory information
- Large capacity, but rapid decay
- Actual length of time a stimulus exist in sensory storage depends on the modality:

Iconic memory - a visual image in sensory storage - they last approximately 1/4 of a second.

Echoic memory - auditory image. These (as well as other senses) seem to last up to 3 seconds.



# Sensory Memory to Short-term Memory

- ⦿ After getting the information in the form of Iconic and Echoic Memories, data need to be transferred to short term memory otherwise it can be lost.
- ⦿ Two processes are required to get information from sensory memory to short term memory
  - Pattern recognition - when new information comes into sensory storage, we actively search through long term memory in an effort to find a match for this new raw data.
  - Attention - this is pretty obvious. The more we pay attention to a stimulus, the more likely it will continue onto the next memory store (short term memory)

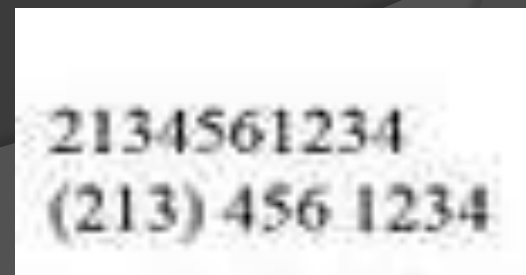
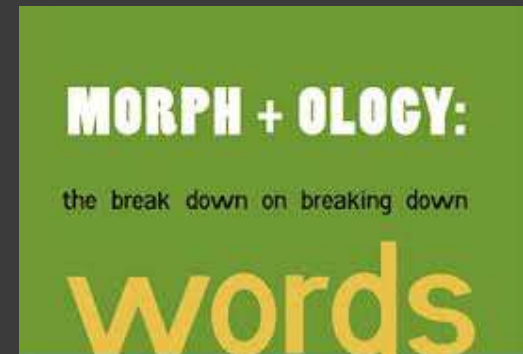
# Short-term Memory

- The stuff we encode from the sensory goes to STM.
- Events are encoded visually, acoustically or semantically.
- A limited capacity store that can maintain information for approximately 20 seconds.
- We recall digits better than letters.



# Ways to Extend duration of STM

- ⦿ Maintenance Rehearsal
  - The process of repeatedly verbalizing or thinking about the information.
- ⦿ Slots/Chunking
  - bits of information are combined into meaningful units, or chunks, so that more information can be held in STM



# Ways to Extend duration of STM

contd...

## ◎ Primacy and Recency

- Primacy - when you are receiving information, the information perceived first is more likely to be remembered. This more recent information may simply get to long term memory more easily, and thus be remembered or we may just rehearse the early information more.
- Recency - information perceived toward the end of an event is also more likely to be remembered. So, information in the "middle" seems to get pushed out and is less likely to be remembered.

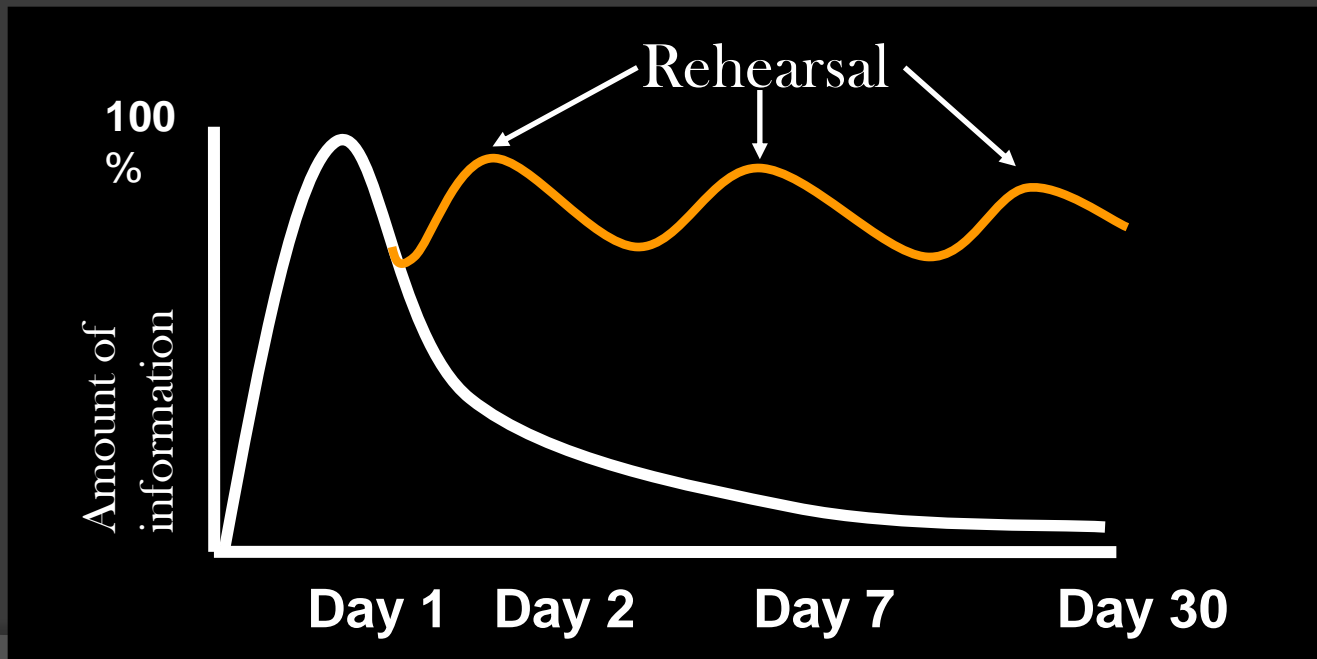
1. BOOK
2. CAP
3. HAWK
4. BALL
5. LETTER
6. BIRD
7. CAN
8. SHIRT
9. LION
10. DOOR

# Ways to Extend duration of STM

contd...

## ◎ Elaborative Rehearsal

- the only way to bring information into long-term memory
- connecting new information with previously stored, already existing associative structures



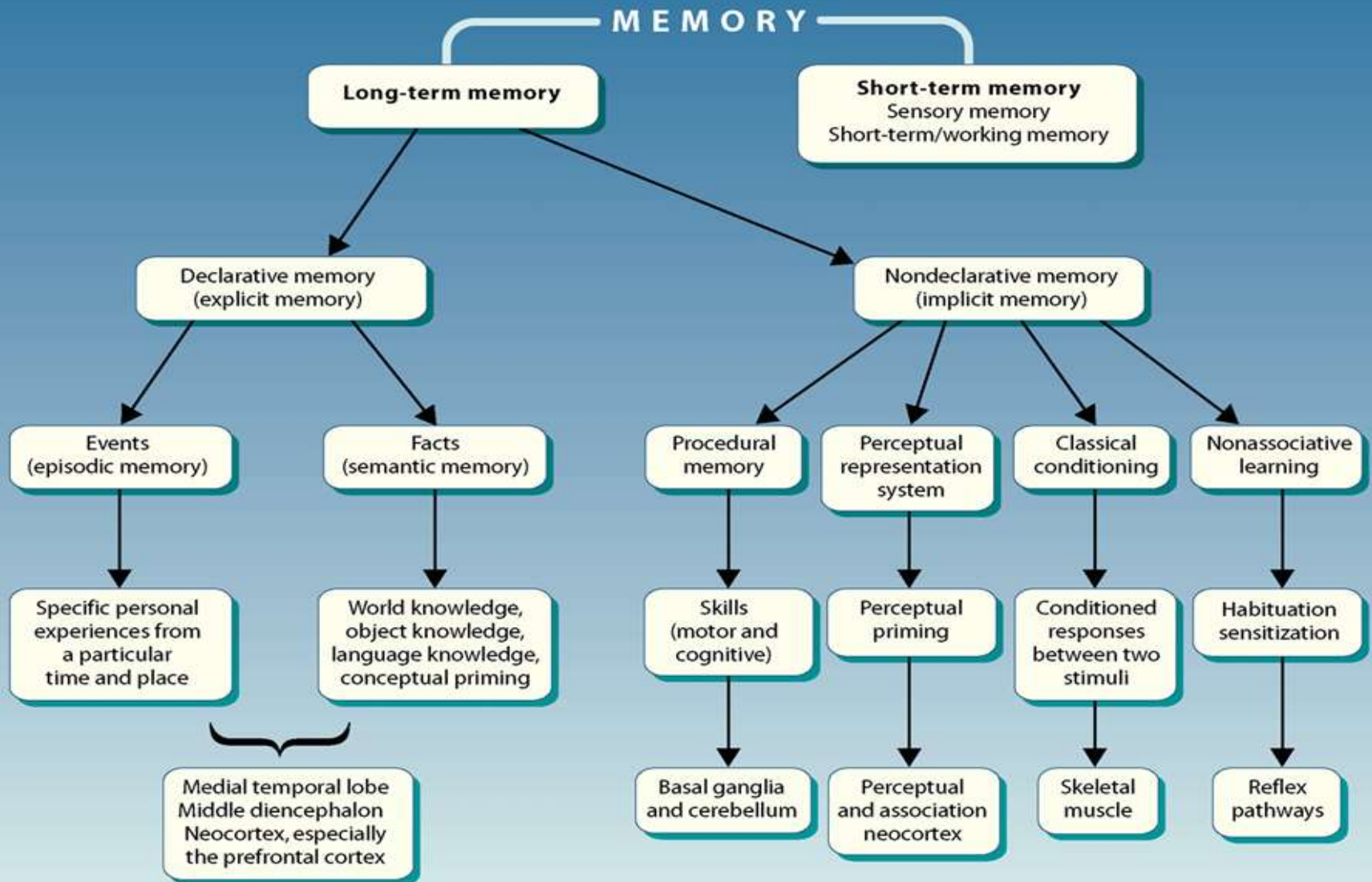


# Long-term Memory

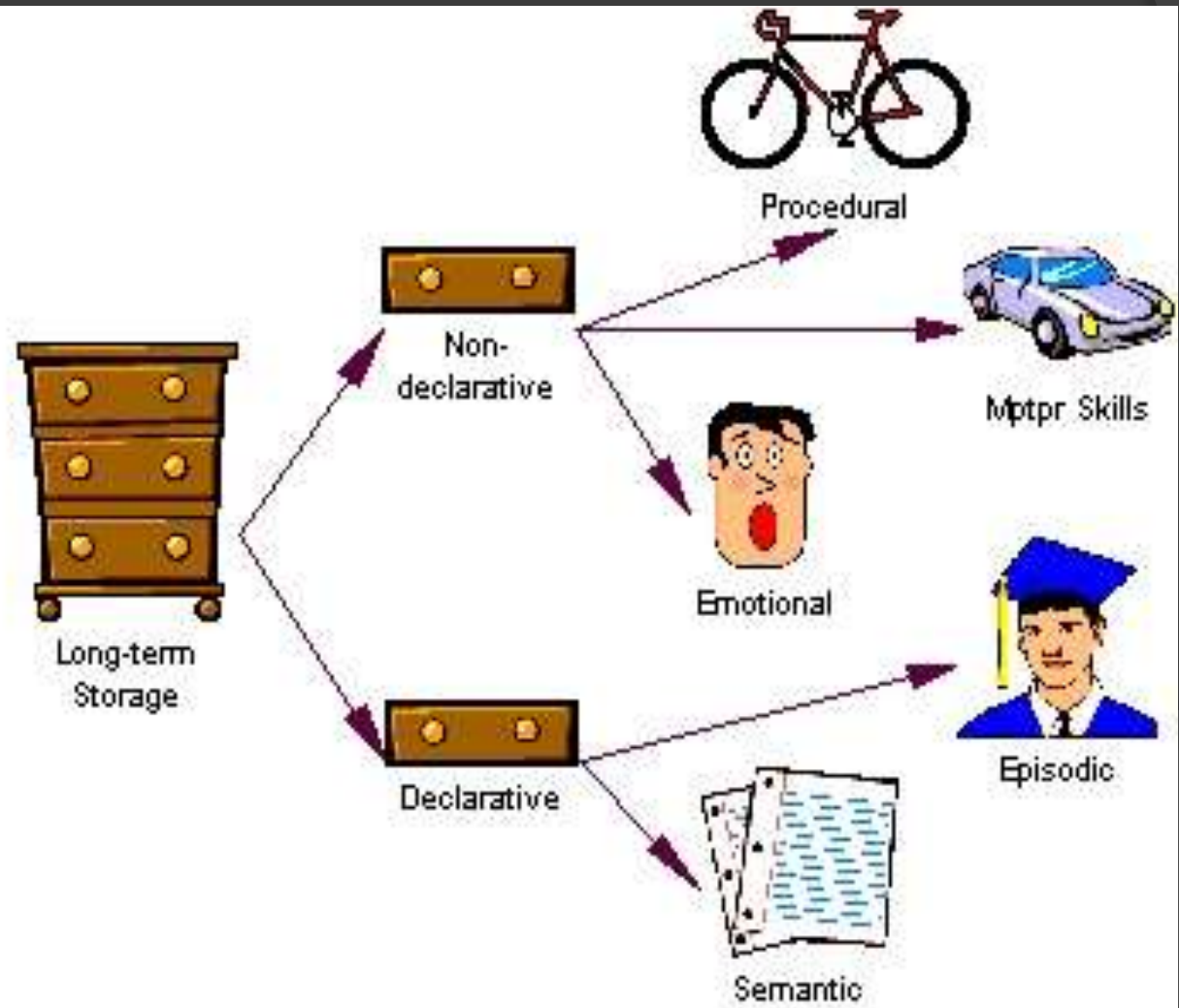
- An unlimited capacity store that can hold information over lengthy periods of time.
- Suggested encoding modes are semantic (meaning) and visual (pictorial) in the main but can be acoustic also.



# Long Term Memory



# Types of LTM (with examples)



# Types of Long-term Memory

- Declarative: memory for facts!



- Non-declarative: memory for skills and procedure



# Declarative LTM

- ⦿ Semantic memory - containing general knowledge, such as knowledge of language and information learned in formal education.
- ⦿ Episodic memory - containing personal information not readily available to others, such as daily activities and events.
- ⦿ Semantic and episodic memories are forms of explicit memory - memory that is consciously known.



# Declarative LTM contd...

**Declarative memory**  
(Medial temporal lobe; diencephalon)

**Semantic Memory**  
(facts)

**Episodic Memory**  
(Events)





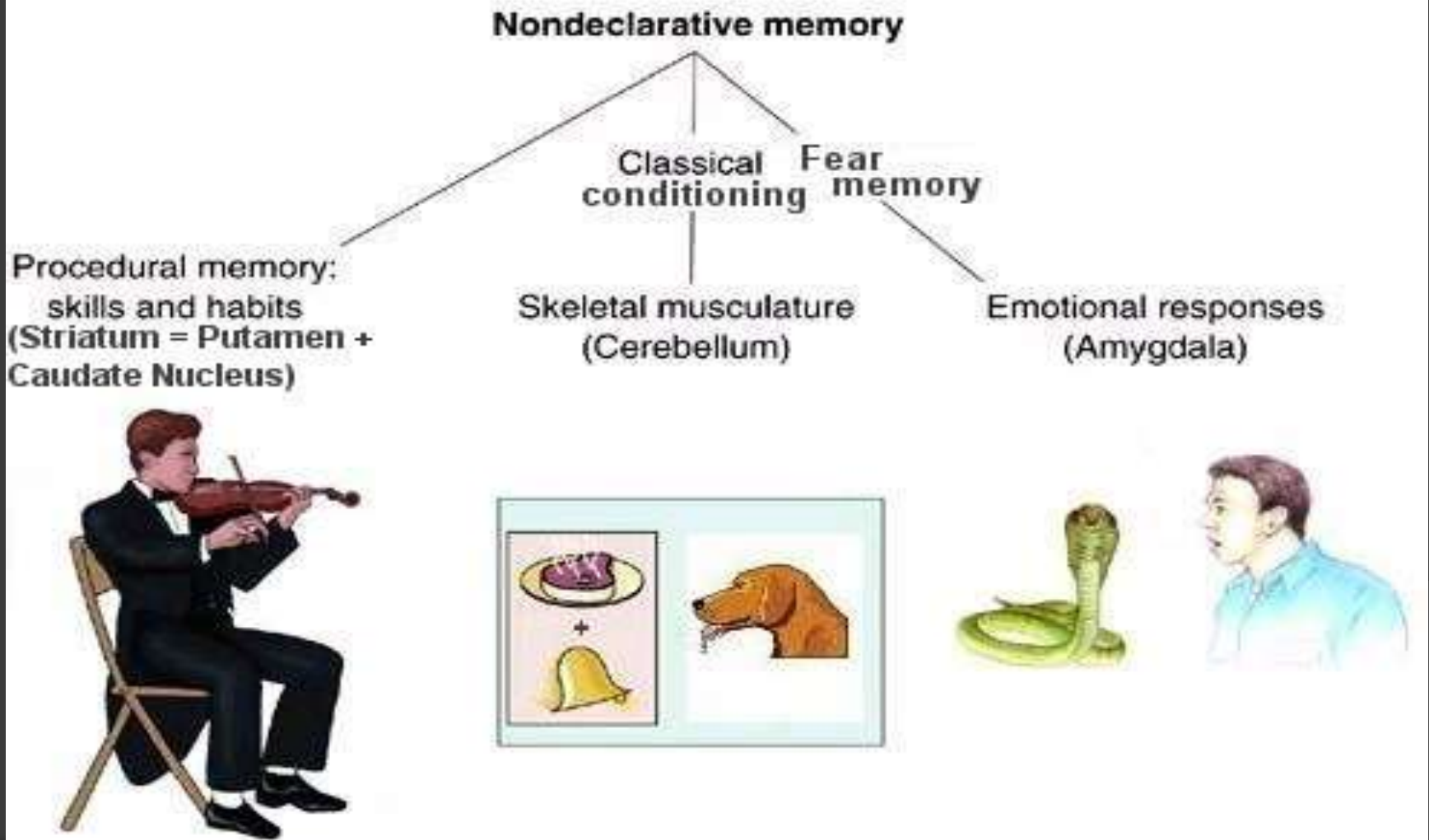
# Non-declarative LTM

- ⦿ Skills that people know how to do.
- ⦿ Also include emotional associations, habits, and simple conditioned reflexes that may or may not be in conscious awareness.
- ⦿ Non-declarative memory often called implicit memory - memory that is not easily brought into conscious awareness.





# Non-declarative LTM contd...



# Level of Processing Model

- ◎ A model of memory as a single system in which retention depends on how deeply information is processed
  - With the shallowest levels of processing, a person is merely aware of the incoming sensory information
  - Deeper processing (elaboration) takes place only when the person does something more with the information, such as forming relationships, making associations, attaching meaning to a sensory impression, or otherwise engaging in active elaboration on new material


# Level of Processing Model contd...

## ◎ Craik and Tulving

- Had participants answer *yes* or *no* to questions asked about words just before the words were flashed to them for 1/5 of a second
- Participants had to process the words visually, acoustically, or semantically
- The test required shallow processing for the first question, deeper processing for the second question, and still deeper processing for the third question
- Later retention tests showed that the deeper the level of processing, the higher the accuracy rate of memory

# Level of Processing Model

contd...



Level of processing	Type of encoding	Example of questions used to elicit appropriate encoding
<i>Shallow processing</i>	<i>Structural encoding:</i> emphasizes the physical structure of the stimulus.	Is the word written in capital letters?
<i>Intermediate processing</i>	<i>Phonemic encoding:</i> emphasizes what a word sounds like.	Does the word rhyme with weight?
<i>Deep processing</i>	<i>Semantic encoding:</i> emphasizes the meaning of verbal input.	Would the word fit in the sentence: "He met a _____ on the street"?

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# Remembering

## ◎ Three kinds of memory tasks

### • Recall

- A measure of retention that requires a person to remember material with few or no retrieval cues, as in an essay test
- Trying to remember someone's name, recalling items on a shopping list, memorizing a speech or a poem word for word, and remembering
- May be made a little easier if cues are provided to jog memory
- Sometimes serial recall is required; that is, information must be recalled in a specific order
- Research suggests that, in free recall tasks, order associations are more resistant to distractions than meaningful associations



# Remembering

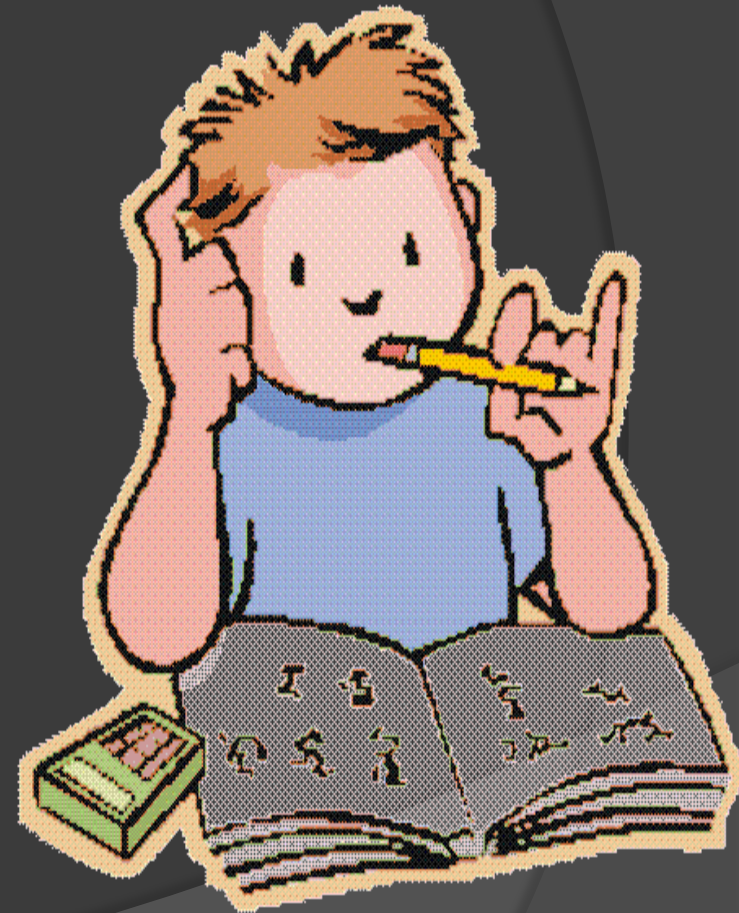
- Recognition
  - A measure of retention that requires a person to identify material as familiar, or as having been encountered before
  - Multiple-choice, matching, and true/false questions are examples of recognition test items
  - The main difference between recall and recognition is that a recognition task does not require you to supply the information but only to recognize it when you see it
  - Recent brain-imaging studies have discovered that the hippocampus plays an extensive role in memory tasks involving recognition, and the degree of hippocampal activity varies with the exact nature of the task





# Remembering

- Relearning
  - Measuring retention in terms of the percentage of time or learning trials saved in relearning material compared with the time required to learn it originally; also called the *savings method*
  - Savings score
    - The percentage of time or learning trials saved in relearning material over the amount of time or number of learning trials required for the original learning
    - College students demonstrate the relearning method each semester when they study for comprehensive final exams





# Example:

## Recall versus Recognition

- ◎ **Example of Recall:**

The process of storing information in memory is called \_\_\_\_\_.

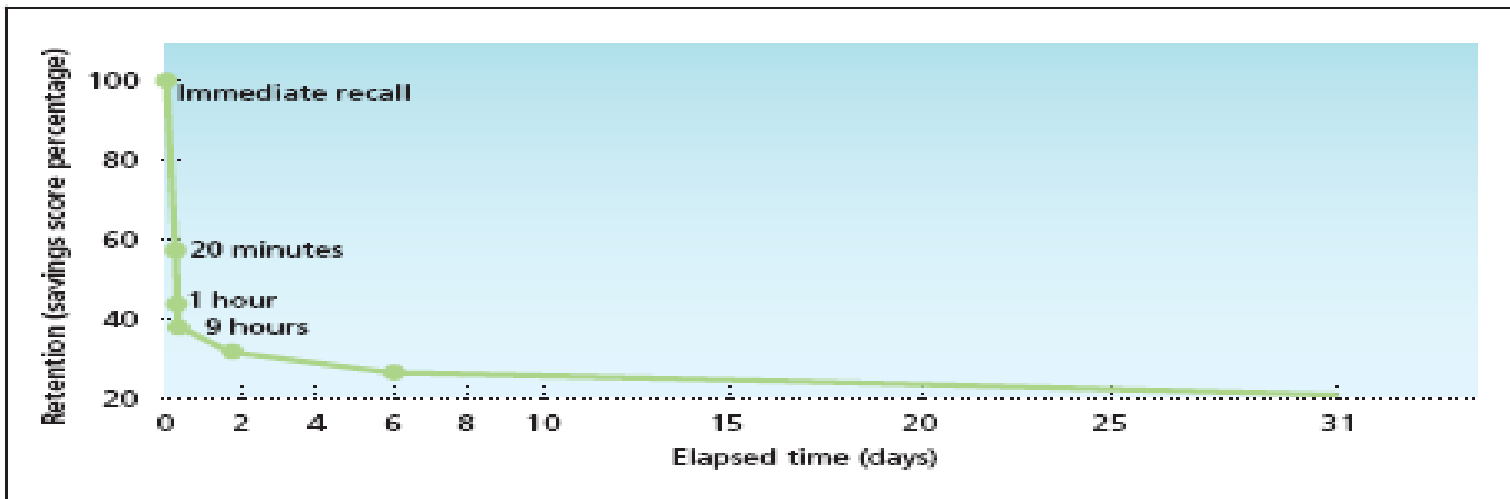
- ◎ **Example of Recognition:**

The process of storing information in memory is called:

- a. rehearsal    b. deep processing
- c. encoding    d. retrieval

# Forgetting

- Curve of forgetting - a graph showing a distinct pattern in which forgetting is very fast within the first hour after learning a list and then tapers off gradually.



# Forgetting: Encoding Failure

- Encoding failure - failure to process information into memory.



# Forgetting: Memory Trace Theory

- ⦿ Physical change in the brain that occurs when a memory is formed.
- Decay - loss of memory due to the passage of time, during which the memory trace is not used.
- Disuse - another name for decay, assuming that memories that are not used will eventually decay and disappear.



Memories after many years – not explained by memory trace theory.

# Forgetting: Interference Theory

- ◎ Proactive interference
  - memory retrieval problem that occurs when older information prevents or interferes with the retrieval of newer information.
- ◎ Retroactive interference
  - memory retrieval problem that occurs when newer information prevents or interferes with the retrieval of older information.



Proactive interference – problem driving in England after learning in US.

# Forgetting: Interference Theory

## Proactive Interference

French, learned beforehand,  
interferes proactively



## Retroactive Interference

Spanish, learned afterwards,  
interferes retroactively



**FIGURE 6.11 Proactive and Retroactive Interference** If a student were to study for a French exam and then a Spanish exam, interference can occur in two directions. When taking the Spanish exam, the French information studied first may proactively interfere with retrieval of the Spanish information. But when taking the French exam, the more recently studied Spanish information may retroactively interfere with the retrieval of the French information.

# Some Ways to Improve Memory

- ◎ **Knowledge of Results:** Feedback allowing you to check your progress
- ◎ **Recitation:** Summarizing aloud while you are learning
- ◎ **Rehearsal:** Reviewing information mentally (silently)
- ◎ **Selection:** Selecting most important concepts to memorize
- ◎ **Organization:** Organizing difficult items into *chunks*; a type of *reordering*

*Thank You*