

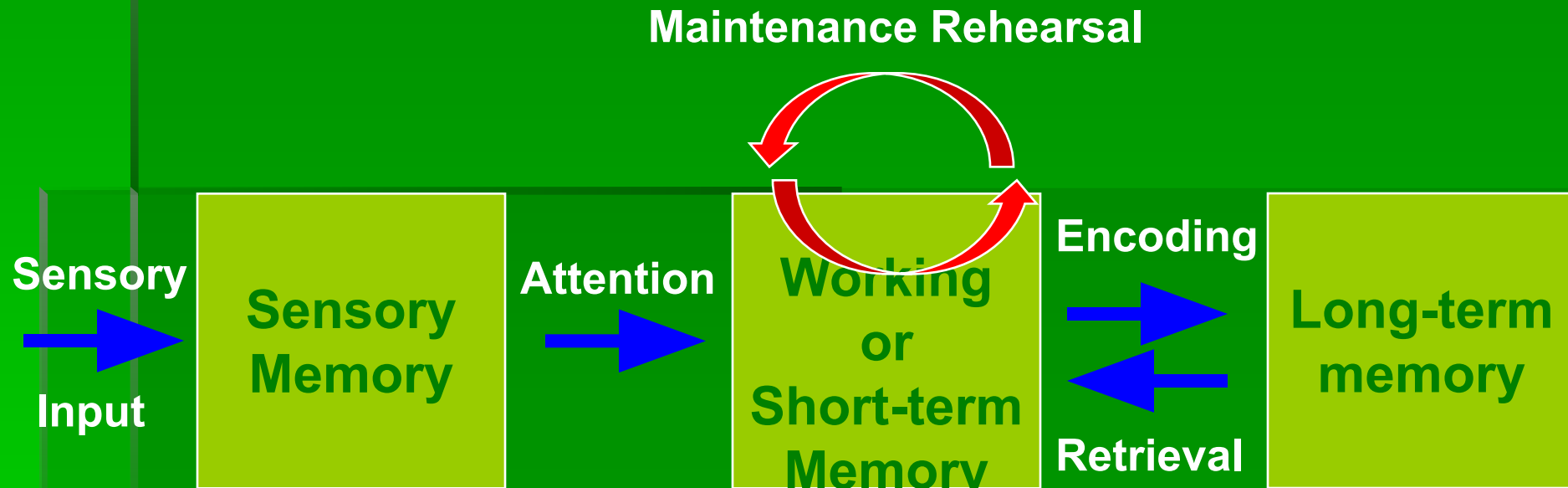
# Memory

# Memory Processes

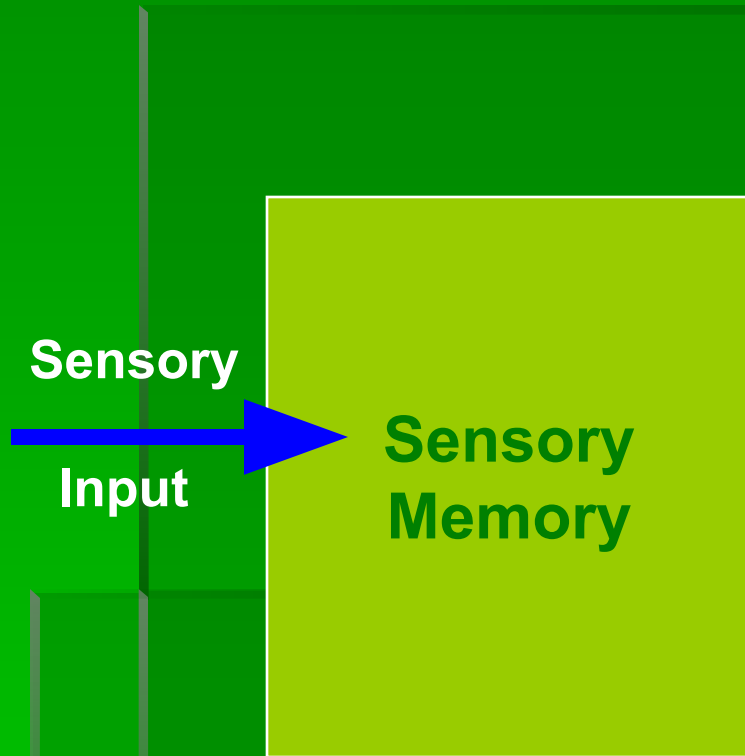
- Encoding--transforming information into a form that can be entered and retained in the the memory system
- Storage--retaining information in memory so that it can be used at a later time
- Retrieval--recovering information stored in memory so that we are consciously aware of it

# Three Stages of Memory

- Three memory stores that differ in function, capacity and duration



# Sensory Memory

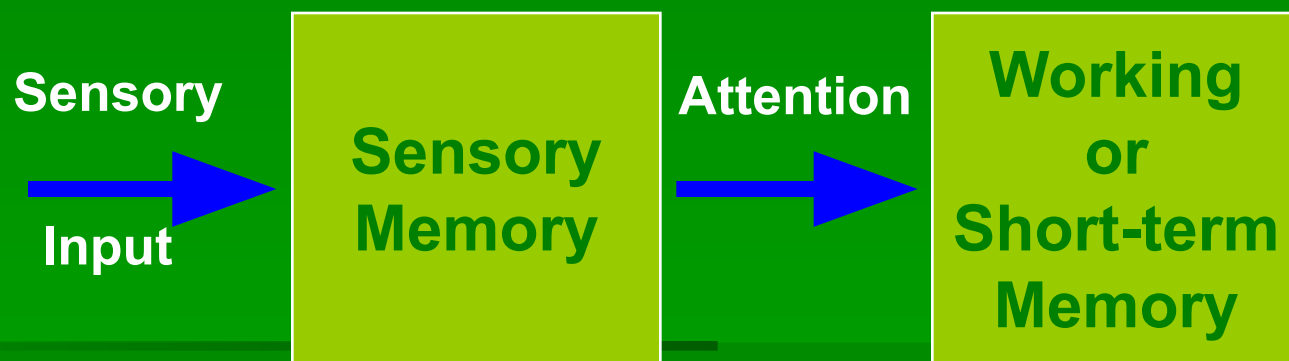


- Function —process for basic physical characteristics
- Capacity—large
  - can hold many items at once
- Duration—very brief retention of images
  - .3 sec for visual info
  - 2 sec for auditory info
- Divided into two types:
  - iconic memory—visual information
  - echoic memory— auditory information
- Attention is needed to transfer information to working memory

# Sensory Memory

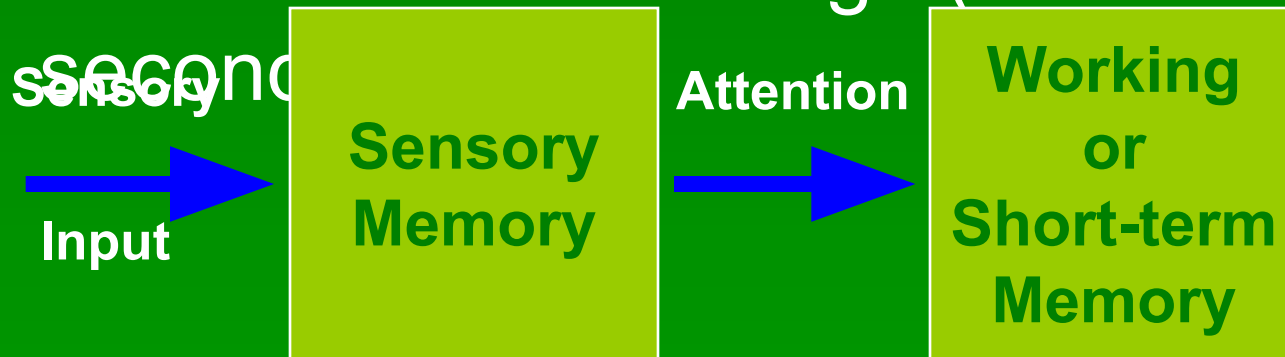
- Visual sensory memory—brief memory of an image or icon. Also called iconic memory.
- Auditory sensory memory—brief memory of a sound or echo. Also called echoic memory.
- Auditory sensory memories may last a bit longer than visual sensory memories

# Short Term or Working Memory



# Short-Term Memory

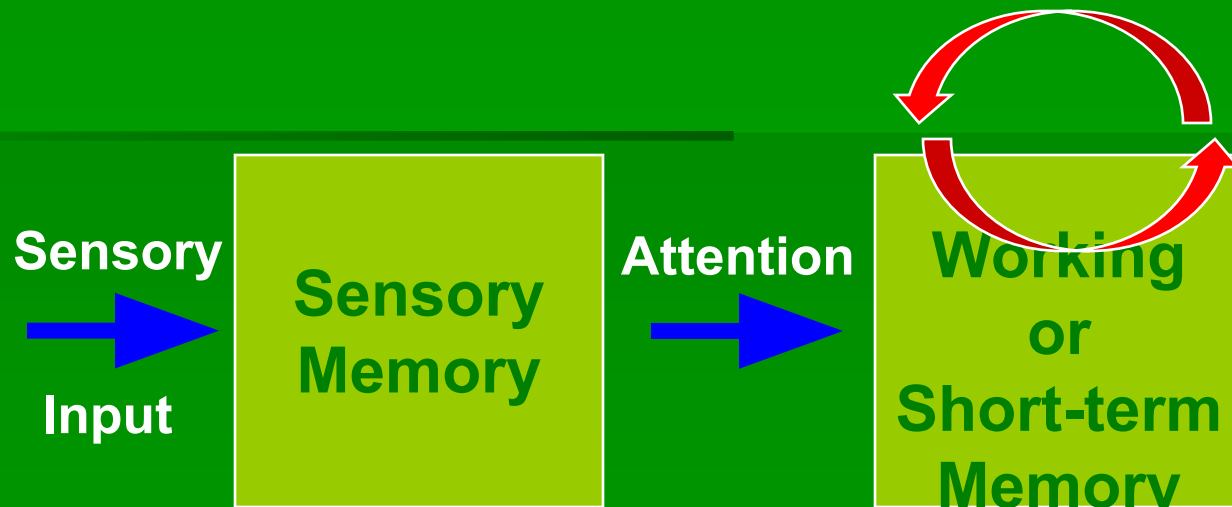
- Function—conscious processing of information
  - where information is actively worked on
- Capacity—limited (holds 7+/-2 items)
- Duration—brief storage (about 30



# Maintenance Rehearsal

- Mental or verbal repetition of information allows information to remain in working memory longer than the usual 30 seconds

## Maintenance Rehearsal



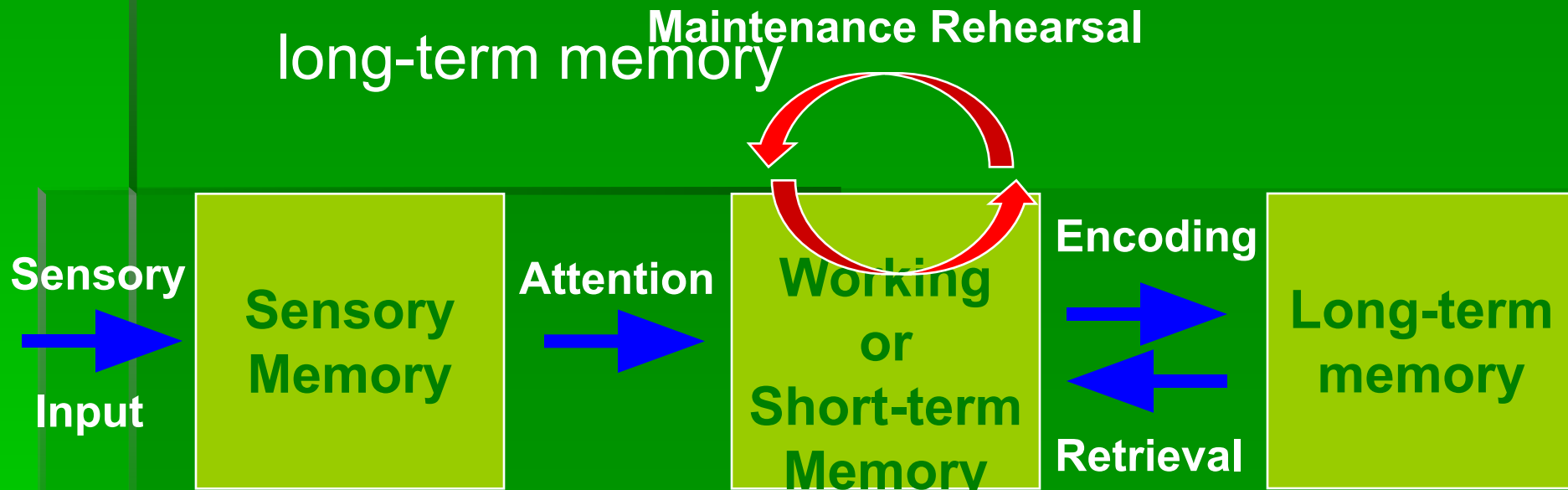


# Chunking

- Grouping small bits of information into larger units of information
  - expands working memory load
- Which is easier to remember?
  - 4 8 3 7 9 2 5 1 6
  - 483 792 516

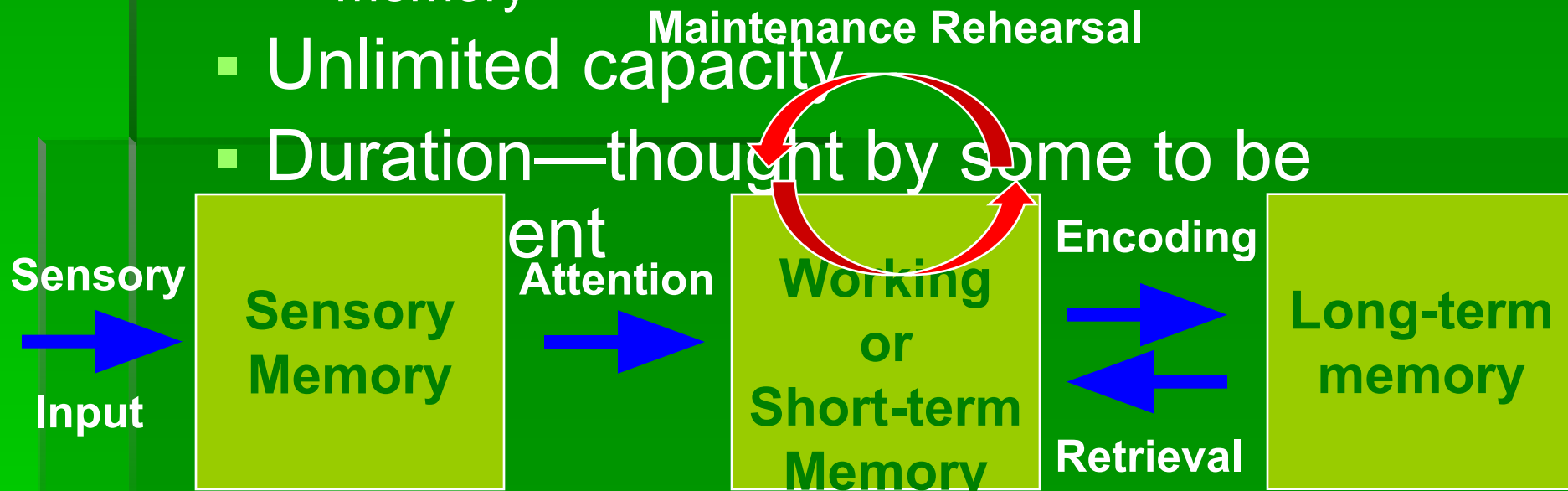
# Long-Term Memory

- Once information passes from sensory to working memory, it can be encoded into long-term memory



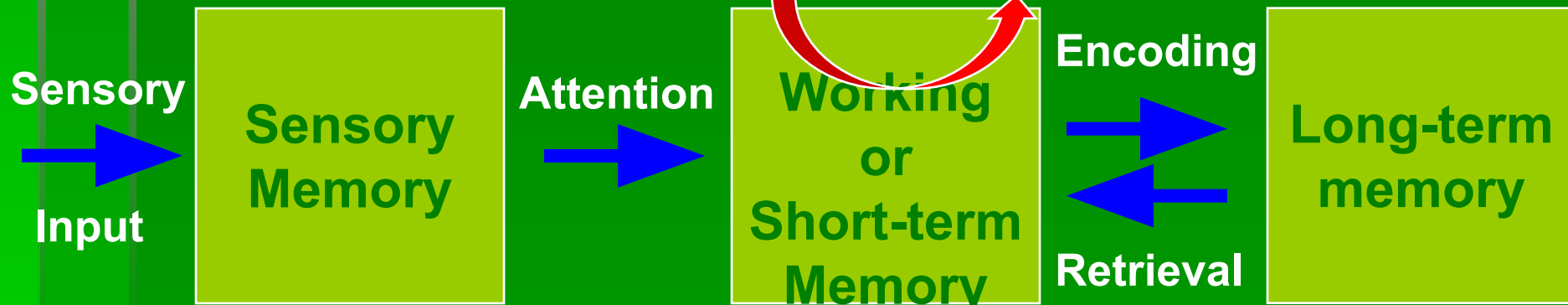
# Long-Term Memory

- Function—organizes and stores information
  - more passive form of storage than working memory
- Unlimited capacity
- Duration—thought by some to be



# Long-Term Memory

- Encoding—process that controls movement from working to long-term memory store
- Retrieval—process that controls flow of information from long-term to working memory store



# Automatic vs. Effortful Encoding

- Automatic processing
  - Unconscious encoding of information
  - Examples:
    - What did you eat for lunch today?
    - Was the last time you studied during the day or night?
    - You know the meanings of these very words you are reading. Are you actively trying to process the definition of the words?

# Automatic vs. Effortful Encoding

- Effortful processing
  - Requires attention and conscious effort
  - Examples:
    - Memorizing your notes for your upcoming Introduction to Psychology exams
    - Repeating a phone number in your head until you can write it down

# Types of Long-Term Memory

- Explicit memory—memory with awareness; information can be consciously recollected; also called declarative memory
- Implicit memory—memory without awareness; memory that affects behavior but cannot consciously be recalled; also called nondeclarative memory

# Explicit Memory

- Declarative or conscious memory
- Memory consciously recalled or declared
- Can use explicit memory to directly respond to a question
- Two subtypes of explicit



# Explicit Memory

- Episodic information—information about events or “episodes”
- Semantic information—information about facts, general knowledge, school work

# Episodic Memory

- Memory tied to your own personal experiences
- Examples:
  - What month is your birthday?
  - Do you like to eat caramel apples?
- Q: Why are these explicit memories?
- A: Because you can actively declare your answers to these questions

# Semantic Memory

- Memory not tied to personal events
- General facts and definitions about the world
- Examples:
  - How many tires on a car?
  - What is a cloud?
  - What color is a banana?
- Does NOT depend on tying the item to your past

# Implicit Memory

- Nondeclarative memory
- Influences your thoughts or behavior, but does not enter consciousness

# Procedural Memory

- Memory that enables you to perform specific learned skills or habitual responses
- Examples:
  - Riding a bike
  - Using the shift stick while driving
  - Tying your shoe laces
- Q: Why are these procedural memories implicit?
- A: Don't have to consciously remember the steps involved in these actions to perform them
  - Try to explain to someone how to tie a shoelace

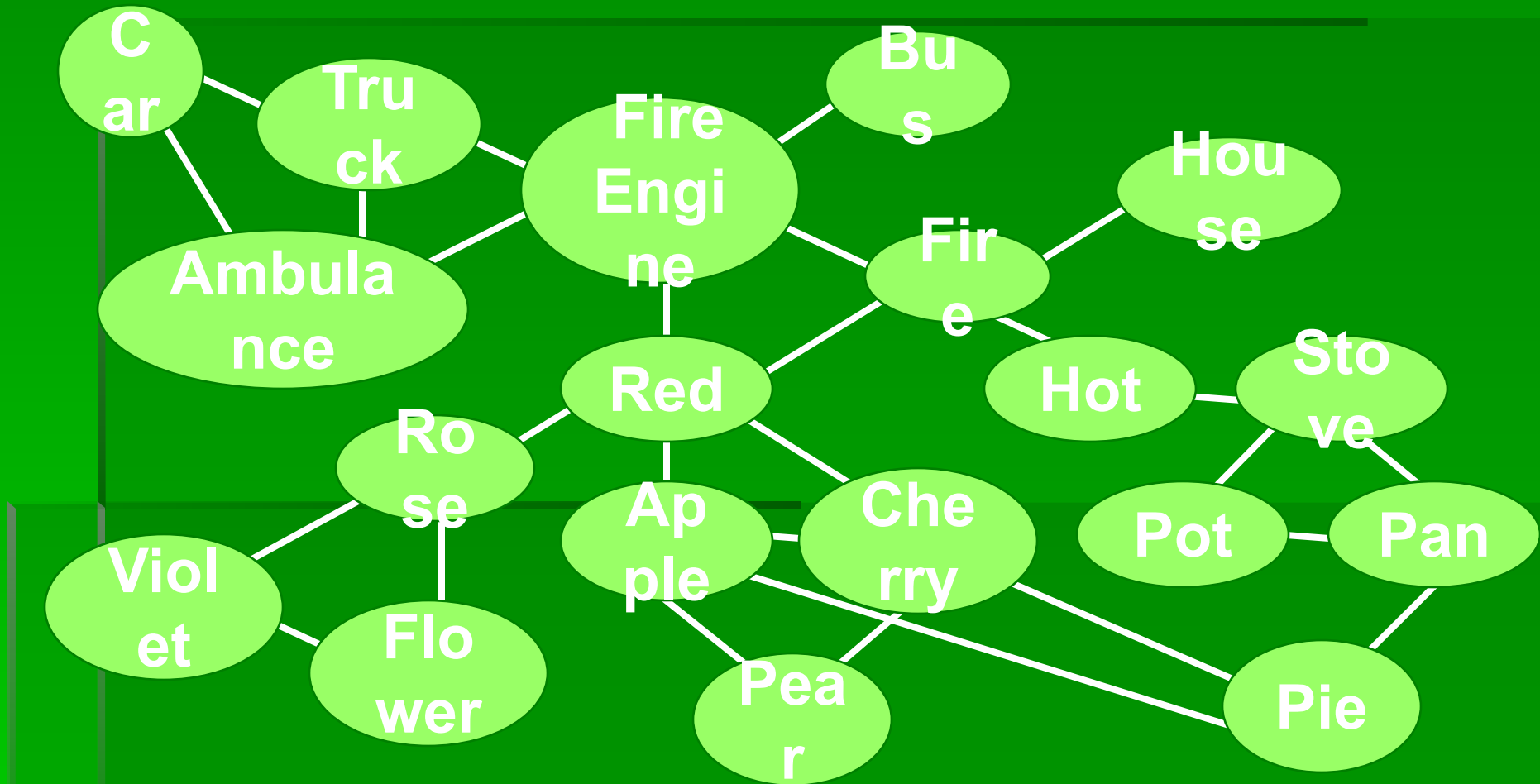
# How are memories organized?

Clustering--organizing items into related groups during recall from long-term memory

# Semantic Network Model

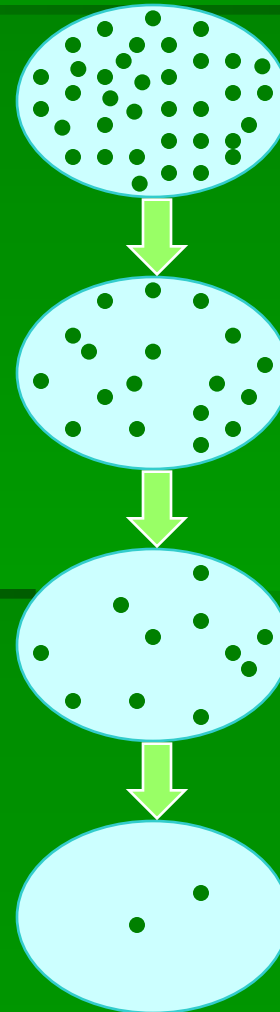
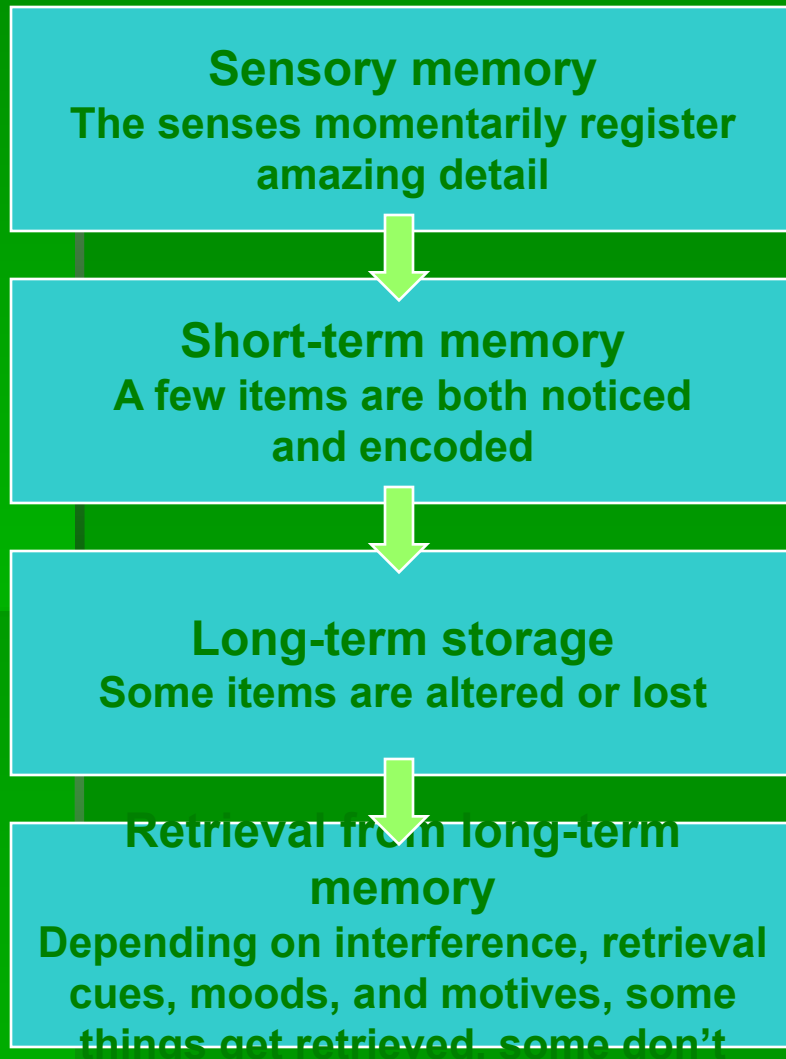
- Mental links between concepts
  - common properties provide basis for mental link
- Shorter path between two concepts = stronger association in memory
- Activation of a concept starts decremental spread of activity to nearby concepts

# Semantic Network Model





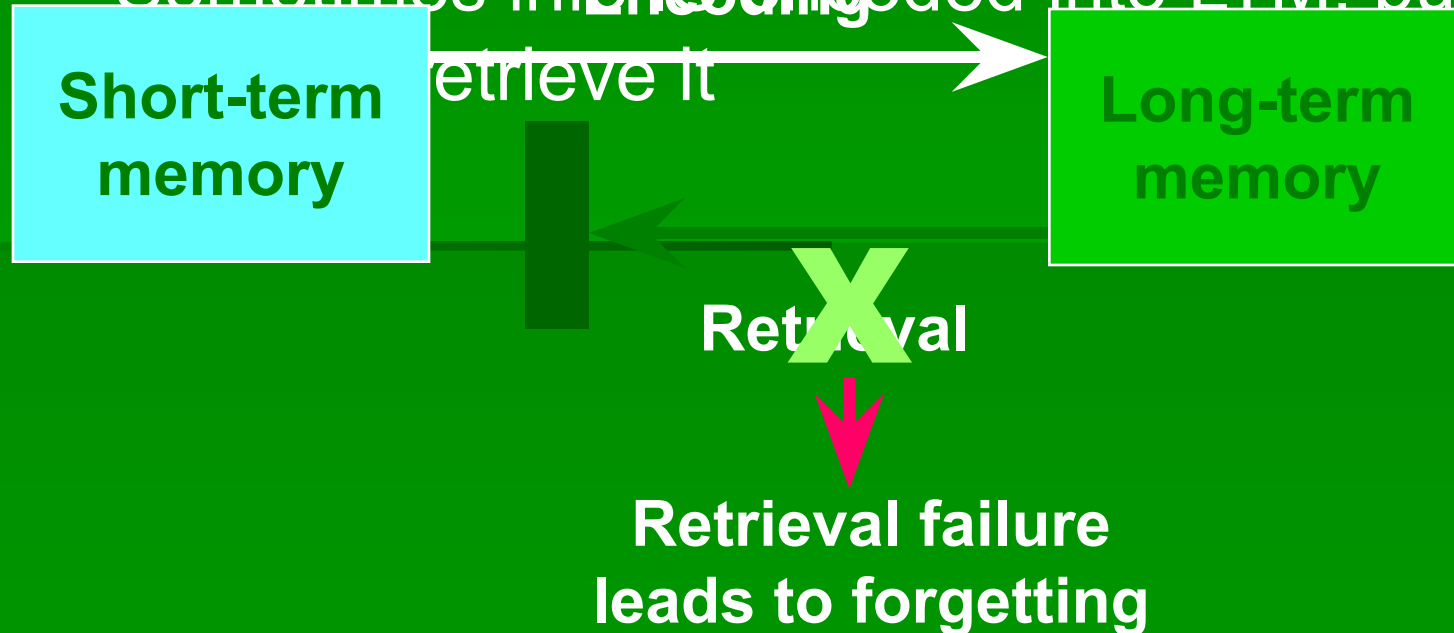
# Why do we forget?



- Forgetting can occur at any memory stage

# Forgetting as retrieval failure

- Retrieval—process of accessing stored information
- Sometimes information is encoded into LTM, but can't retrieve it



# Measures of Retrieval

- Recall—test of LTM that involves retrieving memories without cues, also termed free recall
- Cued recall—test of LTM that involves remembering an item of information in response to a retrieval cue
- Recognition—test of LTM that involves identifying correct information from a series of possible choices
- Serial position effect—tendency to remember items at the beginning and end of

# Encoding Specificity

- When conditions of retrieval are similar to conditions of encoding, retrieval is more likely to be successful
- You are more likely to remember things if the conditions under which you recall them are similar to the conditions under which you learned them

# Encoding Specificity

- Context effects—environmental cues to recall
- State dependent retrieval—physical, internal factors
- Mood Congruence—factors related to mood or emotions

# Flashbulb Memories

- Recall of very specific images or details about a vivid, rare, or significant event
- May seem very vivid and specific, but they are not more accurate than ordinary memories

# Memory Distortion

- Memory can be distorted as people try to fit new info into existing schemas
- Giving misleading information after an event causes subjects to unknowingly distort their memories to incorporate the new

# Loftus Experiment

- Subjects shown video of an accident between two cars
- Some subjects asked: How fast were the cars going when they smashed into each other?
- Others asked: How fast were the cars going when they hit



Accident



Leading question:

Memory construction

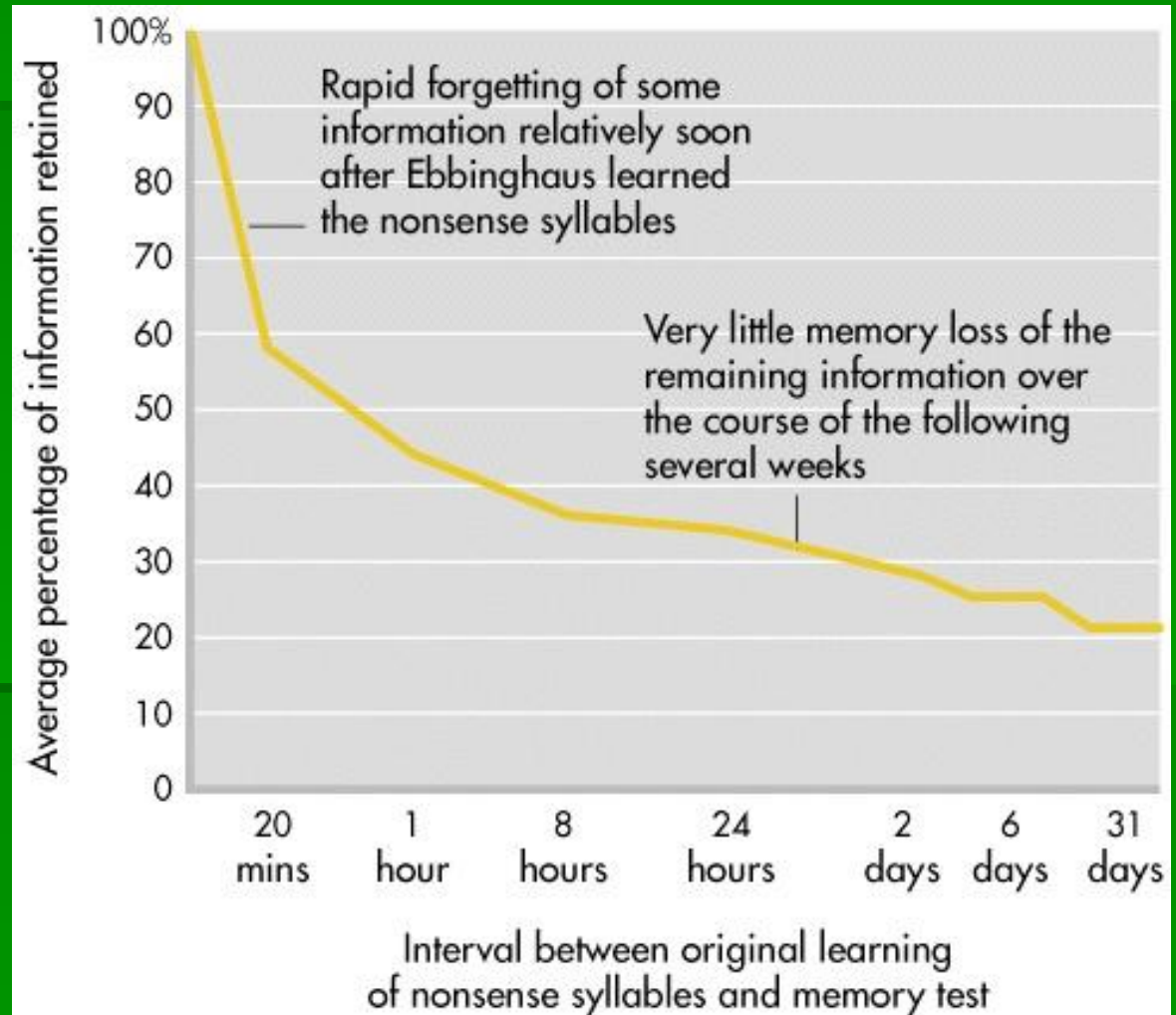
“About how fast were the cars going when they *smashed* into each other?”



# The Forgetting Curve

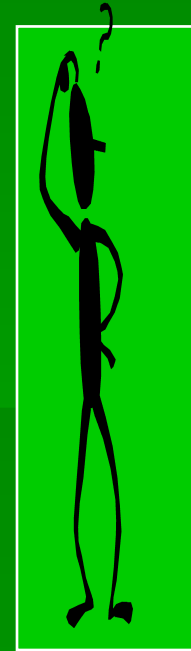
Hermann Ebbinghaus first began to study forgetting using nonsense syllables

Nonsense syllables are three-letter combinations that look like words but are meaningless (ROH, KUF)



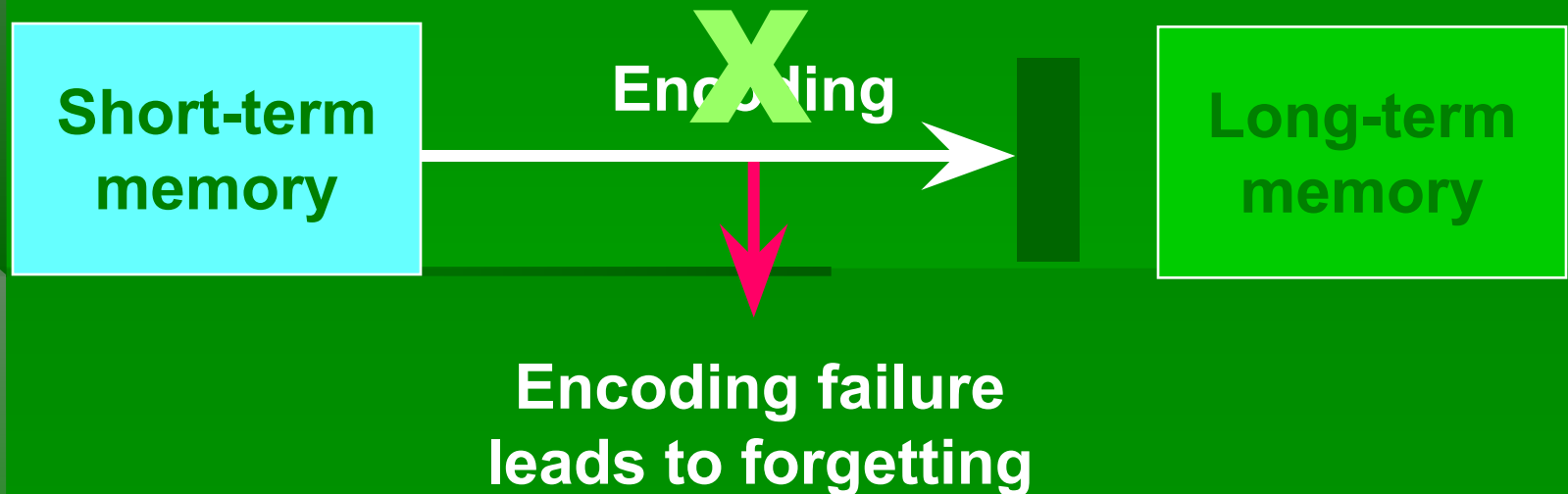
# Forgetting Theories

- Encoding failure
- Interference theories
- Motivated forgetting
- Decay



# Forgetting as encoding failure

- Info never encoded into LTM



# Which is the real penny?



(a)



(b)



(c)



(d)



(e)



(f)



(g)



(h)



(i)



(j)



(k)



(l)



(m)

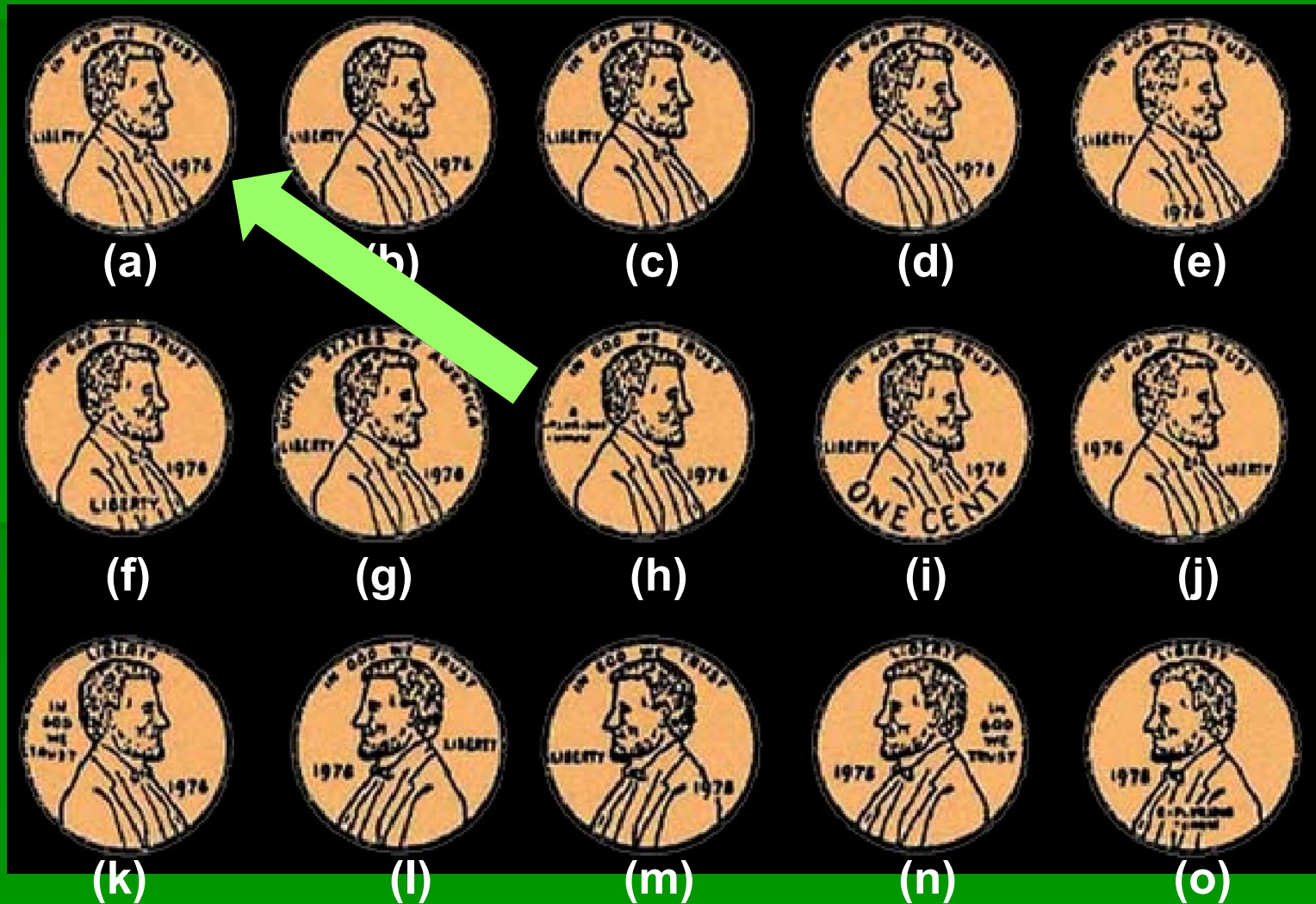


(n)



(o)

# Answer





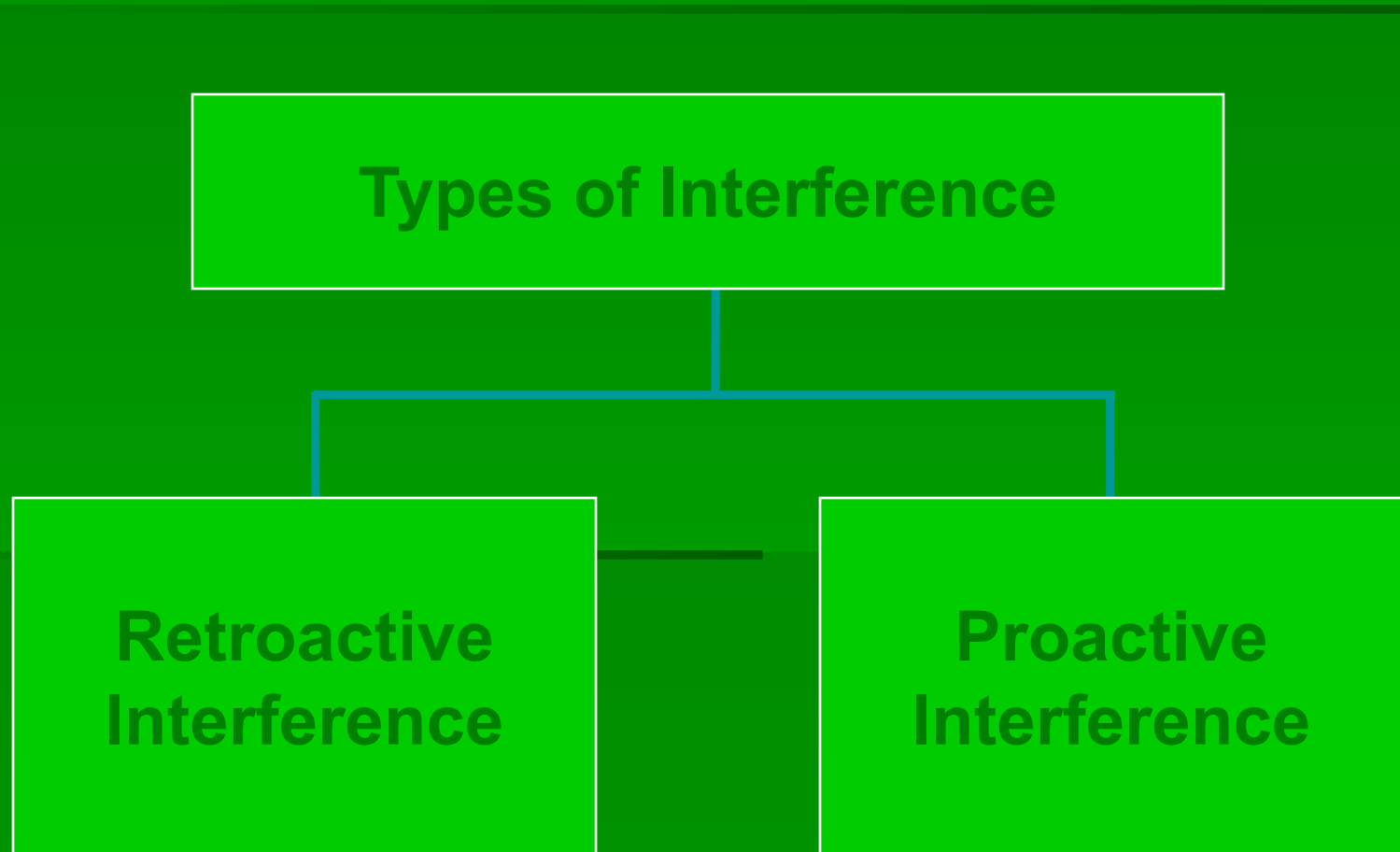
# Encoding Failures

Even though you've seen thousands of pennies, you've probably never looked at one closely to encode specific features

# Interference Theories

- “Memories interfering with memories”
- Forgetting NOT caused by mere passage of time
- Caused by one memory competing with or replacing another memory
- Two types of interference

# Two Types of Interference





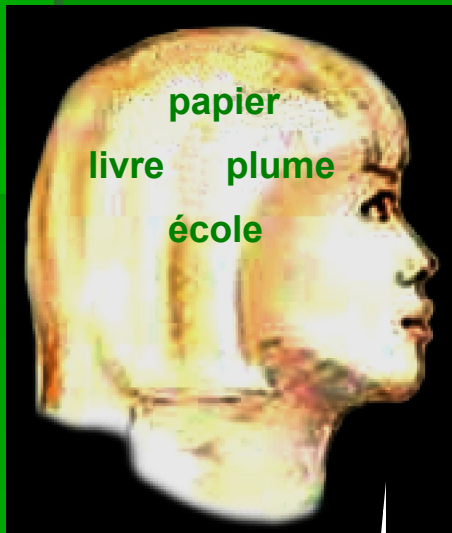
# Retroactive Interference

- When a NEW memory interferes with remembering OLD information
- Example: When new phone number interferes with ability to remember old phone number

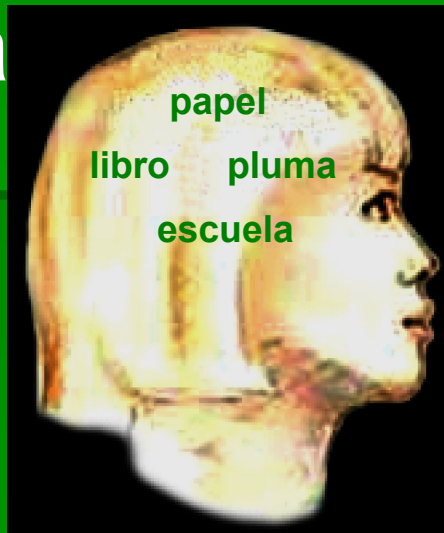
# Retroactive Interference

- Example: Learning a new language interferes with ability to remember

Study French



Study Spanish



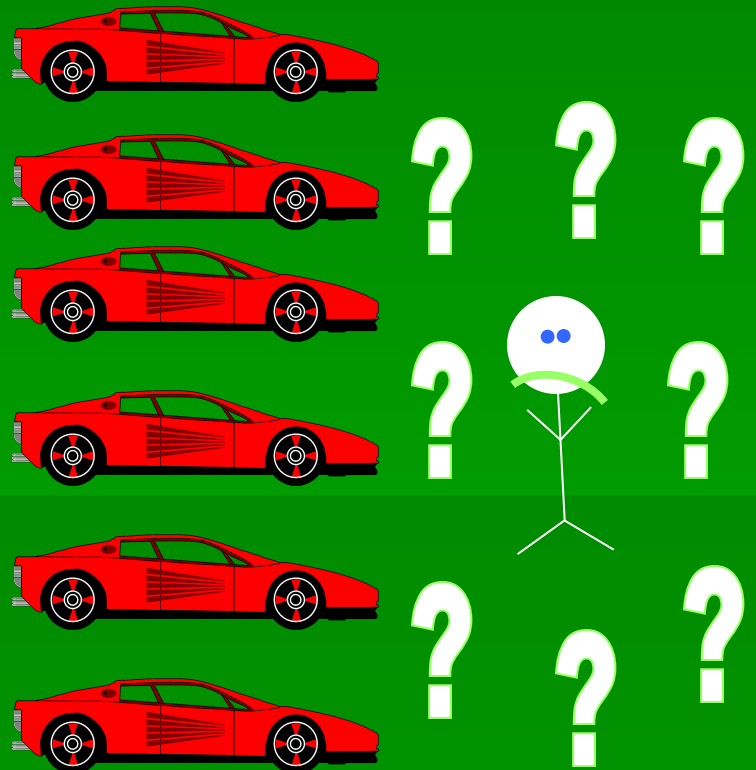
retroactive interference

French 101  
Mid-term  
exam



# Proactive Interference

- Opposite of retroactive interference
- When an OLD memory interferes with remembering NEW information
- Example: Memories of where you parked your car on campus the past week interferes with ability find car today



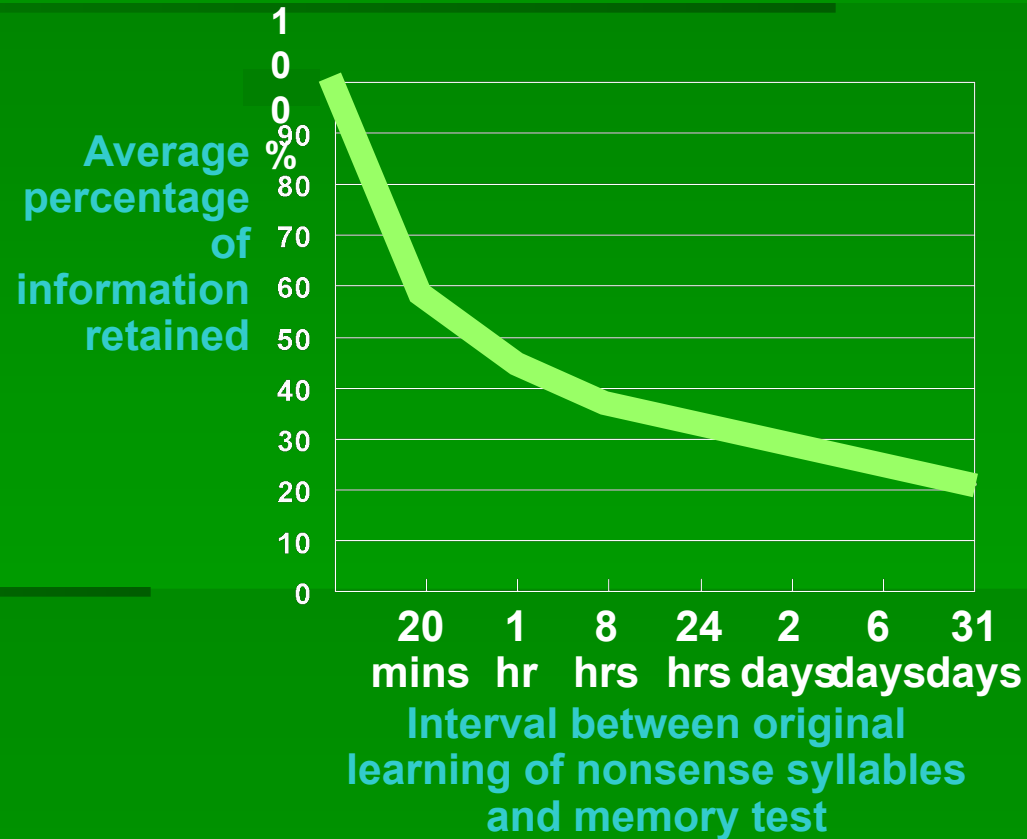
# Motivated Forgetting

Undesired memory is held back from awareness

- Suppression—conscious forgetting
- Repression—unconscious forgetting (Freudian)

# Decay Theories

- Memories fade away or decay gradually if unused
- Time plays critical role
- Ability to retrieve info declines with time after original



# Decay Theories

- Biology-based theory
- When new memory formed, it creates a *memory trace*
  - a change in brain structure or chemistry
- If unused, normal brain metabolic processes erode memory trace
- Theory not widely favored today

# Biological Basis of Memory

Karl Lashley searched for a localized memory trace or *engram*

Found that maze-learning in rats was distributed throughout the brain

Richard Thompson found that memory for simple classically conditioned responses was localized (in the cerebellum)

# Amnesia

- Amnesia—severe memory loss
- Retrograde amnesia—inability to remember past episodic information; common after head injury; need for *consolidation*
- Anterograde amnesia—inability to form new memories; related to hippocampus damage



