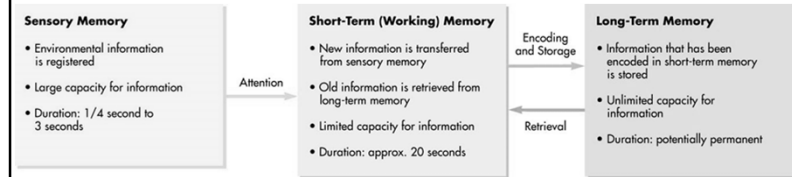


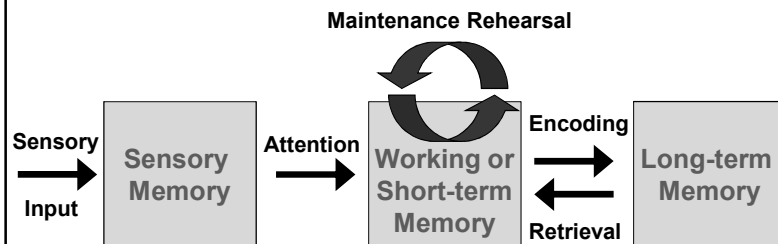
Chapter 6: Memory

Stage Model of Memory

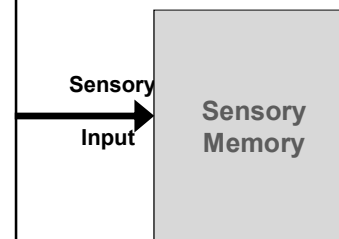


Three Stages of Memory

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

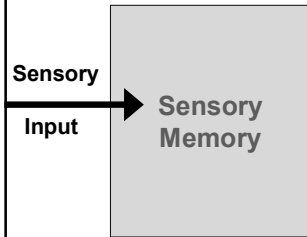


Sensory Memory



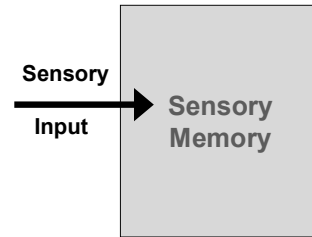
- Function—holds information long enough to be processed for basic physical characteristics
 - Capacity—large
 - can hold many items at once
 - Duration—very brief retention
 - of images
 - .3 seconds for visual info
 - 2 seconds for auditory info

Sensory Memory



- Divided into two types:
 - iconic memory: visual information
 - echoic memory: auditory information
- George Sperling studied iconic memory.

Sensory Memory

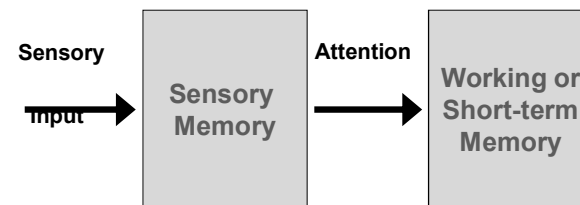


- Sensory memory forms automatically, without attention or interpretation.
- Attention is needed to transfer information to working memory.

Sensory Memory

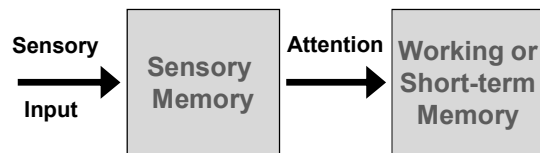
- **Visual sensory memory**—brief memory of an image or icon.
 - Also called iconic memory.
- **Auditory sensory memory**—brief memory of a sound or echo.
 - Also called echoic memory.
- Auditory sensory memories may last a bit longer than visual sensory memories.

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 seconds)



Working Memory

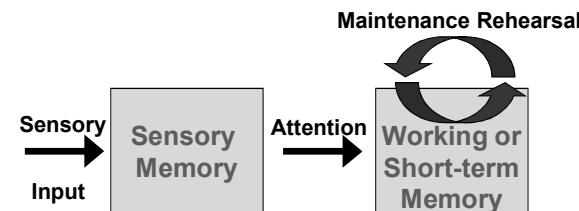
- The active, conscious manipulation of temporarily stored information.-sometimes used interchangeably with short-term memory.
- Used when problem solving, reasoning, comprehending language, and mental comparisons.
- Short-term memory is more likely to be used when the focus is on simpler memory processes (rehearsing lists of syllables, words, or numbers).
- Best-known model of working memory developed by British psychologist Alan Baddeley.

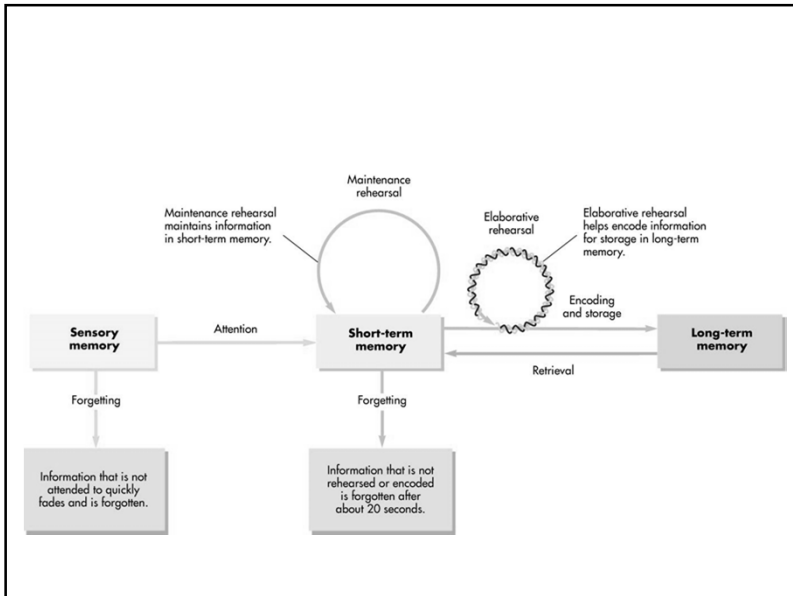
Working Memory

- Three main components, each of which can function independently:
 - The phonological loop is specialized for verbal material, such as lists of numbers or words.
 - The visuospatial sketchpad is specialized for spatial or visual material, such as remembering the layout of a room or city.
 - The central executive, which controls attention, integrates information, and manages the activities of the phonological loop and the visuospatial sketchpad.

Maintenance Rehearsal

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



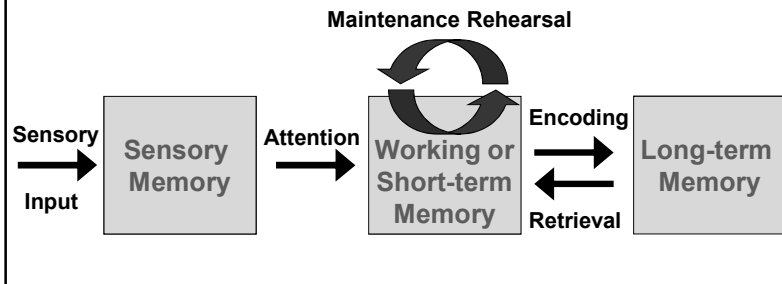


Chunking

- 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

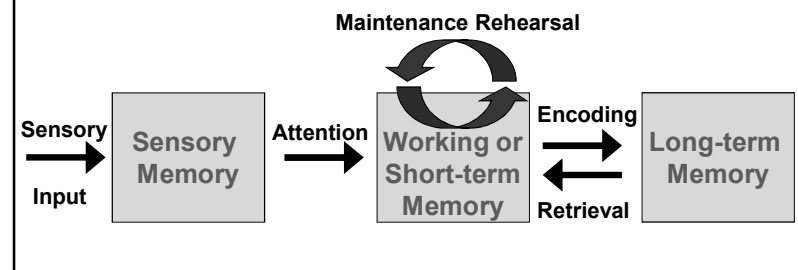
Long-term Memory

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



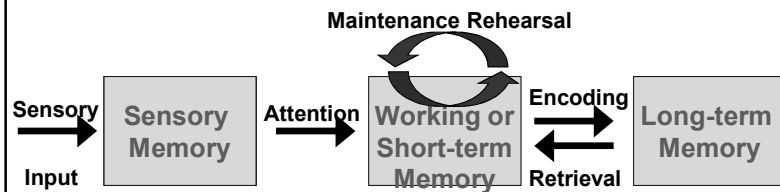
Long-Term Memory

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



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 Versus 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?

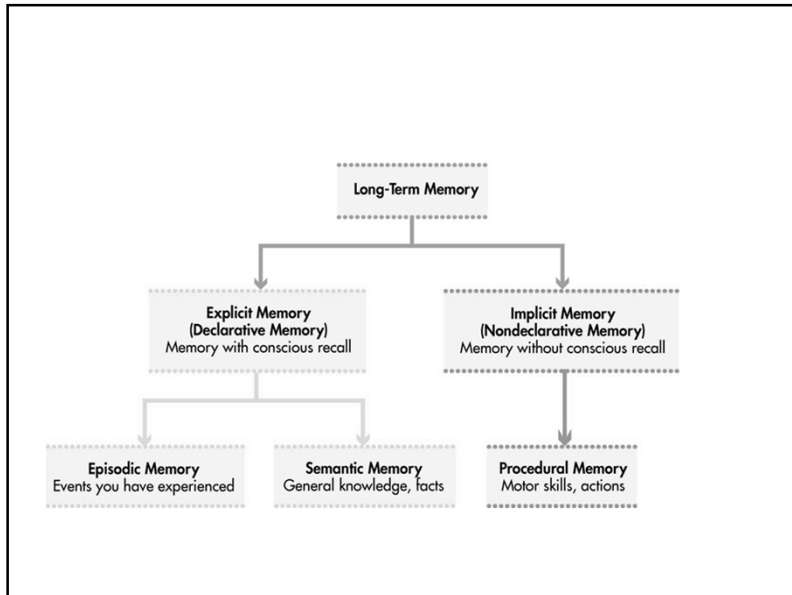
Automatic Versus Effortful Encoding

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 memory

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?

Semantic Memory

Q: Why are these explicit memories?

A: Because you can actively declare your answers.

Important note: Though you may have personal experience with these items, your ability to answer does NOT depend on tying the item to your past.

- i.e., you do not have to recall the time last week when you ate a banana to say that bananas are yellow

Implicit Memory

- Nondeclarative memory
- Influences your thoughts or behavior, but does not enter consciousness
- Three subtypes—we will look only at one (procedural)

Procedural Memory

•Memory that enables you to perform specific learned skills or habitual responses

•Examples:

- Riding a bike
- Using the stickshift while driving
- Tying your shoe laces

Q: Why are these procedural memories implicit?

A: You 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.

Culture and Early Memory

- Cross-cultural research has shown how culture helps shape one's sense of self.
- Research has shown that Americans' first memories focused on themes of self-awareness and individual autonomy.
- Asians' first memories often include other people, centering on collective activities.

How are memories organized?

- Hierarchical organization
- Associations

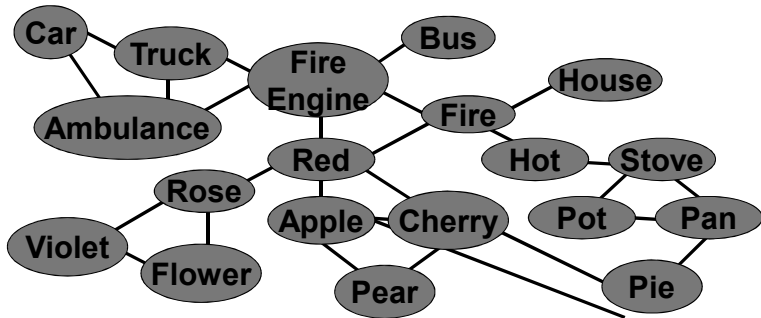
Hierarchical Organization

- Related items clustered together to form categories
- Related categories clustered together to form higher-order categories
- Remember list items better if list presented in categories
 - poorer recall if presented randomly
- Even if list items are random, people still organize information in some logical pattern.

Semantic Network Model

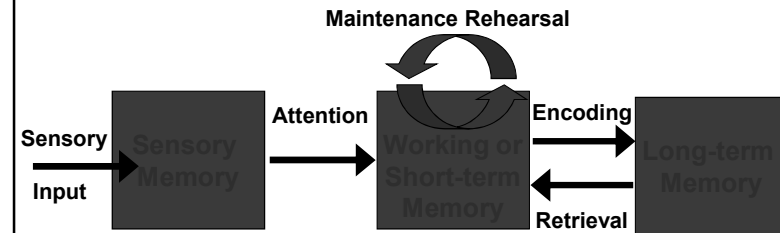
- Mental links between concepts
 - common properties provide basis for mental link
- Shorter path between two concepts = stronger association in memory
- Activation of a concept starts decremental spread of activity to nearby concepts.

Semantic Network Model

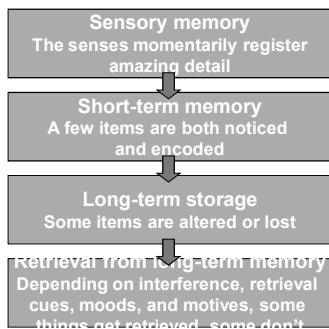


Review of Long-term Memory

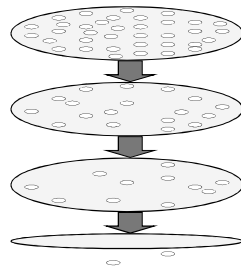
- Retrieval transfers info from LTM to STM
- Forgetting—inability to retrieve previously available information
- Why do people forget?



Why Do We Forget?

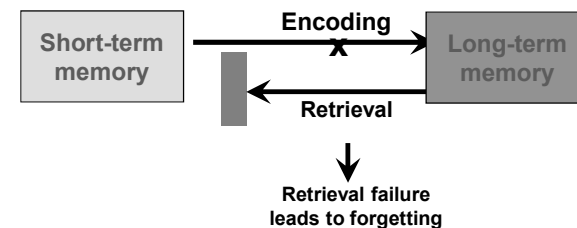


- Forgetting can occur at any memory stage



Forgetting as Retrieval Failure

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



Tip-of-the-Tongue (TOT) Experience

- TOT—involves the sensation of knowing that specific information is stored in long-term memory but being unable to retrieve it
- Can't retrieve info that you absolutely know is stored in your LTM.
- Shown also among American Sign Language (ASL) users

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 a list better than items in the middle.

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

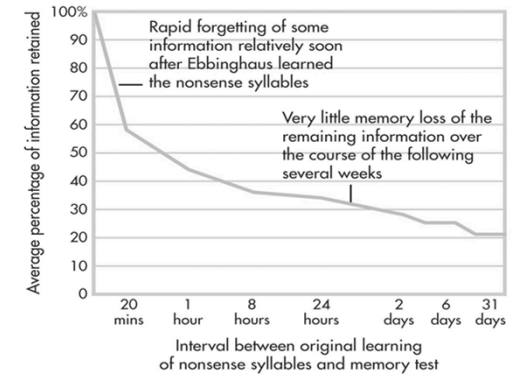
- Context effects—environmental cues to recall
- State dependent retrieval—physical, internal factors
- Mood congruence—when a given mood tends to evoke memories that are consistent with that mood

Flashbulb Memory

The recall of very specific images or details surrounding a vivid, rare, or significant personal event; details may or may not be accurate (e.g., 9/11, wedding day, high school graduation)

The Forgetting Curve

- Hermann Ebbinghaus first began to study forgetting by using nonsense syllables.
- Nonsense syllables are three-letter combinations that look like words but are meaningless (ROH, KUF).

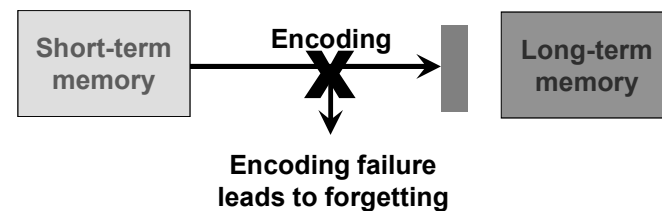


Forgetting Theories

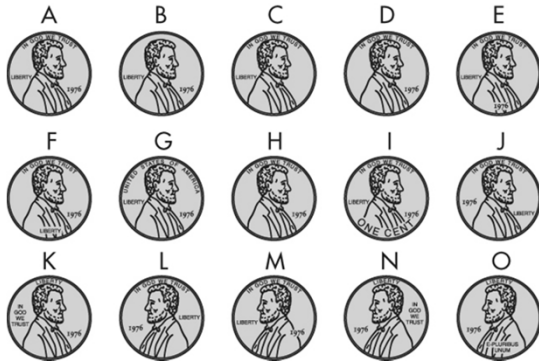
- Encoding failure
- Interference theories
- Motivated forgetting
- Decay

Forgetting as Encoding Failure

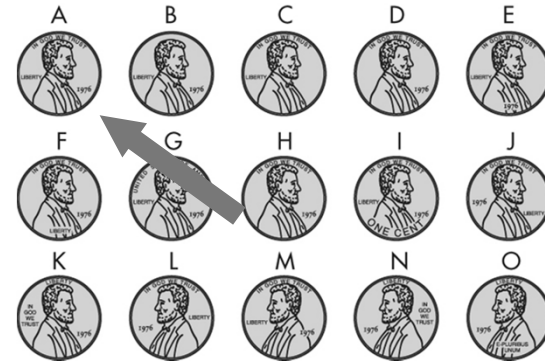
Info never encoded into LTM



Which Is the Real Penny?



Answer



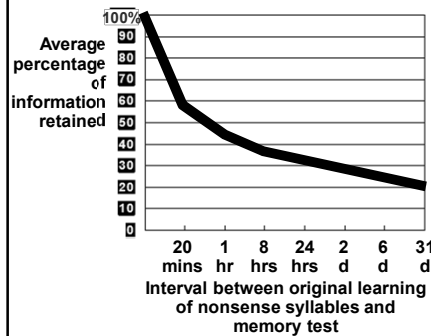
Encoding Failures

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

Déjà Vu

- A brief but intense feeling of remembering a scene or an event that is actually being experienced for the first time.
- French for "already seen."

Decay Theories



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

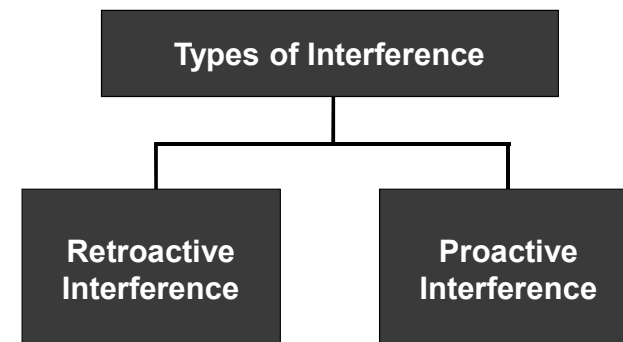
Decay Theories

- 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

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

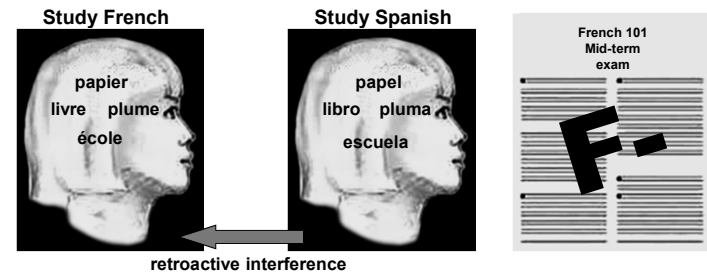


Retroactive Interference

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

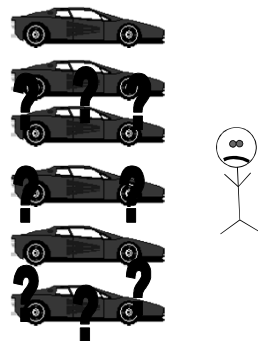
Retroactive Interference

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



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)

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?

Leading question:
"About how fast were the cars going when they *smashed* into each other?"
Memory construction

- Others asked: How fast were the cars going when they hit each other?



Loftus Results

Word Used in Question	Average Speed Estimate
smashed	41 mph
collided	39 mph
bumped	38 mph
hit	34 mph
contacted	32 mph

Eyewitness Testimony

Scripts—type of schema

- Mental organization of events in time.
- Example of a classroom script: Come into class, sit down, talk to friends, bell rings, instructor begins to speak, take notes, bell rings again, leave class, etc.

Eyewitness Testimony

- Recall not an exact replica of original events
- Recall a *construction* built and rebuilt from various sources
- Often fit memories into existing beliefs or schemas
- Schema—mental representation of an object, scene, or event
 - Example: schema of a countryside may include green grass, hills, farms, a barn, cows, etc.

The Misinformation Effect

- A memory-distortion phenomenon in which a person's existing memories can be altered if the person is exposed to misleading information

Source Confusion

- A memory distortion that occurs when the true source of the memory is forgotten
- Can give rise to a false memory: a distorted or fabricated recollection of something that did not actually occur

Memory Distortions

- 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 misleading information.

Forming False Memories

A person can actually believe an event occurred by imagining the event; called "imagination inflation"

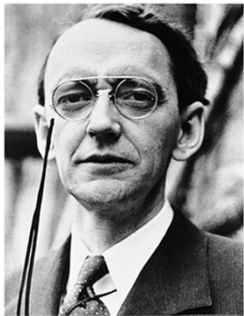
Recovered vs. False Memories

- Accuracy of memory recovered in therapy difficult to determine.
- Types of therapies for memory:
 - Repressed memory therapy
 - Recovery therapy
 - Recovered memory therapy
 - Trauma therapy

Recovered vs. False Memories

- Research with thousands of participants has intentionally distorted a significant portion of the subjects' memories.
- The mechanism by which people are convinced that they were lost, frightened, and crying in a mall is not so different than the mechanism by which therapists might unwittingly encourage memories of sexual abuse.

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

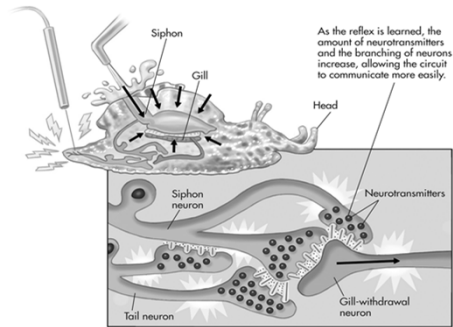
Biological Basis of Memory

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



New Memories in a Snail

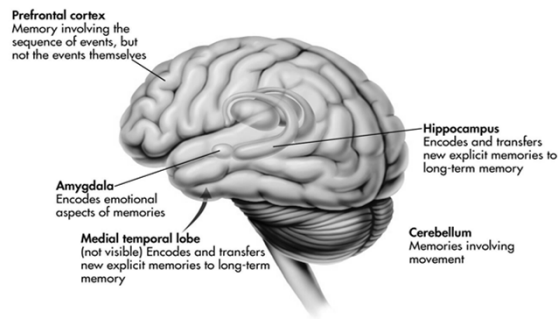
Aplysia—a sea snail used to study how memories can change neurons



Biological Basis of Memory

- 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 (demonstrated with much research on patient H.M.)

Brain Structures Involved in Human Memory



Gradually Losing the Ability to Remember

- Dementia: Progressive deterioration and impairment of memory, reasoning, and other cognitive functions occurring as the result of a disease or a condition
- Alzheimer's disease (AD): A progressive disease that destroys the brain's neurons, gradually impairing memory, thinking, language, and other cognitive functions, resulting in the complete inability to care for oneself; the most common form of dementia

Biology of Alzheimer's Disease

- *Plaques* interfere with the ability of neurons to communicate
- *Tangles* are twisted fibers that build up inside the neuron and interrupt the flow of nourishment to the neuron
- Both result in the death of the neuron

Strategies for Boosting Memory

- Focus attention
- Commit the time
- Space study sessions
- Organize the information
- Elaborate on the material
- Use visual imagery
- Use a mnemonic device
- Explain it to a friend
- Reduce interference within a topic
- Counteract the serial position effect
- Use contextual clues
- Sleep on it
- Forget the ginkgo biloba