Chapter 7
Memory
Memory: Some Key Terms

- Memory: Active system that receives, stores, organizes, alters, and recovers (retrieves) information
- Encoding: Converting information into a useable form
- Storage: Holding this information in memory for later use
- Retrieval: Taking memories out of storage
FIGURE 7.2 Remembering is thought to involve at least three steps. Incoming information is first held for a second or two by sensory memory. Information selected by attention is then transferred to temporary storage in short-term memory. If new information is not rapidly encoded, or rehearsed, it is forgotten. If it is transferred to long-term memory, it becomes relatively permanent, although retrieving it may be a problem. The preceding is a useful model of memory; it may not be literally true of what happens in the brain.
Sensory Memory

• Storing an exact copy of incoming information for a few seconds; the first stage of memory

  – Icon: A fleeting mental image or visual representation

  – Echo: After a sound is heard, a brief continuation of the sound in the auditory system
Short-Term Memory (STM)

- Holds small amounts of information briefly
  - Working Memory: Another name for STM; like a mental “scratchpad”
  - Selective Attention: Focusing (voluntarily) on a selected portion of sensory input (e.g., selective hearing)
  - Phonetically: Storing information by sound; how most things are stored in STM by sound (phonetically)
    - Very sensitive to interruption or interference
Long-Term Memory (LTM)

- Storing information relatively permanently
- Stored on basis of meaning and importance
Short-Term Memory Concepts

• Digit Span: Test of attention and short-term memory; string of numbers is recalled forward or backward
  – Typically part of intelligence tests
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• Magic Number 7 (Plus or Minus 2): STM is limited to holding seven (plus or minus two) information bits at once
  – Information Bits: Meaningful units of information
More Short-Term Memory Concepts

• Recoding: Reorganizing or modifying information in STM
  – Information Bits: Meaningful units of information, like numbers, letters, or words
  – Information Chunks: Information bits that are grouped into larger chunks

• Maintenance Rehearsal: Repeating information silently to prolong its presence in STM

• Elaborative Rehearsal: Links new information with existing memories and knowledge in LTM
  – Good way to transfer STM information into LTM
Long-Term Memory Concepts

• General storehouse of information which remains relatively permanent.
• Constructive Processing: Re-organizing or updating long-term memories on basis of logic, reasoning, or adding new information
• Redintegrative Memory: Memories that are reconstructed or expanded by starting with one memory and then following chains of association to related memories
• What we remember depends on what we ______________, what we regard as _______________ or what we find ________________ strong.
Types of Long-Term Memories

- **Procedural**: Long-term memories of conditioned responses and learned skills

- **Declarative**: LTM section that contains factual information
  - **Semantic Memory**: Impersonal facts and everyday knowledge
  - **Episodic**: Personal experiences linked with specific times and places
FIGURE 7.6 In the model shown here, long-term memory is divided into procedural memory (learned actions and skills) and declarative memory (stored facts). Declarative memories can be either semantic (impersonal knowledge) or episodic (personal experiences associated with specific times and places).
Measuring Memory

• Tip-of-the Tongue (TOT): Feeling that a memory is available but not quite retrievable

• Recall: Supply or reproduce facts or information with some external cues; direct retrieval of facts or information
  – Hardest to recall items in the middle of a list; known as Serial Position Effect
  – Easiest to remember last items in a list because they are still in STM
FIGURE 7.7 The serial position effect. The graph shows the percentage of subjects correctly recalling each item in a 15-item list. Recall is best for the first and last items.
Measuring Memory (cont'd)

- **Recognition Memory**: Identifies correctly previously learned material
  - Usually superior to recall

- **Relearning**: Learning again something that was previously learned
  - Used to measure memory of prior learning
  - Savings Score: Amount of time saved when relearning information

- **Explicit Memory**: Past experiences that are consciously brought to mind

- **Implicit Memory**: A memory not known to exist; memory that is unconsciously retrieved

- **Priming**: When cues are used to activate hidden memories
Eidetic Imagery (Somewhat Like Photographic Memory)

- Occurs when a person (usually a child) has visual images clear enough to be scanned or retained for at least 30 seconds
- Usually projected
- onto a “plain” surface, like a blank piece of paper
- Usually disappears during adolescence and is rare by adulthood
Forgetting

• Nonsense Syllables: Meaningless three-letter words (fej, quf) that test learning and forgetting
• Curve of Forgetting: Graph that shows the amount of memorized information remembered after varying lengths of time
• Encoding Failure: When a memory was never formed in the first place
• Memory Decay: When memory traces become weaker; fading or weakening of memories
FIGURE 7.10 The curve of forgetting. This graph shows the amount remembered (measured by relearning) after varying lengths of time. Notice how rapidly forgetting occurs. The material learned was nonsense syllables. Forgetting curves for meaningful information also show early losses followed by a long gradual decline, but overall, forgetting occurs much more slowly.
FIGURE 7.11 Some of the distractor items used in a study of recognition memory and encoding failure. Penny A is correct but was seldom recognized. Pennies G and J were popular wrong answers.
Additional Theories of Forgetting

• Memory Cues: Any stimulus associated with a memory; usually enhance retrieval of a memory

  – A person will forget if cues are missing at retrieval time

• State-Dependent Learning: When memory retrieval is influenced by body state; if your body state is the same at the time of learning AND the time of retrieval, retrievals will be improved

  – If Robert is drunk and forgets where his car is parked, it will be easier to recall the location if he gets drunk again!
Even More (!) Theories of Forgetting

- Interference: Tendency for new memories to impair retrieval of older memories, and vice versa
- Retroactive Interference: Tendency for new memories to interfere with retrieval of old memories
- Proactive Interference: Prior learning inhibits (interferes) with recall of later learning
FIGURE 7.13 The amount of forgetting after a period of sleep or of being awake. Notice that sleep causes less memory loss than activity that occurs while one is awake.
More on Forgetting

• Repression: *Unconsciously* pushing painful, embarrassing or threatening memories out of awareness/consciousness
  – Motivated forgetting, according to some theories
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• Suppression: *Consciously* putting something painful or threatening out of mind or trying to keep it from entering awareness
Flashbulb Memories

• Memories created during times of personal tragedy, accident, or other emotionally significant events that are especially vivid
  – Where were you when you heard that the USA was attacked on September 11th, 2001?
  –

• Includes both positive and negative events

• Not always accurate

• Great confidence is placed in them even though they may be inaccurate
Memory Formation

- Retrograde Amnesia: Forgetting events that occurred \textit{before} an injury or trauma
- Anterograde Amnesia: Forgetting events that \textit{follow} an injury or trauma
- Consolidation: Forming a long-term memory
- Electroconvulsive Shock (ECS): Mild electrical shock passed through the brain, causing a convolution; one way to prevent consolidation
Memory Structures

- Hippocampus: Brain structure associated with information passing from short-term memory into long-term memory; also associated with emotion
  - If damaged, person can no longer “create” long-term memories and thus will always live in the present
  - Memories *prior* to damage will remain intact
- Engram: Memory trace in the brain
Ways to Improve Memory

- Knowledge of Results: Feedback allowing you to check your progress
- Recitation: Summarizing aloud while you are rehearsing material
- Rehearsal: Reviewing information mentally (silently)
- Elaborative Rehearsal: Look for connections to existing knowledge
- Selection: Selecting most important concepts to memorize
- Organization: Organizing difficult items into chunks; a type of reordering
Ways to Improve Memory (cont'd)

- Whole Learning: Studying an entire package of information at once, like a poem

- Part Learning: Studying subparts of a larger body of information (like text chapters)

- Progressive Part Learning: Breaking learning task into a series of short sections

- Serial Position Effect: Making most errors while remembering the middle of the list

- Overlearning: Studying is continued beyond bare mastery
Ways to Improve Memory Concluded

• Spaced Practice: Alternating study sessions with brief rest periods

• Massed Practice: Studying for long periods without rest periods

• Lack of sleep decreases retention; sleep aids consolidation

• Hunger decreases retention

• Cognitive Interview: Technique used to improve memories of eyewitnesses
Mnemonics: Memory “Tricks”

• Any kind of memory system or aid
  – Use mental pictures
  – Make things meaningful
  – Make information familiar
  – Form bizarre, unusual or exaggerated mental associations

• Keyword Method: Memory aid; using a familiar word or image to link two items
Using Mnemonics to Remember Things in Order

- Form a Chain: Remember lists in order, forming an exaggerated association connecting item one to two, and so on.

- Take a Mental Walk: Mentally walk along a familiar path, placing objects or ideas along the path.

- Use a system.