

Chapter 8: Memory

- Why do we need to have memory?
 - o To retain useful skills, knowledge, and expertise
 - o To recognize familiar people and places
 - o To build our capacity to use language
 - o To enjoy, share, and sustain culture
 - o To build a sense of self that endures: what do I believe, value, remember, and understand?
 - o To go beyond conditioning in learning from experience, including lessons from one's past and from experiences of others
- Studying Memory
 - o Memory refers to the persistence of learning over time, through the storage and retrieval of information and skills
 - 3 behaviors show that memory is functioning:
 - Recall
 - Recognition
 - Relearning
 - o How does memory work?
 - An Information-Processing Model
 - Encoding: getting information into your brain
 - Storage: keeping the information in your brain
 - Retrieval: reactivating and recalling the information
 - o Models of Memory Formation
 - Atkinson-Shiffrin Model (1968)
 - Stimuli are recorded by our senses and held briefly in sensory memory
 - Some of this information is processed into short-term memory and encoded through rehearsal
 - Information then moves into long-term memory where it can be retrieved later
 - Modifying the Model
 - More goes on in short-term memory besides rehearsal; this is now called working memory
 - Some information seems to go straight from sensory experience into long-term memory; this is automatic processing
 - o Working Memory: Functions
 - The short-term memory is "working" in many ways
 - It holds information not just to rehearse it, but to process it (such as hearing a word problem in math and doing it in your head)
 - Auditory rehearsal: repeating a password to memorize it
 - Executive functions: choosing what to attend to, respond to
 - Visospatial "sketchpad": rearranging room furniture in your mind
 - Short-term memory integrates information from long-term memory with new information coming in from sensory memory (brings in new information and connects it to old information; relate to what you already know)
 - o Dual-Track Processing: Explicit and Implicit Memories

- Explicit/“declarative” memories are facts and experiences that we can consciously know and recall
 - Our minds acquire this information through effortful processing (studying, rehearsing, thinking, processing)
- Some memories are formed without going through all the Atkinson-Shiffrin stages. These are implicit memories.
 - These memories are typically formed through automatic processing
 - Formed without our awareness that we are building a memory, without an effortful processing
- o Automatic Processing
 - Some experiences go directly to long-term implicit memory; our implicit memories include:
 - Procedural memory: automatic skills and well-practiced knowledge such as word meanings
 - Conditioned associations
 - Information about space
 - Information about time
 - Information about frequency
- o Encoding: Effortful Processing Strategies
 - Without active processing, short-term memories disappear
 - Effortful processing strategy: a way to encode information into memory to keep it from decaying and make it easier to retrieve
 - Also known as studying
 - Examples:
 - Chunking (grouping)
 - Mnemonics: images, maps, and peg-words
 - Hierarchies/categories (we are more likely to recall a concept if we encode it in a hierarchy)
 - Rehearsal, especially distributed practice
 - Semantic processing
 - Making information personally meaningful
 - Rehearsal & Distributed Practice
 - Massed practice refers to cramming information all at once, not time-effective
 - The spacing effect: You will develop better retention and recall if you use the same amount of study time spread out over many shorter sessions
 - Testing effect: If your distributed practice includes self-testing (having to answer questions about the material) you will learn more and retain more than if you merely reread
 - Deep/Semantic Processing
 - When encoding information, we are more likely to retain it if we deeply process even a simple word list by focusing on the semantics (meaning) of the word
 - Shallow, unsuccessful processing refers to memorizing the appearance or sound of words

- Memorizing meaningful material takes one tenth the effort of memorizing nonsense syllables
 - Self-reference effect: relating material to ourselves, aids encoding and retention
- Memory Storage: Capacity & Location
 - Memories are not in isolated files, but are in overlapping neural networks, distributed throughout the brain
 - Brain's long-term memory storage does not get full; it gets more elaborately rewired and interconnected
- Memory Processing
 - Explicit/declarative memories
 - Retrieval and use of explicit memories is directed by the frontal lobes
 - Encoding and storage of explicit memories is facilitated by the hippocampus. Events/facts are held there for a couple of days before consolidating, moving to other parts of the brain for long-term storage. Much of this consolidation occurs during sleep.
 - Implicit memories
 - The cerebellum forms and stores our conditioned responses. We can store a phobic response even if we can't recall how we acquired the fear.
 - The basal ganglia controls movement, and forms and stores procedural memory and motor skills
- Infantile Amnesia
 - Implicit memory from infancy can be retained
 - However, explicit memories, our recall for episodes, only goes back to about age 3 for most people → infantile amnesia
 - Explanation...
 - Encoding: the memories were not stored well because the hippocampus is one of the last brain areas to develop
 - Forgetting/retrieval: the adult mind thinks more in a linear verbal narrative and has trouble accessing preverbal memories as declarative memories
- How do strong emotions facilitate memory?
 - Amygdala (part of the limbic system, controls emotion)
 - Emotions can trigger a rise in stress hormones
 - These hormones trigger activity in the amygdala
 - The amygdala increases memory-forming activity and engages the frontal lobes and basal ganglia to "tag" the memories as important
 - As a result, the memories are stored with more sensory and emotional details
 - These details can trigger rapid, unintended recall (PTSD)
- Synaptic Changes
 - When sea slugs or people form memories, their neurons release neurotransmitters across the synapses
 - With repetition, the synapses undergo long-term potentiation; signals are sent across the synapse more efficiently