Memory

The Phenomenon of Memory

- **Memory** – the persistence of learning over time through storage and retrieval of information
- Memory of people, places, things, events, etc differs from person to person.
- **Flashbulb memories** – clear memories of emotionally significant moments or events
  - Ex: 9/11, high school graduation, wedding day, birth of children, death of parents, etc

Information Processing

- Memory is like a computer’s information processing system – encoding outside info through key strokes (makes meaning), stores it on a disk or hard drive, and recalls the info later when needed
  - Encoding – the processing of information into the memory system
  - Storage – the retention of encoded information
  - Retrieval – the process of getting information out of memory storage
- Atkinson-Shiffrin three-stage processing model
  - Sensory memory – the immediate, very brief recording of sensory information into memory
  - Short term memory – STM, activated memory that holds a few items briefly before the info is stored or forgotten
  - Long term memory – LTM, the relatively permanent and limitless storehouse of the memory system
  - Limitations to model – some info passes the first two steps and proceeds to LTM automatically

- Memory researchers who prefer the “working memory” model emphasize visual-spatial and auditory subsystems controlled by a central executive that focuses attention where necessary
  - Working memory – a newer understanding of STM that involves conscious, active processing of incoming auditory and visual-spatial info and info retrieved from long-term memory (STM and LTM working together)
For OUR purposes, we will use working memory and STM interchangeably.

Encoding: Getting Information In

- Encoding is the processing of external info into memory
- **Automatic encoding** – unconscious encoding of incidental info, such as space, time, frequency, and of well-learned info, such as word meanings.
- **Effortful processing** – encoding that requires attention and conscious effort
  - Rehearsal – the conscious repetition of info, either to maintain it in consciousness or to encode it for storage
  - Hermann Ebbinghaus – studied memory by rehearsing a group of nonsense syllables; found that encoding info into memory depends on the time spent learning/rehearsing the info.
  - Spacing effect – the tendency for distributed study or practice to yield better long term retention than is achieved through massed study or practice.
    - It is better to space out study times than to cram the night before a test.
  - Serial position effect – the tendency to recall best the last and first items in a list.

What We Encode

- **Visual encoding** – encoding of picture images (ex: visualization of info on page)
  - Imagery – mental pictures
  - Mnemonic devices – memory aids, especially those techniques that use vivid imagery and organizational devices (ex: peg-method)
- **Acoustic encoding** – encoding of sounds (ex: rhymes with, repetition of info out loud)
- **Semantic encoding** – encoding of meaning (ex: assigning/creating meaning)

Organizing Info for Processing

- **Chunking** – organizing items into familiar manageable units; often occurs automatically
- **Hierarchies** – hierarchical organization can help process info by putting info into groups/sets
Storage: Retaining Information

- Sensory memory
  - **Iconic memory** – a momentary sensory memory of visual info (brief photographic memory)
    - You can briefly look a word’s spelling to copy the word, but cannot recall the spelling minutes later.
  - **Echoic memory** – a momentary sensory memory of auditory stimuli, 3-4 seconds
    - Teacher asks you “what did I just say?” and you can recall the last few words
- STM/Working memory
  - STM/Working memory can only hold 7 +/- 2 pieces of info at once. Chunking info can help hold more at once.
- LTM
  - Unlimited, but is subject to forgetting

Storing Memories in the Brain

- Biological look at memory storage.
- **Long-term potentiation (LTP)** – an increase in a synapse’s firing potential after brief, rapid stimulation; believed to be a neural basis for learning and memory
  - As experience strengthens the pathways between neurons, synapses transmit signals more efficiently

Storing Implicit and Explicit Memories

- **Amnesia** – the loss of memory (cannot recall old info or cannot store new info)
- **Implicit memory** – procedural memory, retention of skills/procedures
  - Processed in part in the cerebellum
- **Explicit memory** – declarative memory, retention of facts and experiences that one can consciously know and declare.
  - Processed mainly in the hippocampus
Retrieval: Getting Information Out

- **Recall** – retrieving info not in conscious awareness
  - Short answer questions, fill-in-the-blank questions
- **Recognition** – identifying items previously learned
  - Multiple choice questions
- **Relearning** – learning information a second time, faster than the first time
  - Test corrections

Retrieval Cues

- Retrieval cues are bits of related info we encode while processing a certain piece of information – become associated with the target info
  - Mnemonic devices help by assigning meaning to random info that is associated with the target info.
    - EX: ROY G BIV serves as a cue for retrieving the colors in the light spectrum
  - Priming – unconscious activation of particular associations in memory.

Context Effects

- **Déjà vu** – the eerie sense that “I’ve experienced this before.” Cues from the current situation may subconsciously trigger retrieval of an earlier experience.
- **Context-dependent memories** – memories are more easily recalled in the same context as when they were encoded
  - Ex: taking a test in the same classroom that you learned the information in can help increase performance.
- **State-dependent memories** – memories are more easily recalled in the same state as when they were encoded
  - Ex: Happier memories are more easily recalled when feeling happy.
  - Ex: Memories made in one state (drunk) are hard to recall when in a different state (sober).
Forgetting

- Forgetting is just as important as remembering. We need to be able to discard useless info to avoid cluttering.

Three sins of forgetting

- Absent-mindedness – inattention to details produces encoding failure
  - We cannot remember what we do not encode.
- Transience – storage decay
  - Even if we encode something, we can still forget it later.
  - We often forget information that is unused or no longer holds meaning
- Blocking – tip of the tongue phenomenon; inaccessibility of stored info
  - **Proactive interference** – the disruptive effect of prior learning on the recall of new info.
    - Ex: your old cell phone number makes it difficult to remember your new cell phone number for a while.
  - **Retroactive interference** – the disruptive effect of new learning on the recall of old info.
    - Ex: after a year with your new phone number, it may be hard to remember the old one.
  - Motivated forgetting
    - **Repression** – in psychoanalytic theory, the basic defense mechanism that banishes from consciousness anxiety-arousing thoughts, feelings, and memories.
    - Freud believed our memories self-censored themselves to protect the individual.
    - Most memory theorists think repression rarely, if ever, occurs.

Three sins of distortion

- Misattribution – confusing the source of info
  - **Source amnesia** – attributing to the wrong source an event we have experienced, hear about, read about, or imagined.
- Suggestibility – the lingering effects of misinformation (ex: leading questions)
  - **Misinformation effect** – incorporating misleading info into one’s memory of an event.
    - Loftus’ study on recollections of car accidents using leading questions.
- Bias – belief-colored recollections
  - Memories are perceptions of the past and as such are subject to expectations and bias.

One sin of intrusion

- Persistence – unwanted memories
  - During the 1990s, the “memory wars” concerned claims of childhood sexual abuse and repressed memories. Some clinicians who attempted to recover repressed memories actually caused their patients to recall abuse that never really happened.
  - Regardless of the validity of the memories, psychologists have agreed on several points:
    - Injustice happens – some innocent people have been convicted while some guilt people have evaded charges.
    - Incest and other sexual abuse happen – sexual abuse can leave victims predisposed to a variety of problems from sexual dysfunction to depression.
    - Forgetting happens – young abused children may have forgotten the event or did not understand the meaning of the event.
    - Recovered memories are commonplace – pleasant and unpleasant memories can be cued by triggers. What is debated is if the unconscious mind forcibly represses memories to protect the individual.
    - Memories recovered under hypnosis or the influence of drugs are especially unreliable – hypnosis is a questioned practice in itself.
Memories before the age of 3 are unreliable - people cannot remember before the age of 3 (infantile amnesia). The older a child was and the more severe the abuse was are better indicators of reliability.

Memories, whether real or false, can be emotionally upsetting – if a false memory abuse because a real part of one’s history, both the accuser and the accused may suffer.

Children and Eyewitness Recall:
- Young child can recall events as they occurred if a neutral adult asks non-leading questions (therefore, not a police officer or societal authority figure) and uses words they understand.
- However, children are more suggestible than adults can be lead to produce false memories through suggestive questions.

Improving Memory
- Study repeatedly to boost long term recall (spacing effect).
- Spend more time rehearsing or actively thinking about material (effortful processing).
- Make material personally meaningful. (create personalized retrieval cues)
- Use mnemonic devices. (chunking into acronyms, peg-word method)
- Refresh memory by activating retrieval cues. (recreate situations in which the encoding occurred)
- Minimize interference. (Study before sleeping or resting)
- Test your own knowledge, both to rehearse the info and determine what you do not know yet. (practice recall rather than recognition)

Memory as a Biopsychosocial Phenomenon
- Biological
  - Stress
  - LTP
  - Brain circuits
  - Automatic processing
  - Electric current or head injury
  - Storage decay
- Psychological
  - Rehearsal
  - Context effects
  - Priming
  - Mood
  - Stress
  - Encoding and organizing strategies
  - Retrieval interference
  - Memory construction
- Social-cultural
  - Misinformation effect
  - Flashbulb memories for important events
  - Level of implied importance
  - Source amnesia