Chapter seven
Memory

- The Nature of Memory
- Forgetting
- Biological Bases of Memory
- Memory Distortions

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Things You’ll Learn in Chapter 7
- Do daydreamers actually have better memory than people who don’t daydream?
- How can taking a nap improve your memory?
- Can merely imagining engaging in a behavior create a false memory of actually engaging in that behavior?
- Why might exposure to pornography interfere with memory?
- Why does accuracy increase when eyewitnesses have only a few seconds to make an identification?

The Nature of Memory

- Memory is a constructive process: actively organizes and shapes information
- Process -> storage -> retrieval
- Two primary models of memory:
  1. Encoding, Storage, Retrieval (ESR)
  2. Three-Stage Model
Three Stage Memory Model

- Information enters through five senses
- Remains only long enough for relevant pieces to be transferred to next stage of memory
- The rest of the sensory stimuli degrade to make room for newer stimuli
- Iconic memory = visual, 1/2 second
- Echoic memory = auditory, 4 seconds

Sensory Memory

Swing a flashlight in a dark room. You will see the light in a continuous stream because the image lingers for a fraction of a second after the flashlight is moved.
Short-Term/Working Memory (STM)

• Processing and temporary storage
• Received from sensory memory, organizes and sends information to long-term memory
• Retrives and uses memories from long-term
• Capacity and duration are limited:
  – Use chunking to extend capacity
    864552497 or 864-555-2497
  – Use maintenance rehearsal to extend duration
    repeat, repeat, repeat

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Do daydreamers actually have better memory than people who don't daydream?

• Daydreaming while completing simple tasks is associated with higher working-memory capabilities (Levinson et al., 2012)
  – IV = strength of working memory
  – DV = amount of mind wandering reported during mindless task of pressing button when specific letter appears

Long-Term Memory (LTM)

• Memory is stored long term, sent back to STM for use
• Relatively unlimited capacity and duration
• The better memories are labeled and arranged, the easier they are to retrieve
1. **Mnemonic devices**, such as outlines or acronyms.

2. **Organization**: similar to chunking in STM
   - Some filing happens while you sleep!
   - How can taking a nap improve your memory?
   - Resting with eyes closed for as little as 10 minutes improves memory for story details (Dewar et al., 2012)

3. **Rehearsal**: Repetition works to maintain in STM, but in LTM need **elaborative rehearsal** for deeper processing
   - Focus on understanding, not memorizing

4. **Retrieval**: memory is not helpful unless you can retrieve and use it
   - **specific cues** require you to **recognize** the correct response
   - **general cues** require you to **recall** learned material by searching all possible matches in LTM

**Examples of recognition vs. recall?**
5. **Encoding Specificity**: better recall when we use memory in the same context it was learned. Matching location acts as retrieval cue.
6. **Mood congruence**: better memory when mood during learning matches retrieval. When sad, you tend to remember other sad circumstances.
7. **State-dependent retrieval**: taking a drug like caffeine during retrieval leads to better recall if drug was used during encoding.

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**Forgetting**

- Ebbinghaus forgetting curve (1885)
- Meaningful material is easier to remember
- Relearning takes less time than initial learning
- The best time to practice is *when you are about to forget* (not too soon and not too late)

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**Why we Forget**

- Five theories of why forgetting occurs:
  - Decay
  - Interference
  - Motivated forgetting
  - Encoding failure
  - Retrieval failure

In what ways can forgetting be adaptive?
Decay

- **Decay** = “use it or lose it”
- Memory is stored in the form of connections between neurons (physical)
- Connections deteriorate over time, especially without use

Interference Theory

- **Interference** = competing memories
- Retroactive interference: new information makes you forget old information
- Proactive interference: old information interferes with ability to remember new information

Motivated Forgetting

- **Motivated forgetting** = on purpose
- Freud said people forget unpleasant or anxiety-producing information either consciously or unconsciously
Encoding Failure Theory

- Encoding failure = never recorded
- Sensory information traveled into STM but didn’t get encoded into LTM
- Failure to attend to details may result in partial encoding

Retrieval Failure Theory

- Retrieval theory = it’s there, but not available
- Tip-of-the-tongue phenomenon: the information has been encoded but temporarily can’t be retrieved
- Problems caused by interference, faulty cues, emotional arousal

Factors that influence forgetting

- Misinformation effect
- Serial-position effect
- Source amnesia
- Sleeper effect
- Spacing of practice
- Culture
Misinformation Effect

- **Misinformation Effect**: Memories aren’t an instant replay; they are reconstructed and altered each time they are retrieved, often influenced by information occurring after the event.

- Can merely imagining engaging in a behavior create a false memory of actually engaging in that behavior?

- Study had subjects read a phrase (“shake the bottle”) and either imagine performing it or watch a video of someone else doing it. Two weeks later they “remembered” doing 23% of the actions they imagined and 33% of the actions they watched others perform (Linder et al., 2010).

Serial Position Effect

- The order in which the information is encountered effects memory.

- **Primacy effect**: information at the beginning of a list is easier to recall.

- **Recency effect**: information at the end of the list is easier to recall.

- If an employer is conducting interviews all day long, which appointment time do you want?

Source Amnesia and Sleeper Effect

- **Source amnesia**: forgetting the true source of the information.

- **Sleeper effect**: At first we discount information from an unreliable source as bad information, but through source amnesia we forget who said it and then the unreliable information is no longer discounted.

Do political campaigns ever take advantage of source amnesia and sleeper effect?
**When to Practice**

- Massed practice = cramming
- Distributed practice = spacing learning periods with rest periods. Practice sessions separated by 24 hours showed significant improvement in retention

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**Culture**

- In some culture, stories are passed down through generations. These people, in turn, have better recollection of information told in story form

  - How is information conveyed in your culture?
  - What implications might this have for the strength or weakness of people in this culture in terms of memory?

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**BIOLOGICAL BASES OF MEMORY**
Neuronal and Synaptic Changes

- Learning changes the brain
- **Long-term potentiation** = long-lasting increases in neural excitability
- Learning causes repeated stimulation of a synapse, which stimulates dendrites to grow more spines and strengthens synapse
- Learning creates increase in neurotransmitters, increasing neuron’s efficiency

Hormonal Changes & Emotional Arousal

- Stress -> epinephrine and cortisol -> stimulate amygdala -> stimulate hippocampus and cortex
- Epinephrine and cortisol increase encoding and storage of new information
- Prolonged and excessive stress interfere with memory

**Why might exposure to pornography interfere with memory?**

Men saw both pornographic and nonpornographic images. Which did they remember better? The nonsexual ones.

(Laier et al., 2013)

Hormonal Changes & Emotional Arousal

- Flashbulb memories = vivid, detailed and near-permanent images from surprising or strong emotional events (Brown & Kulik, 1977)

**Examples of flashbulb memories?**

- Events are accompanied by a flood of hormones, which are activated again when you recall the event
- No more accurate than other memories
Where are Memories Located?

- Hippocampal formation (hippocampus and surrounding area)
  - Memory recognition, implicit, explicit, spatial, episodic memory, declarative (LTM; sequence of events; Schacter & Wagner, 2013; O’Reilly et al., 2015; Green, 2016; Price, 2015; Ito, 2015)

- Thalamus
  - Formation of new memories and spatial and working memory (Mogil & Feinberg, 2000; Centonze & Colombo, 2015; Iida & Takeuchi, 2016; Ito, 2015)

- Cerebral cortex
  - Encoding of explicit (declarative) memories; storage of episodic and semantic memories, skill learning, working memory (Chang et al., 2013; O’Reilly et al., 2015; McBlack et al., 2015; Ito, 2015)

- Amygdala
  - Emotional memory (Scheff, 2013; Siegel et al., 2015; Murry et al., 2013; Paz & Pari, 2013)

- Basal ganglia and cerebellum
  - Creation and storage of basic memory and implicit (nondeclarative) memory (such as skills, habits, and simple classical conditioned responses) (Brown & Sugrue, 2012; Seifert et al., 2013; Fende & Jihad, 2011; Brodsky, 2010)

Memory Loss

- Traumatic Brain Injury (TBI) is leading cause of neurological disorders (including memory loss) for 15- to 25-year-olds. Car accidents, blows, falls, gunshots

- Amnesia = memory loss due to brain trauma
  - Retrograde amnesia: The person loses memories of events that occurred before the accident, yet has no trouble remembering things that happened afterward (old, “retro” memories are lost).
  - Anterograde amnesia: The person cannot form new memories for events that occur after the accident. Anterograde amnesia also may result from a surgical injury or from diseases such as chronic alcoholism.

- Alzheimer’s disease = progressive mental deterioration
  - Extreme decrease in explicit/declarative memory
  - Still retain implicit/nondeclarative memory, such as habits and procedures

Real World Psychology

Patients with epilepsy receive electrical stimulation to specific regions of the cortex show improvement in memory. Treatment might be applicable to Alzheimer’s and other memory disorders.
Memory Activity

• Read this list of words
• No cheating: don’t write them down!

Sour  Chocolate  Pie  Bitter  Soda  Heart
Nice  Artichoke  Honey  Good  Honey  Tart
Honey  Sugar  Candy  Taste  Tooth  Cake

MEMORY DISTORTIONS

Why We Misremember

• Need for logic and consistency prompt us to arrange information, make “corrections” that allow new information to fit in
• For efficiency, we summarize and connect new information with old memories, leaving out some details
Memory and Criminal Justice

- Problems with eyewitness testimony
- Easy to create false memories through leading questions:
  - Was there a telephone in the room?
  - What color was the telephone in the room?
- False memories can multiply over time and last for years
- Eyewitnesses are often very confident of their memories, even when wrong

Tutorial Video: Eyewitness Testimony

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- 5000 participants saw political photos; some were real events, others were fabricated
- Participants were asked to indicate which ones they remembered.
- About 50% of participants “remembered” that the false events had occurred.
- Politically liberal subjects were more likely to remember Bush socializing during Katrina and politically conservative were more likely to remember Obama shaking hands with Iranian president.
- We are primed to form false memories that fit with our preexisting attitudes
False vs. Repressed

- **False memories** = the creation of memories of an event that never happened
- **Repression** = the purposeful forgetting of actual, especially anxiety-producing, events
  - Conscious: some memories are actively forgotten
  - Unconscious: some memories are so painful they reside in the unconscious corners of the brain and require therapy to unlock (Freud)
- Much debate over whether repression exists
  - People who have experienced trauma often have trouble forgetting, not remembering, the event
  - Concern that recovery of repressed memories is actually the creation of false memories

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**applying real world psychology**

We began this chapter with five intriguing Real World Psychology questions, and you were asked to revisit these questions at the end of each section. Questions like these have an important and lasting impact on all of our lives. See if you can answer these additional critical thinking questions related to real world examples.

1. Many people think they can perfectly recall elaborate memories about how they felt or what they said when they first learned about devastating events, like the Boston Marathon bombings. What do you recall about this particular event? Do your memories fit with what flashbulb memory (FBM) research suggests?
2. Despite documented errors with FBMs, most people are very confident in their personal accuracy. What problems might result from this overconfidence?
3. Human memory is often compared to the workings of a computer. Based on your own experience, what are the advantages and limits of this comparison?
4. Amnesia is a common theme for Hollywood movies and television. How might these portrayals, which are often inaccurate, negatively influence the public’s perception?
5. What memory improvement techniques described in this chapter have you found to be helpful in your everyday life? What new strategies do you plan to try?