UNIT VII: COGNITION

MODULE 31: STUDYING AND BUILDING MEMORIES
MODULE 32: MEMORY STORAGE AND RETRIEVAL
MODULE 33: FORGETTING, MEMORY CONSTRUCTION, AND MEMORY IMPROVEMENT
MODULE 34: THINKING; CONCEPTS, AND CREATIVITY
MODULE 35: SOLVING PROBLEMS AND MAKING DECISIONS
MODULE 36: THINKING AND LANGUAGE
“Life with no memory, is no life at all.”

CONSIDER THIS: WHAT WOULD LIFE BE LIKE WITH NO MEMORY?

With no memory, how would your identity be affected?

“Memento”
MODULE 31

STUDYING AND BUILDING MEMORIES
COGNITION:

- all the mental activities associated with thinking, knowing, and remembering information.

Fact: Cognitive revolution in psychology occurred in the 60s and 70s and helped dethrone behaviorism as the dominant perspective in psychology.
MEMORY: *PLOT

- learning that has persisted over time; information that has been acquired, stored, and can be retrieved.

- We are what we remember

- How do we remember countless voices, sounds, songs, tastes, smells, textures, faces, places, happenings, etc.?

https://www.youtube.com/watch?v=tESffhWs8l0
HOW DOES MEMORY WORK?

- Psychologists create *Memory Models* to explain how we form and retrieve memories.
- We use different “models” to explain memory.
- **Information Processing Model**: 3 stage model that compares human memory to a computer’s operations.
**Information Processing Model:**

- **Three step process in how memory works**
  
  1. **Encoding**: The processing of information into the memory system.
  
  2. **Storage**: The retention of encoded material over time.
  
  3. **Retrieval**: The process of getting the information out of memory storage.
ENCODING

↑ the processing of information into the memory system.

↑ What you do when you are trying to learn something.

↑ Increase attention and intention while encoding.

Typing info into a computer

Getting someone’s IG name at a party.
STUDYING MEMORY

STORAGE

- the retention of encoded material over time.
- Create mnemonics/associations to help store info.

Pressing command S and saving the info.

Remembering someone’s IG handle after you leave the party.
RETRIEVAL

- the processing of getting the information out of memory storage.
- Find cues, use external memory aids.

Finding your document and opening it up.

Going on IG the next day and typing in wrong IG names. (Retrieval failure!)
Computers process information sequentially, our dual track mind processes information simultaneously (parallel processing).

Example: in the cafeteria, you process info about (1) the people you see, (2) the sounds of voices, and (3) the smell of food.
THREE STAGE MEMORY FORMING MODEL

- Atkinson and Shiffrin three stage model of memory, describes 3 different memory systems characterized by time frames:

  - **Stage 1 - Sensory Memory (encoding):** is a brief representation of a stimulus while being processed in the sensory system.

  - **Stage 2 - Short-Term Memory (encoding):** (STM) is working memory that holds a few items briefly.
    - Limited capacity (7 items +/- 2)
    - Duration is about 30 seconds

  - **Stage 3 - Long-Term Memory (storage):** (LTM) is large capacity and long duration.
EXTERNAL STIMULI

Sensory memory
Briefly retains the information picked up by the sensory organs

Short-term memory
Temporarily holds information in consciousness

Long-term memory
Can retain information for long periods of time, often until the person dies
THREE STAGE PROCESSING MODEL OF MEMORY: SENSORY MEMORY

- the immediate, very brief recording of sensory information in the memory system.

- Sensory memory relates to memories taken in by the senses. It is divided into **iconic** and **echoic memories**.
THREE STAGE PROCESSING MODEL OF MEMORY: SHORT TERM MEMORY

- activated memory, holds a few items briefly before it is stored or forgotten.
- The stuff we encode from the sensory memory goes to STM.
- From here we encode it through rehearsal.
- Capacity of STM
  - Holds about 7 (plus or minus 2) items for about 20 seconds.
  - We recall digits better than letters.

http://www.psychologistworld.com/memory/test1.php
http://www.garyfisk.com/anim/lecture_stm.swf
THREE STAGE PROCESSING MODEL OF MEMORY: SHORT TERM MEMORY

- Maintenance Rehearsal:
  - continuously repeating the to-be-remembered information
- Volunteer?
THREE STAGE PROCESSING MODEL OF MEMORY: SHORT TERM MEMORY

- STM is NOT just a small, brief storage place.
- STM is an active desktop where your brain processes information, making sense of new input and linking it with LTM.
- The active processing that takes place in this stage is called your working memory. (Example: linking the information you’re reading with prior knowledge.)
YOU WERE TRYING TO LEARN AN ENTIRE CHAPTER IN ONE NIGHT?

CLEARLY YOU'VE NEVER HEARD OF ENCODING FAILURE
THREE STAGE PROCESSING MODEL OF MEMORY: LONG TERM MEMORY

- **Long term memory (LTM):**
  - relatively permanent and limitless storehouse of the memory system.

- **Effortful processing into LTM**
  - chunking
  - form associations w/mnemonic devices!

- *Effortless(ly) automatically processed into LTM*
  - state dependent (emotional/amygdala)
  - flashbulb memories
BUILDING MEMORIES: ENCODING

DUAL-TRACK MEMORY:
EFFORTFUL (EXPLICIT) VS. AUTOMATIC (IMPLICIT) PROCESSING

- Our mind operates on two tracks, even with memory!

  - **Effortful (explicit) processing:**
    - episodic memories (birthdays)
    - explicit (declarative) memories:
      - our LTM of facts and experiences we consciously know and can verbalize.

  - **Automatic (implicit) processing:**
    - procedural memories (how to ride a bike)
    - implicit (non-declarative) memories:
      - our LTM for skills and procedures to do things by previous experience without that experience being consciously recalled.
EXAMPLE:

EFFORTFUL PROCESSING (EXPLICIT)

.citamotua
EXAMPLE:
AUTOMATIC PROCESSING

Spring
EFFORTFUL PROCESSING AND EXPLICIT MEMORIES

- With conscious experience and practice, we learn and remember things.

- How does Sensory Memory work?

  - **Iconic Memory (EYE-conic)**
    - momentary sensory memory of visual stimuli, a photograph like quality lasting only about a second.

  - **Echoic Memory**
    - momentary sensory memory of auditory stimuli.

  - If you are not paying attention to someone, you can still recall the last few words said in the past three or four seconds.

  - "echolalia"

  [http://www.garyfisk.com/anim/iconic.swf](http://www.garyfisk.com/anim/iconic.swf)
EFFORTFUL PROCESSING STRATEGIES

- What are some strategies that can help us remember new information?

  - **Chunking**
    - organizing items into familiar, manageable units.
    - Enables us to recall things more easily.
    - For example: Phone numbers 305-3000, Social Security Numbers, Address?

  - **MNEMONICS!!**
    - memory aids, especially those techniques that use vivid imagery and organizational devices.

  - **Hierarchies**
    - systems in which concepts are arranged from more general to more specific.
Implicit memories include:

- Procedural memories (how to ride a bike, play an instrument, tie a shoelace)
  - automatic skills and classically conditioned associations among stimuli.

Without conscious memory, we automatically process info about:

- **space** (visualizing the location of information in a book)
- **time** (being able to remember the sequence of your day and where you misplaced your hydroflask)
- **frequency** (effortlessly keeping track of things. “That’s the fifth time she’s worn that outfit this week!”)
STM VS. LTM

STM:

<table>
<thead>
<tr>
<th>Types of Memory</th>
<th>Storage Capacity</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>STM or Working</td>
<td>7+-2 items</td>
<td>Fades in 10-12 seconds, lasts up to 30 seconds if unrehearsed</td>
</tr>
</tbody>
</table>

LTM:

<table>
<thead>
<tr>
<th>Type of Memory</th>
<th>Storage</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Long-Term Memory</td>
<td>Infinite</td>
<td>Infinite</td>
</tr>
</tbody>
</table>

Types of LTM:

- **Nondeclarative** (Procedural) memory: are your “how to skills”
- **Declarative** memory: stores personal experiences: your memory for events, or “episodes” in your life. Acts as your autobiographical memory.
  - **Semantic Memory**: names, faces, facts, knowledge, and concepts.
  - **Episodic Memory**: memories of specific dates and events. (An episode on t.v)
  - **Prospective Memory**: a future event that you have to remember.
DISTRIBUTED PRACTICE PRODUCES BETTER LONG TERM RECALL

- We *encode* better when we *study* or practice OVER TIME!
- Therefore, Do NOT CRAM (massed practice)!

**Spacing effect:**
- the tendency for distributed study or practice to yield better long-term retention than is achieved through massed study or practice.

**Testing effect:**
- enhanced memory after retrieving, rather than simply rereading, information.

"Those who learn quickly also forget quickly." - Ebbinghaus
LEVELS OF PROCESSING

- **Shallow processing:**
  - encoding on a basic level such as a word’s letters or word’s sound.

- **Deep processing:**
  - encodes semantically based on the meaning of the words.
  - The more meaningful, the better our retention.

- **How do we process information?**
  - **Visual Encoding:** the encoding of picture/visual images.
  - **Acoustic Encoding:** the encoding of sound, especially the sounds of words.
  - **Semantic Encoding (best level of recall):** the encoding of meaning.
Levels of Processing

1. Structural
   What does the word look like?
   *Is the word in capital letters?*

5. Phonetic
   What does the word sound like?
   *Does the word rhyme with ...?*

9. Semantic
   What does the word mean?
   *Does the word fit in this sentence?*
MODULE 32
MEMORY STORAGE AND RETRIEVAL
ARE OUR LONG TERM MEMORIES PROCESSED AND STORED IN SPECIFIC LOCATIONS?

- “Our memories are flexible and superimposable, a panoramic blackboard with an endless supply of chalk and erasers.” -Elizabeth Loftus and Katherine Ketcham

- Our capacity for storing long-term memories is limitless.

  However! Attention issues, prior knowledge, and memory decay may interfere with the actual memories stored.
TYPES OF LEARNING

- Declarative Memory: Facts and events
- Procedural: Skills, emotional learning
What are the roles of these structures in terms of memory?

Memory requires *brain networks* that processes and stores our explicit memories.

*R and L frontal lobes* process diff types of memories.

- Recalling a password and holding in working memory = L frontal lobe
- Recalling a memory of someone attractive at a party = R frontal lobe
EXPLICIT-MEMORY SYSTEM: FRONTAL LOBES & HIPPOCAMPUS

- **Hippocampus** (ends to storage): neural center located in the limbic system; helps process explicit memories for storage.

- explicit memory for facts and episodes are processed here and fed to other brain regions for storage.

- equivalent of a “save” button

- damage to this structure disrupts recall of explicit memories

- During deep sleep, hippocampus processes memories for later retrieval. Hippocampus and brain cortex show simultaneous brain activity as if they’re working together.
KORSAKOFF’S SYNDROME: LINKED TO CHRONIC ALCOHOL DEPENDENCE. PATIENT’S MEMORIES SLOWLY ERODE, LEAVING THEM TO FILL IN THE MISSING PIECES WITH FALSE MEMORIES. SHOWN TO HAVE SMALLER HIPPOCAMPI.
IMPLICIT-MEMORY SYSTEM: CEREBELLUM & BASAL GANGLIA

- These brain structures are involved in **automatic processing** (skills, and conditioned associations.)
  - Brain-damaged patient with amnesia unable to recognize same doctor everyday.
  - Thumbtack in doctor’s palm and never wants to shake his hand again. Why?
  - Classically conditioned and can’t explain why.
IMPLICIT-MEMORY SYSTEM: CEREBELLUM & BASAL GANGLIA

- Cerebellum:
  - plays a key role in forming and storing implicit memories created by classical conditioning.
  - Damaged cerebellum = unable to develop certain conditioned reflexes.
  - Example: No salivation to tone, no nausea with a food that once made you sick.
IMPLICIT-MEMORY SYSTEM: CEREBELLUM & BASAL GANGLIA

- Basal Ganglia:
  - deep brain structures involved in motor movement.
  - Helps in forming our *procedural* memories for skills.
  - info from cortex -> basal ganglia
  - Example: riding and bike, skateboarding, etc.
INFANTILE AMNESIA: FIRST THREE YEARS WITH NO CONSCIOUS MEMORY. WHY? HIPPOCAMPUS IS ONE OF THE LAST BRAIN STRUCTURES TO DEVELOP. WE COMMUNICATE DIFFERENTLY AS ADULTS THAN WE DID AS BABIES.
THE AMYGDALA, EMOTIONS, AND MEMORY

- How do emotions affect our memory processing?
- Emotions trigger stress hormones.
- Stress hormones provoke the amygdala to initiate a memory trace/pathway in the frontal lobes and basal ganglia.
- Emotional arousal can sear certain events into the brain.
  - Patients with hippocampal damage watching happy and sad films.
  - Couldn’t remember what they watched (no explicit memories)
  - Emotions persisted.
THE AMYGDALA, EMOTIONS, AND MEMORY

- "Stronger emotional experiences make for stronger, more reliable memories."
  - Helps us adapt to the world around us.
  - Memory serves to predict the future and to alert us to potential danger.

- Flashbulb memories:
  - a clear moment of an emotionally significant experience or event.
Flashbulb memories

WHERE WERE YOU?

- Michael Jackson’s death
- School shootings
- 9/11
- Paris attacks
- Death of a loved one

How vividly do you remember your whereabouts?

What emotional reactions did they have about the event?
RECAP OF MEMORY AND THE BRAIN

- Explicit memory (consciously trying to remember something)
  - Brain part = hippocampus
- Implicit memory (remembering something unintentionally)
  - Brain part = cerebellum and basal ganglia
- Emotional memories
  - Brain part = amygdala
- Converting sensory memory into STM
  - Brain part = thalamus
RETRIEVAL: GETTING INFORMATION OUT

RETRIEVAL

▸ the process of getting information over time.

▸ **Recall**
  
  ▸ the ability to retrieve information not in conscious awareness. (vocab test- writing definitions out)

▸ **Recognition**
  
  ▸ a measure of memory in which the person need only to identify items previously learned. (vocab test- matching)

▸ **Relearning**
  
  ▸ a measure of memory that assesses the amount of time saved when learning material for the second time.

▸ **Primacy and Recency Effect (Serial Position Effect)**
  
  ▸ one factor in retrieval is the order in which the information is presented. We tend to remember items that presented at the beginning (p) and the ending (r) of a list.
HOW TO IMPROVE RETRIEVAL—RETRIEVAL CUES

- Mnemonics
  - ROYGBIV, RIDDLES

- Method of Loci “memory palace” [https://www.youtube.com/watch?v=X-xl7_hdWZo](https://www.youtube.com/watch?v=X-xl7_hdWZo)
  - placing items to remember around a familiar location usually your home or room, and then calling forth the image of the place as needed.

- Peg Word System
  - uses association of terms to be remembered with a memorized scheme
  - Example: one is a bun, two is a shoe...

- Priming
  - a technique for cuing implicit memories by providing cues that stimulate memory without awareness of the connection between the cue and the retrieved memory.
FACTORS AFFECTING RETRIEVAL

- Mood-Congruent Memory
  - a memory process that selectively retrieves memories that match one’s mood.
  - Example: “My bf broke up with me and my mom told me I couldn’t go to the party. She ALWAYS tells me NO!

- TOT Phenomenon
  - the inability to recall a word, while knowing it in memory. People often describe this frustrating experience as having the word on the TOT.

- Context-Dependent Memory
  - information that is better retrieved in the context in which it was encoded, stored, or learned.
  - Example: forgetting what you stood up to do. you go back and sit down to remember.
  - Example: studying for subject in the classroom that you’ll be taking the test in.

- State-Dependent Memory
  - information that is better retrieved in the physiological or emotional state in which it was encoded and stored, or learned.
  - Example: while one is drunk, they hide money. can only find it when drunk again
OH YOU'RE IN AP PSYCHOLOGY?

HOW DOES IT FEEL TO SECOND GUESS YOUR MEMORIES?
FALSE MEMORIES

The Bunny Effect (Elizabeth Loftus)

https://www.youtube.com/watch?v=eZlPzSeUDDw&feature=relmfu
WHY DO WE FORGET?

 Reasons:

- Memory loss due to severe and permanent damage (H.M.)
- Encoding failure
- Storage decay
- Retrieval failure
- Interference

"Someday we'll look back at this time in our lives and be unable to remember it."
FORGETTING AND THE TWO-TRACK MIND:

- Anterograde amnesia: (H.M.) [https://www.youtube.com/watch?v=KkaXNvzE4pk](https://www.youtube.com/watch?v=KkaXNvzE4pk)
  - an inability to form new memories.

- Retrograde amnesia:
  - an inability to retrieve information from one’s past.

- Some people are incapable of recalling new facts and forming explicit memories, however they are able to learn nonverbal tasks due to the diff brain structures involved.

- Able to learn tasks without awareness of learning them
  - Examples: Wheres Waldo, find their way to bathroom
A Schematic Definition of Retrograde Amnesia and Anterograde Amnesia

Retrograde Amnesia:
Cannot remember events prior to brain damage

Brain damage occurs

Anterograde Amnesia:
Cannot later remember events that occur after brain damage

Time
THEORIES OF FORGETTING

- **Proactive interference (forward acting):**
  - old information interferes with recall of new information

- **Retroactive interference (backward acting):**
  - new information interferes with recall of old information

- **Encoding failure:**
  - a lot of what we sense, we never notice, and what we fail to encode, we will never remember. (absent mindedness: texting in class..missing important details)

- **Decay theory:**
  - memory trace fades with time

- **Motivated forgetting:**
  - involves the loss of painful memories (protective memory loss)

- **Retrieval failure:**
  - the information is still within LTM, but cannot be recalled because the retrieval cue is absent
EXAMPLES OF INTERFERENCE:

- **Proactive interference (forward acting):**
  - Happens when previously stored info prevents learning and remembering new info.
  - Calling your new boyfriend by your old boyfriend’s name.

- **Retroactive interference (backward acting):**
  - Occurs when newly learned information prevents the retrieval of previously learned material.
  - Getting a new address and forgetting your old address

Mnemonics?
Module 33

- **Proactive interference**: Old information hinders recall of new information
  - Learn combination to high school locker: 17-04-32
  - Memory of old locker combination interferes with recall of new gym locker combination: ??-??-??

- **Retroactive interference**: New information hinders recall of old information
  - Knowledge of new email address interferes with recall of old email address: nvayala@???
  - Learn sibling's new college email address: npatel@siblingcollege.edu
FORGETTING

EXAMPLES OF STORAGE DECAY:

- Even if we encode something well enough, we can forget it.
- Without rehearsal, we forget things over time.
- Why? Possible reasons:
  - forgetting curve is a gradual fading of the physical memory trace.

- Ebbinghaus’s forgetting curve:
  - The course of forgetting unused info is initially rapid, followed by a declining rate of loss, then leveling off with time.
EXAMPLES OF MOTIVATED FORGETTING:

- We sometimes revise our own histories.
- Memory is an “unreliable, self-serving historian.”
- Where did all the cookies go? “I don’t know, I seriously only ate one.”
MOTIVATED FORGETTING: Why does it exist?

- One explanation is REPRESSION:
  - in psychoanalytic theory, the basic defense mechanism that banishes anxiety-arousing thoughts, feelings and memories from consciousness.

- Freud says we repress painful or unacceptable memories to protect our self-concept and to minimize anxiety. Popular in the mid-twentieth century.

- Today however, psychologists believe we forget neutral things like where we placed our keys, and hardly ever forget emotional events.
MEMORY CONSTRUCTION

- Memory does not function like a video recorder!
- We sometimes alter memories as we encode or retrieve them.
- Your expectations, schemas, and environments may alter your memories.
FALSE MEMORIES

Loftus and Palmer 1974

Eyewitnesses reconstruct their memories after a crime or accident and then answered questions about what they had seen.

https://www.youtube.com/watch?v=Rg5bBJQOL74


“Memory is insubstantial. Things keep replacing it. Your batch of snapshots will both fix and ruin your memory. You can’t remember anything from your trip except the wretched collection of snapshots.” -Anne Dillard 1988
MISINFORMATION AND IMAGINATION EFFECTS

- Misinformation effect (Elizabeth Loftus):
  - incorporating misleading information into one’s memory of an event.
- About how fast were the cars going when they SMASHED into each other? (higher speed estimates and glass)
- About how fast were the cars going when they hit each other? (lower speed estimates)
Module 33

**Question**

About how fast were the cars going when they ______ each other?

**Verb**

- smashed into: 40.8
- hit: 34.0
- contacted: 30.8

**Original information**

**External information**

About how fast were the cars going when they SMASHED INTO each other?

**The “memory”**
MEMORY CONSTRUCTION ERRORS

EYEWITNESS TESTIMONY

- Shown to be unreliable.

- Eyewitnesses can only remember what they perceive. The more people you tell the story to, the better the chance of distortion.

- Recall for events may be influenced by what they heard or constructed after incidents.

- Memory is reconstructed.

- Memories are not stored like snapshots, but are instead like sketches that are altered and added to every time they are called up.
EYEWITNESS TESTIMONY

Elizabeth Loftus has shown subjects who are given false information about an event or scene tend to incorporate it into their memories, and "recall" the false information as a part of their original memory even two weeks later.

Loftus gives the example of the sniper attacks in the fall of 2002. "Everybody was looking for a white van even though the bad guys ended up having a dark Chevy Caprice." That's because some people reported seeing a white van at the scene of the crime. "Witnesses overhear each other," says Loftus, and police may also unintentionally influence people's memories when they talk about a crime.
SOURCE AMNESIA (MISATTRIBUTION)

- attributing to the wrong source an event we have experienced, heard about, read about, or imagined.

- Frailest part of memory is its source.

- Along with the misinformation effect, is the heart of many false memories.

- Author and songwriters sometimes suffer from it, thinking they came up with something and end up plagiarizing.
deja vu: “already seen”
HOW TO IMPROVE MEMORY

▸ Study repeatedly
▸ Make material meaningful
▸ Activate retrieval cues
▸ Use mnemonic devices
▸ Get adequate sleep
▸ Self test!