

Unit 7A: Memory

I. Introduction

- A. We are our memories. Without memory, we'd be little more than a rock.
- B. **Memory** is learning that has remained over time, information that's stored and can be retrieved.
- C. Even regular people have amazing memories.
 - 1. In one experiment, people were shown 2,500 slides for 10 seconds. Later, 280 slides were repeated along with never-before-seen slides. People could pick out the seen-slides 90% of the time.
 - 2. In another experiment, people were shown pictures. Then 17 years later, shown partial images of those pictures. Those who had seen the pictures were better at recognizing the partial images than those who'd never seen them.
- D. One idea of memory is called the **information processing model** and takes after a computer. There are three parts to this model...
 - 1. **Encoding** - How we get information into our brain. Like a keyboard on a computer.
 - 2. **Storage** - How we hold onto that information. Like a hard drive.
 - 3. **Retrieval** - How we get the info back out of our brain. Like a computer's file system.
- E. Another model is called connectionism. It has the idea that memories are made up of interconnected neural networks. The theory is that memories are made in three stages...
 - 1. A brief **sensory memory** is stored. This is like an after-image if you have your eyes closed then flashing them open-and-closed again.
 - 2. The info goes into **short-term memory** where it's encoded via rehearsal.
 - 3. Finally, the info goes into **long-term memory**.
 - 4. This theory is a bit limited. A modified version of this 3-step theory would also include:
 - a. The idea that some memories go straight to long-term memory.
 - b. There is a **working memory**, a version of stage 2. The working memory is where we focus on information that is useful or needed right then.

II. Encoding: getting information in

- A. There are two main types of encoding: automatic (where you don't think about it) and effortful (where you must purposely try to remember).
- B. **Automatic processing** takes place automatically, without any conscious effort on your part. You know the way from a classroom to the cafeteria and you walk there without even thinking about it.
 - 1. Whereas computers do things in sequence (called "serial processing"), the human brain can do many things at once, called **parallel processing**.
 - 2. Automatic processing can simultaneously handle: space (where you are), time, frequency (how often something happens), well-learned information (some things we've learned so well, like words on a sign, we process them without even knowing it).
 - a. Reading is a good example of automatic processing. While first learning to read, you start with a word or two. Then maybe 50 on a page, then more. Eventually, your eyes cover pages almost as fast as they can scan the words.
- C. **Effortful processing** takes place when we put in a purposeful effort to remember something. There are three components to effortful processing. They are:
 - 1.

- a. **Rehearsal** is simply repetition. Hermann Ebbinghaus studied this type of memory.
 - i. He made up jibberish syllables like: BAZ, KEL, NOX, or WUQ. Then he read them aloud until he remembered them. The next day he recorded how many he could remember (not many). But...
 - ii. The more times he'd rehearsed or repeated the syllables, the quicker he could relearn them the next day.
 - iii. Once learned, additional rehearsal called **overlearning** increased retention.
 - iv. The principle emerged: the amount remembered depends on amount of time spent learning.
 - b. The **spacing effect** influences memory. This says that we remember better if we space our study or rehearsal out over time.
 - i. "Mass practice" (AKA "cramming") gives quick, short-term learning and may make a person feel more confident.
 - ii. However, "distributed study time" yields better long-term learning.
 - iii. Also, in the "testing effect," repeated quizzing helps to learn material (as well as evaluate what someone has learned).
 - c. The **serial position effect** suggests that, when trying to remember a list of something, you're more likely to remember the first and last ones.
 - i. The idea here is that while trying to remember the first things, your learning of them interferes with your learning of the ones that follow. This is called the "primacy effect."
 - ii. Then, you're likely to remember the last one or two because they're in your working memory. This is called the "recency effect."
2. What we encode is sometimes a mystery. We immediately ignore some things, work to remember some things, and remember others without much or any effort at all.
- a. What we encode is affected by its context. This means that what we already know impacts what we take in and how we remember it. This can sometimes mess us up.
 - b. There are three types of encoding techniques for verbal information...
 - i. **Visual encoding** – refers to images and shapes.
 - ii. **Acoustic encoding** – refers to sounds.
 - iii. **Semantic encoding** – refers to meanings of words.
 - iv. A study tried to measure which of these was most effective to memory. Words were flashed then people were asked visual, acoustic, and questions of meaning.
 1. The results revealed that semantic encoding was most effective, then acoustic, and lastly visual encoding.
 2. These studies show how effective it is to rephrase things in our own words when trying to memorize them.
 3. They also show that when learning new material it's (a) important to rehearse or repeat it and (b) it's important to make it meaningful to you in some way.

- c. Visual encoding involves **imagery**. We can much more easily remember concrete things or words, like "dog", "truck", or "flower" than abstract words like "honor", "wrath", or "clever."
 - i. The "good times" of our memories may be due to what's called "**rosy retrospection**." This is where the boring memories fade away and the nice images remain. For instance, on a trip to New York City, we forget the long wait in the airport but remember the scene atop the Empire State Building.
 - ii. **Mnemonic devices** are tricks that help memory and are often visually based.
 - 1. For example, the peg-word system assigns a visual image to a number, like one-bun, two-shoe, three-tree, etc. By pairing another word to the peg-word, a list can be recalled in order.
- d. Chunking is memorizing things in small groups, rather than alone or in one large group. This is why we write and think of phone numbers as 555-867-5309. We remember 555, then 867, and 5309.
 - i. **Chunking** is often used as a mnemonic device. For instance Roy G. Biv stands for red, orange, yellow, green, blue, indigo, violet.
- e. **Hierarchies** are organized structures. You usually see these as flow-charts that analyze an organization (like a government) or a process.
 - i. Hierarchies help us to organize and thus to remember info. The human brain likes order – hierarchies help us get that.

III. Storage: retaining information

- A. Sensory memory is like a lightning flash of what you see (or hear, etc.). How much of this do we remember?
 - 1. George Sperling flashed a 3 by 3 grid of letters to people and asked how many letters they remembered (about half). But, if prompted just after the flash to remember a certain row, they remembered them almost perfectly.
 - 2. This illustrated **iconic memory** which says that for a brief moment the image remains "burnt" in our eye. In Sperling's experiment, all 9 letters were "visible" for a short time. That's why a row could be named.
 - 3. For sound, we also have a very similar **echoic memory** where sound is very briefly stored.
- B. **Working** or **short-term memory** is the temporary holding place for information that we're using at the current time. For instance, if someone tells us a phone number, we can stick it in our head long enough to dial, then we forget it.
 - 1. Short-term memory lasts only a few seconds. In one study, after a 3 second delay, people forgot 3-consonant groups half the time. They forgot them almost completely after 12 seconds.
 - 2. Short-term memory can hold only about 7 bits of information.
- C. Long-term memory appears to be limitless.
 - 1. There are extreme examples of this, like people remembering and reciting pi to ridiculous levels.
 - 2. The biological storage process is complex.
 - a. Memories appear to be stored throughout the brain (not in one place).
 - b. Researchers have studied the synapses of sea slugs called Aplysia. It's nerve cells are very large and accessible.
 - i. The sea slugs' synapses changed. Eventually it needed less of a stimulus to make the neuron "fire." This is called **long-**

term potentiation or (**LTP**). In other words, the threshold needed to achieve action potential is lowered due to LTP.

- c. The protein "**CREB**" is an off/on switch for genes. A drug or supplement of CREB may one day help the synapses that help memory.
- d. Increasing **glutamate**, a neurotransmitter, may also increase LTP and memory.
- e. An electric current or a jolt to the head won't affect long-term memories, but can wipe out short-term memories. A boxer who gets knocked out often doesn't remember the hit that brought him down.

D. Strong emotion or severe stress can heavily influence memories.

1. Emotional news, like hearing of a loved-one's death, or stressful situations, like an oncoming tornado "burn" themselves into our memories. These memories are very accurate.
2. These memories are "written" into our memories due to action by the amygdala and to hormones released at the time.
3. **Flashbulb memories** occur at times of crisis, such as the events of 9/11, 2001. Our brain's take a "snapshot" when something like that happens. These memories also prove to be very accurate.

E. **Amnesia** is the inability to form new memories.

1. The famous patient known as "H. M." had part of his brain removed. He retained old memories, but could not retain new ones.

F. There appears to be two types of memory systems...

1. **Explicit memory** – Consciously recalled memories. AKA **declarative memory**.
 - a. These are things like facts or experiences that you can call up.
2. **Implicit memory** – Memory without conscious recall. AKA **nondeclarative memory** or **procedural memory**.
 - a. This can be either skills (like riding a bike) or classical conditioning. The person may know how to skateboard, but wouldn't be able to explain (or declare) that they know it.
3. Two parts of the brain play a special role in memory...
 - a. The hippocampus (in the temporal lobe) seems important in writing new memories.
 - i. Damage to the hippocampus hurts memories. Extra activity in it during sleep seems to help people remember things later on.
 - ii. The hippocampus is more of a temporary site for memories.
 - b. The cerebellum is important for storing implicit memories from classical conditioning.
4. The dual implicit/explicit memory systems apply to infants as well. Things infants learn may well stretch into the future, but we have no explicit memories of learning them.

IV. **Retrieval**: getting information out

A. Key terms in retrieval...

1. **Recall** is the ability to call up stored memories. It's like a fill-in-the-blank test.
2. **Recognition** is identifying something already learned. It's like pinpointing a correct definition on a multiple choice test.
3. **Relearning** is a measurement of time saved when learning something a second time. Learning something a second time comes faster and easier.

B. **Retrieval cues** help us to pull information out of our memories.

1. Mnemonic devices serve as retrieval cues. Examples are ROY G. BIV and peg-words.

2. Sometimes **priming** cues us to remember things. Priming gives us hints to unlock our memories, and could be nothing more than a key word to open the door to our memories.
- C. Context effects refer to the fact that we remember things in the context or setting in which they're normal. It's like knowing a person by name, then seeing them somewhere unexpected and not being able to recognize them.
 1. The phenomena of **déjà vu** can be triggered by reentering a similar situation. Rather than actually having been in a situation before, certain similar memories may be similar enough to make us believe we've been there before.
- D. Moods and memories also cue us to remember certain things. If we re-live a certain mood or memory, we're more likely to remember a certain memory that was stamped into our brains at that time.
 1. Our memories are said to be **mood-congruent**. This means that when in a certain mood, it's easier to recall memories that fit that mood. For instance, when in a depressed mood, for whatever reason, it's easier to recall other depressing memories.

V. Forgetting

- A. Memory can be stunningly accurate, like people who remember every detail of every day of their lives, or stupidly bad, like forgetting a person's name who was introduced to you 2 seconds earlier.
- B. Daniel Schacter has identified "7 sins of memory"...
 1. Forgetting:
 - a. Absent-mindedness – our minds are elsewhere.
 - b. Transience – time decays memories.
 - c. Blocking – we have it on the tip of our tongue, but can't get it.
 2. Distortion:
 - a. Misattribution – our memories "cross wires" as to who said it or if it was a dream.
 - b. Suggestibility – our memories become susceptible to suggestion by others.
 - c. Bias – our current feelings/beliefs can influence memories.
 3. Intrusion:
 - a. Persistence – certain memories, usually bad, won't go away.

VI. Encoding failure

- A. Most of what we sense, we don't notice. And, much of what we notice we don't encode (thus don't remember it).
- B. As we get older, our ability to encode declines.
- C. An example of sensing much but encoding less is seen in the penny. Most people incorrectly identify a real penny if its components are switched around.

VII. Storage decay

- A. Once encoded, the question then is, "How quickly do we forget?"
- B. **Hermann Ebbinghaus** graphed his forgetting of nonsense syllables. His results showed the **forgetting curve**.
 1. At first, we forget very much very fast.
 2. Then, forgetting diminishes, then finally levels off.

VIII. Retrieval failure

- A. Sometimes, info is "on the tip of our tongues." It hasn't been forgotten, it's in memory, but we can't get it out. There's a retrieval failure.
- B. **Interference** can hurt retrieval. It's when something similar gets in the way of trying to remember something. For instance, it's hard to remember a phone number if other phone numbers are told to you at that time.
 1. **Proactive interference** (AKA "forward acting interference") takes place when something you've previously learned gets in the way of learning something new.

- a. For example, learning letters in Italian may be tricky if you'd first learned letters in Spanish (they're similar).
 - 2. **Retroactive inference** (AKA "backward-acting interference") takes place when new info makes it hard to remember old info.
 - a. For example, a computer programmer might learn a new programming language. Then, he may have trouble reverting back to the old language that he once knew well.
 - b. Two researchers, John Jenkins and Karl Dallenbach, studied this in 1924.
 - i. They had people study nonsense syllables then tried to recall them 8 hours later. One group stayed awake, the other group slept.
 - ii. The two groups' forgetting curves showed that the sleeping group remembered things much better.
 - iii. The idea was that the awake group experienced more sensations which interfered with the retrieval. The sleeping group did not have that interference.
 - 3. Notably, sometimes knowing something similar can help. Knowing a similar language can sometimes help you learn another. This is called **positive transfer**.
- C. Our memories are pretty fluid. That is to say, we tend to unknowingly revise them.
 - 1. As to why we do this, **Sigmund Freud** would've said we do this as a defense-mechanism. He felt we "repress" painful memories to protect our self-concepts and reduce anxiety.
 - 2. In Freud's world, these memories are repressed, but not forgotten. They'll one day surface if cued the right way.
 - a. An example was a woman afraid of running water. She didn't understand her fear until her aunt said, "I have never told." As a girl the woman had run off, gotten trapped under a waterfall, and was saved by the aunt who promised to never tell.
 - b. Freud's ideas are rich throughout psychology. But, modern psychologists tend to think that he was wrong. Sadly, painful memories usually last.

IX. Misinformation and imagination effects

- A. Oftentimes, we weave memories from things we remember—we tend to fill-in-the-blanks. This fact means that our memories are often inaccurate.
- B. Studies of eyewitnesses consistently reveal that eyewitness memory is a rather fluid thing. Memories can be very different depending on cues such as how the questions about the incident are asked.
 - 1. The **misinformation effect** tricks us. This occurs when we're given a bit of wrong information, we often incorrectly remember things. Often, it's hard to tell what really happened and what we created.
 - 2. "Imagination inflation" occurs when we repeatedly imagine something that happened, then remember it as though it actually did.

X. Source amnesia

- A. **Source amnesia** (AKA "source misattribution") occurs when we either can't or wrongly label the source of a memory. The memory is there, but we're not sure where it came from.
 - 1. Sometimes it's hard to tell if a memory was real or if it was a dream.

XI. Discerning true and false memories

- A. Memories, both real and invented, seem real. So, by going by gut only it's hard to tell which is real and which is made-up.
- B. Memories are influenced by the way we interpret them.

1. In a study, researchers showed a face that was either happy or angry. The subjects were asked to interpret one of the emotions ("Why is she happy?" or, "Why is she angry?").
 2. Later, a slider morphed the picture from happy to angry. Those who explained the angry face stopped the slider at a much "angrier" level than those that saw the happy face.
- C. Eyewitness testimony is frequently wrong. 79% of convicts who were proven innocent by DNA testing had been jailed largely due to eyewitness testimony.
1. This field (eyewitness memory and the fabrication/unreliability or memories) is pioneered by Elizabeth Loftus.
 2. Police officers take this to heart when interviewing witnesses. They let the eyewitness tell everything without much interruption. Then they ask "cognitive interview techniques" to cue memories.
- D. As we grow older, we tend to think our opinions when young were much like they currently are (they usually change).

XII. Children's eyewitness recall

- A. Children's memories seem even more far-fetched.
1. In a study to gauge memories for child-abuse cases, children were shown anatomically-correct dolls and asked, "Where did the doctor touch you?" Although none were touched there, 55% pointed to the genitals or anal area.
 2. Most preschool children would report false events when using suggestive interviewing techniques.
- B. Children's memories can be reliable when asked neutrally and without interaction with adults involved in the memory.

XIII. Repressed or constructed memories of abuse?

- A. Therapists go into murky waters when trying to dig up supposed lost child-abuse memories. Using techniques like hypnosis, drugs, and "guided imagery", they often create the memories they're trying to discover.
1. On one hand, the therapists may be trying to correctly get to the bottom of a bad deed.
 2. On the other hand, this can lead to innocent people being wrongly accused.
- B. Several psychological groups use the following guidelines on this topic:
1. Sexual abuse happens. It's too common.
 2. Injustice happens. Sometimes, the guilty walk free and the innocent are charged.
 3. Forgetting happens. The person may simply have been too young to remember.
 4. Recovered memories are common. When cued, it's common to dig up old memories. But, memories that surface on their own are more reliable than cued ones.
 5. Memories of events before age 3 are unreliable.
 6. Memories recovered while under hypnosis or drugs are very unreliable.
 7. Memories, real or false, can be emotionally upsetting.

XIV. Improving memory

- A. There are psychologically-proven strategies to improve your memory. They are...
1. Study repeatedly. It's best to space out study time. Speeding over material is of little or no value. Like the tortoise who beats the hare, "Slow and steady wins the race."
 2. Make the material meaningful. It's very effective if you can tie whatever you're studying to you personally. Take notes in your own words.
 3. Activate retrieval cues. Try to recreate the mood and situation you were in when you studied it.
 4. Use mnemonic devices.
 5. Sleep more.

6. Test yourself. This rehearsal helps you learn and it shows what you need to study more