

## Memory (part 2)

Last time, we talked about memory. We mostly talked about the types of memory, how they are structured, and the processes by which we move information from one type of memory to another (such as attention and rehearsal). Those processes are not just about what to remember, but they are also about what we don't need to remember, maybe because that information is not relevant or because we use information we already have to derive that information. We use rules and shortcuts to decide what we need to remember. Those rules and shortcuts are useful most of the time, but because we use rules, we sometimes get things wrong. Today's lecture will focus on the things we have stored in long term memory because we want to be able to remember them.

Researchers in this area have been very interested in why we forget. There are two types of theories to account for forgetting: **inference theories** and **retrieval cue theories**.

### Inference theories

According to inference theories, forgetting is not due to the passage of time. In other words, it's not that as time passes things are harder to remember. Instead, it's that memories interfere with each other and compete. There are two types of interferences:

- **Proactive interference:** old memories make it hard to remember new memories. For example, you moved from one apartment to another. Then you are asked your new address when you are tired, and you accidentally give your old address. Or one day you find yourself walking to the old apartment rather than to the new one.
- **Retroactive interference:** new memories interfere with old ones. For example, you want to find out movie times in your area online but your internet connection does not work. Because you are so used to going on the internet to find out movie times, you forget the old fashioned ways of doing it; you forget that you could call or check the papers.

### Retrieval cue theories

From the retrieval cue perspective, forgetting is a consequence of having insufficient or inappropriate cues to pull out the information. One example of that illustrates retrieval cue theories is **context dependent memory**. In one study, scuba divers were to learn a list of words. Some learned the list on land and some under water. Then the scuba divers were tested either under water or on land. They were better at remembering the words if there was a match between where they learned the words and where they were asked to recall the words. They had better memory if they learned words on land and were tested on land, or learned them under water and were tested under water. As we are trying to memorize something we also encode info from the environment. This

might be useful as a study skill: for instance, one can study the same topic always at the same spot, and associate things to remember with the environment. During the test, going back to the place in the mind can provide cues to help retrieve the information.

### Metaphors of memory

How can we think of memory? What's a good metaphor to describe long term memory? Several metaphors have been proposed:

- Memory has been compared to an **attic**: things are stored in it, and when they are need, it's possible to go to the storage and get it. It might need dusting, but it's there and you can get it
- Memory has also been compared to a **tape**: an event is recorded /stored on it, then the tape can be replayed when desired. The images might be grainy, but the event is still there.

Both metaphors are compelling, but are wrong. This is not how memory works. Why? Researchers were bothered with a few questions that those metaphors could not answer:

- If memory is an attic, then how do we fit so much stuff in there? As far as the evidence shows, long term memory has an unlimited storage capacity, which is not true of an attic.
- How can the stuff we take out be different from the stuff we put in? We have the impression that our memories are accurate, but in fact, they are constructions.

**Class demo:** we see a picture of a shark, and we read the sentence: "in no time at all the great white was upon him, its razor teeth cutting like a laser through his flesh and his bone". Later the sentence disappears, and we are asked out of three new sentences, which was the same as the one we saw before? Only few of us realized that none of the sentences we saw were true. They were very much like the original sentence, except that they had the word "shark" in them, which was not presented in the original sentence. They felt right because the original sentence was about a shark although the word shark was not in the sentence. Memory feels like we are encoding information bits by bits, then once the encoding process is successful, we recall the information just by pulling it out as it went in. This is compelling, but it's not how memory works. Basically, we are getting all of the information, but what we try to remember is the overall meaning, the gist of the information. We are using our theories about what it is that the sentence means, what our life experience tells us is important to remember, what the main idea is, etc. That's what we memorize. When we recall, we reconstruct: we might remember some of the bits of information, but we reconstruct them to find the main thing that connected the bits of information we had into a main idea. So it's not really what happened, but an interpretation of what happened. The hardest thing to get our head

around: what I remember happening is not the same as what happened. It is what happened through the lens of my expectations and what I think and know about the world. We try to answer “what is it that must have happened”, given the bits that I have. We can think of memory as a **highway** that is constantly evolving. We use the old parts of a memory, to which we integrate new information, and new experiences. We can’t determine which part of the memory is original and which part is not. The best we can do is try to infer it from the memory we have of an event now.

In order to fit so much stuff in there, we are using theory based encoding. In other words we are only taking in the important information because we are guided by theories. If something happens to you and you describe the event to a group of friends, they will focus on knowing what the event is about, what the narrative is saying. They will not remember the details that make the story colorful but that are not relevant to what happened. We use theories, expectations to reconstruct events. What we know about people we are close to (personality for instance) is an example of a theory we might use to reconstruct the event. As a result, the recollection of the event is filtered. Even the memories we have about ourselves change. If you were to remember today something that happened to you when you were 10 years old, that memory would be different from if you were to remember it 5 years from now, because as new things happen to you, they affect how you recollect that event, although the event itself did not change.

### **How does memory get distorted?**

1. **Power of suggestion:** there is evidence especially in research on courtroom testimony that having things suggested to you by yourself or by someone else can distort memories. There is a lot of evidence from eye witness testimony cases. Typically in such studies, people come to the lab, they watch a video of a car accident. The participants don’t know that there will be an accident in the scene they will watch. Then participants are asked questions about the scene: participants are asked “did you see the driver stay too long at the stop sign?”. Then participants come back to a second session in the lab, and they are asked “did you see a stop sign when you watched the clip in the first session? “. The researchers found that many participants remembered seeing a stop sign even though there was no stop sign in the actual clip. In another study, the same paradigm was used. Participants watched a clip of an accident, then they were asked: in one condition “about how fast were the cars going when they smashed into each other?”; in another condition “About how fast were the cars going when they contacted each other?”. The researchers also tried this with the words like “collided”, “bumped”, “hit”. Additionally, participants were asked whether or not they remembered seeing broken glass on the scene. The researchers wanted to see if the shift in language led to a switch in memory. It

was found that people were more likely to provide a high speed with the word smashed than with the word hit or bumped. Also 32% of people who were asked with "smashed" reported seeing broken glass, vs. 14% of people asked with "hit". So people are confabulating memory. These are events that did not occur. This has important implications for eye witness testimony and how people can ask questions to get what they want to hear.

2. **Interference:** we can have wrong memory because we try to remember things the wrong way. When humans try to remember a face, they focus on the overall face. They don't focus on details about the shape of eyebrows or nose length. When people are asked to describe the face of an aggressor for example, they are typically asked questions about the details, like "how was his nose?". Research shows that this makes people worse at identifying suspects in line ups than when people are not asked to recall details. The same has been shown with memory for colors. People come into the lab, they are presented with colors. In one condition, they are asked to describe the color, in another they are not. Then all participants come back in a second session to recognize the colors. People who were asked to describe the colors did worse than people who were not. That's because naturally, we don't describe colors in words.
  
3. **Identifying the sources:** We can hear information, as we are hearing it we know it to be false. But later when we are remembering the event, we might be able to recall the information but not be able to remember whether or not it was false. In one study (becoming famous overnight) people came to the lab and read a list of names of people who were not famous. They came back the next day and were asked whether or not names on a list were for famous people. The list is mixed so that some of the names are of people who are not famous but who were seen the previous day, some are of people who are famous, and some are of people who aren't famous and whose names were not seen the previous day. People made a lot of errors and thought names they had seen the previous day of people who weren't famous were names of people who were famous. People don't remember "I saw this name yesterday", they just remember "this name is familiar". They experience the rise in familiarity but can't identify the source.
  
4. **False memories:** memories for things that did not occur. The lost in the mall study: people were brought in the lab, and asked them to describe "what it would be like to be lost in a mall when you are 6". Researchers made sure that participants had not been lost in a mall at 6. Then in another session on a different day, they asked participants "were you ever lost in a mall? If yes, describe what happened". Participants remembered having been lost in a mall,

and described the event like they had described it in the previous session, although they were never lost in a mall at 6. We talked about Lawrence Wright's book *Remembering Satan*. This is a story of a priest who was accused by his daughter of sexually assaulting her. He did not remember having sexually assaulted her. Then he started to think about the event more and more during prayer, after a while, he began to believe that the assault had really happened and he remembered many vivid details about the assault. The priest went to prison. It turned out as the investigations later showed that the assault had never happened. False memories have been studied in people who report having been abducted by aliens. Researchers find individual differences that might explain vulnerability to false memories. For example, people who report having been abducted by aliens are typically more suggestible than other individuals.

**Beliefs and motivations:** the hindsight bias is a phenomenon related to beliefs and motivation. It's often called the "I knew it all along" effect. Basically, once people know what exactly happened, they cannot be accurate at reporting what they thought would happen before they found out what happened. In other words once something happens, it's hard to exclude the information that it happened and report what it would be like if we did not know that it happened. This is often studied in elections. People are asked who they think will win. Then after the election results, they are asked to remember who they thought would win before the results. People are bad at this. What they remember is typically biased towards what actually happened and might differ from what they had reported the first time. They typically include the new information about what actually happened.

We are affected by motivations too:

- **self protection:** we have distorted memories because we want memories that give us a positive view of ourselves
- **Self promotion:** we have distorted memories because we want memories that make us look good in front of others
- **Self deception:** we have distorted memories because we remember things that did not happen

### Main ideas for today:

- Memory feels like an attic but it isn't. We think we remember what happened, but we use theories to reconstruct events.
- - memories don't say where they came from
- - memories can feel very right but be very wrong