Memory

Memory involves mental processes. These processes allow us to acquire, retain, and retrieve information.

Memory involves three different basic processes:

Encoding: the process by which perceptual and sensory information is transformed to enter in, and be retained by, the memory system.

Storage: the process by which we retain information for use later in time

Retrieval: the process by which we recover information & become consciously aware of it

These processes play out across time and can be expressed in terms of this model of memory (show graphic).

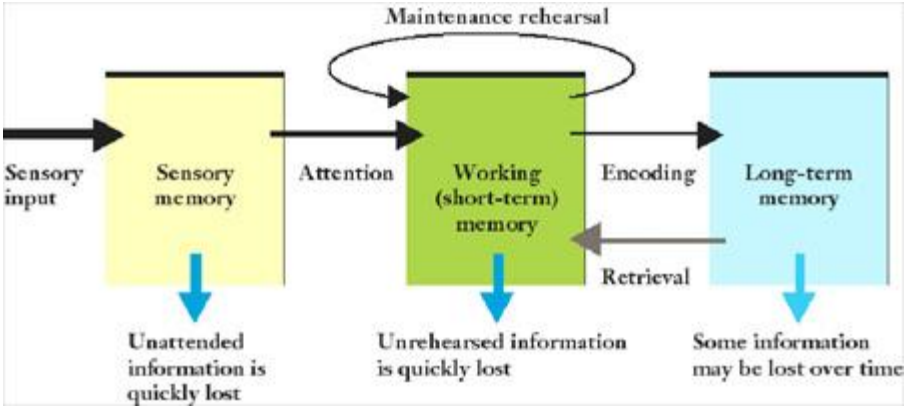
The model makes clear that there are stages of memory:

Each stage differs in several respects:

Capacity (amount of information that is storable at a stage).

Duration (length of time that information is stored at a stage).

Function (what is done with the information at that stage).



Sensory Memory

Sensory Memory has a large capacity, very short duration, allows quick/online commerce with environment.

It registers sensations coming into our "system" from the environment, allowing us to pick up on all the rich stimuli "out there." There are many "types" of sensory memories, corresponding to our different senses, as in eyes, hears, touch, taste, etc.

Sensory memory lasts no more than 2 seconds. The precise length of different types of sensory memories differs (e.g., visual sensory memory is shorter than auditory).

Sensory memory traces fade fairly rapidly. We simply lose the information UNLESS we do something further with it.

What must we do? We must ATTEND to the information. Many so-called memory problems are thus attention failures. Attention is often very selective.

The Selective Nature of Attention

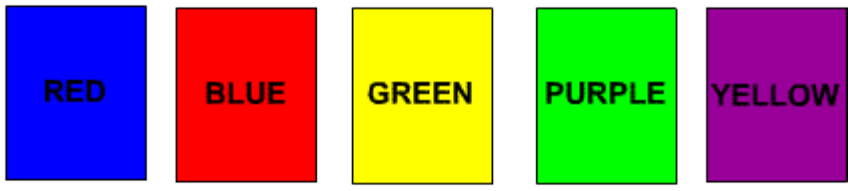
Attention is the gate that lies between sensory memory and working memory. In order for the gate to be effective, it must discriminate between useful and non-useful information. This is accomplished through preattentive processing.

Selective Viewing

Unconscious, Automatic Processing of Stimulus Input

Priming - What is priming? It is the effect of "prior context" on how we interpret incoming information. I want you to imagine that you are on vacation at the beach. The water is warm as it laps up against your legs and seems to glide effortlessly as it ebbs and flows from the sand out to the horizon and back again..... (l.d.)

Stroop interference effect –



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Working Memory: The Active, Conscious Mind

Short-Term Memory

Also called Working Memory.

It has a limited capacity, short duration, allows for information transfer from sensory to long-term memory, and allows for information transfer from long-term to short-term.

Sensations to which we actively attend become encoded into short-term memory (STM) Think of it as a "conveyor belt," "assembly line," or "workbench." It is essentially our stream of consciousness.

How does STM work? By attending, information gets onto the conveyor belt in various "codes." For example:

acoustically (you can literally "hear" the phone number you just looked up);

visually (you can literally "see" what you're trying to get onto the belt).

Is our STM foolproof/limitless in capacity? Our conveyor belt is limited in capacity. Some people have relatively longer belts; other people have shorter belts.

How much capacity does STM have on average? STM can only hold so much information (without further encoding efforts). STM usually can hold no more than 7 +/- 2 bits of information.

George Miller referred to this as the "Magic Number 7 +/- 2."

Is there any way to increase capacity of STM?

U V A F C I C R B S A I

(vs. V C R F B I U S A C I A)

• Did you remember more than 7 of the digits? How about the letters? How about the license plates?

If yes, how?

• "Chunking" as a trick to increase capacity of STM:

• Of the earlier numbers or letters, how did some of you remember more than 7?

One way of "holding on" to the information is called maintenance rehearsal. This is mentally or verbally repeating the information to keep it on your short-term memory workbench longer than the typical 30-second duration of STM. A kind of rote rehearsal that many of you use (wrongly) to study for exams!

STM viewed in terms of Duration

Again, unless you further attend to the information, you will "lose/forget" it after about 15-30 seconds. That information fades away or decays.

Interference often takes place (pizza ph. # ex.)

Exactly how do we account for losing information from our STM? One idea is that the memory trace fades or decays. A second idea is that the memory trace gets interfered with or displaced.

Let's count up how many of you remembered the license plates that WE FIRST showed you. Now let's count those that you remembered in the middle of the list. How about those plates at the end of the list?

Explanations of the Serial Position Effect

Items early in a list had the chance of getting transferred into long-term memory. Items at end of list were still "in" your short-term memory; you could almost "read" them off the belt. Items in middle of list are worst remembered, because of interference or displacement

Long-Term Memory (LTM)

LTM is infinite in capacity & duration. Information gets into LTM through encoding. Maintenance rehearsal is one way to try to encode into LTM, but not an effective one. WHY?

Transferring information from STM to LTM:

There are many ways of encoding information into LTM.

Encoding Strategies: Depth of Processing

The deeper you process, the better LTM. Self-reference is an example of this

Other Encoding Strategies:
Meaning

Associations to already stored information

Elaborative rehearsal:

Focuses on the meaning of information.

You relate what you already know to what you're trying to encode.

Self-referent processing is a kind of elaborative rehearsal.

The Hockenburys give this example:

Instead of simply rote memorizing that the hypothalamus, hippocampus, and amygdala are three structures in the limbic system of the brain, you instead do this:

You make up a silly story that is meaningful about these three structures. The Hockenburys state: "...you could think about the limbic system's involvement in emotions, memory, and motivation by constructing a simple story. 'I knew it was lunchtime because my hypothalamus told me I was hungry, thirsty, and cold. My hippocampus helped me remember a new restaurant that opened on campus, but when I got there I had to wait in line and my amygdala reacted with anger" (p. 229).

Explanations for why elaborative rehearsal and "association" methods are so effective:

Our memory is organized

Recall months of year in chronological order NOW.Recall months of year in alphabetical order NOW.

Some associations are closer to one another than others.

The more associations you form and the closer they are, the more "nodes" you have to help you access the desired information! "Cells that fire together, wire together!"

What Kinds of Information are in Long-Term Memory? (and why do we care?)

We store different kinds of information in long-term memory. Exactly what these kinds of information are called differs across scientists. They all seem to agree that it is important to distinguish between

Explicit Memories (Declarative Memories): Involves memories that you can consciously recall; put into words; put into pictures, etc.

There are various types of explicit/declarative memories:

There are episodic memories. This is your long-term memory for events or episodes in your life (e.g., your first date; your last birthday party; where you went for summer vacation).

There are semantic memories: These are your memories of general knowledge, facts, dates, concepts, ideas that aren't tied to specific episodes. For example, you know that Christmas is on Dec. 25th; that Christopher Columbus (supposedly) sailed the ocean blue in _ _ _ _; that "birds

of a feather _ _ _ _ _ together;" that your name is John; that with three _ _ _ _ _ _ _ you're out, etc. etc. You have these memories INDEPENDENTLY of when you learned them or where you were when you learned them.

versus

Implicit Memories (Nondeclarative or Procedural Memories): Involves memory, but you're not conscious of it. Memory with no conscious recall or conscious access to what you're recalling.

Implicits memory involves the motor skills, actions, basic procedures you KNOW but you have difficulty putting this knowledge into words. Being classically conditioned to express disgust to objects (e.g., raisins) or to be fearful of other objects (e.g., the dark) can also be examples of implicit memories.

Try to explain to someone:

exactly what operations are involved in breathing, walking, running, typing, driving a car, crawling. We all know how to do these things, but they're difficult to put into words.

Idea is: Your LTM has stored the information you needed to perform the typing procedure without you consciously being aware of what letters appear on the keyboard.

Why should we care about these different types of LTMs? Several reasons:

Different types of memory "disorders" reflect deficits in only one kind of LTM. For example, although we generally think that people's LTMs decline with increasing age, is this universally true or true only for certain types of LTMs?

Different types of memory disorders involve damage to different parts of the brain. Examples:

Also illustrates that the hippocampus is importantly involved in forming new explicit memories.

Also illustrates that the brain contains various memory systems.

Hippocampus: involved in forming new, explicit memories

Amygdala: involved in forming implicit memories. Amygdala is where emotional aspects of memories are encoded and where sensory memories are encoded.

Prefrontal cortex: involves memory for the sequence of events (damage here: patients could remember key words from a story, but couldn't remember the order in which the words had been presented in the story)

Cerebellum: involves memories regarding movement (damage this and ability to classically condition eyeblink responses is destroyed -- Thompson's research)

Infantile Amnesia can also be understood in terms of the role of different brain structures in memory.

Hippocampus requires a long period of maturation in order to be fully functional. Takes longer than other brain systems. So, little kids may not form explicit memories because their hippocampi, like H.M.'s, aren't fully functional.

BUT, little kids obviously form procedural memories (otherwise, they would be completely incapable of learning!). This is consistent with two facts: (1) amygdala matures before hippocampus and (2) amygdala is involved in procedural learning!

Flashbulb Memories can also be understood in these terms.

McGaugh's research shows that hormones (like adrenaline) affect the solidification of memories. Give rats adrenaline right after they learn something and they show great memory for the event.

Amygdala is involved. Stress the organism --> amygdala turns on ANS --> activates release of adrenaline into bloodstream --> indirectly influences temporal lobe functioning, strenghtening those types of memories (implicit emotional ones and explicit ones). Indirect influence? LONG STORY; don't need to know.

Research demos these links, though. If human Ss are given an adrenaline blocker, then they are incapable of recalling especially the emotional details of a story. (Implication for rescue/emergency workers or combat soliders?)

Information in LTM -- IF accessed-- goes back onto our conveyor belt, i.e., into our short-term memory store. But, we aren't always able to access information.

Think of the Tip-of-the-Tongue phenomenon (TOT):

You know the information is there to be accessed, but you can't quite seem to access it. Or, at other times, we do access information, but it surely isn't what we'd intended to access!

Think of Tamara's Freudian slips in class! Or, Woody Allen talking to a beautiful, buxom woman who was nicely dressed. Instead of complimenting her as he'd intended to (My, what a nice dress), he said (My, what a nice breast). Oooooooops.

When, how do we best RETRIEVE information? Various processes are involved. One good way involves the encoding specificity principle.

Retrieval conditions that match the conditions under which information has been encoded enhances retrieval.

Context effects: Remembering info. better when you try to recall it in the same setting in which you originally learned it (think of this in terms of taking a test; maybe you should study in BNR 102!)

State-dependent retrieval: Remembering info. better when you are in the same state you were in when you encoded the information. Typically examined with drugs, like alcohol, marijuana. Effects are there but weak (and shouldn't be taken as excuse to imbibe)

Mood congruence effect (a kind of state-dependent retreival): Present mood affects what you remember. Sad mood - unpleasant memories. Good mood - pleasant memories.

Encoding specificity principle illustrates notion that memories are stored in associative networks. The more cues present during retrieval that were present during learning (= encoding), the more likely we are to retrieve the memory.

Fallability of Memory

Our memories are very prone to distortions and errors. We use schemas in forming new memories. Schemas are basically knowledge structures containing our expectations or theories of what events, people, roles, etc. are like.

Schemas can distort the memories we form. Examples: The professor's office. The subway.

False memories are common. We are especially prone to forget where the memory came from, i.,e., is it truly our own memory based on our personal experience or someone else's memory?

Misleading information can distort memory. Loftus' research (smashed vs. bumped in terms of Did you see any broken glass?)

Distortions are common in eyewitness testimony. Innocent people are convicted most often because of eyewitness erorr. There is only a small positive correlation between accuracy and confidence, yet people tend to believe confident eyewitnesses more.

We think we remember things we never saw. Ex: Read these words: bed night dream wake slumber yawn blanket clock rest calm tired [Tamara will explain this in terms of deja vu.]

Forgetting

Many processes contribute to forgetting. Psychologists used to think that memory traces could physically decay. Not many believe in this anymore, though.

Interference, however, is a big reason why we "forget". In interference, memories compete with one another. The more similar the memories, the greater the interference. Two types of interference:

Retroactive interference: A new memory (e.g., your new phone number or girlfriend's name) gets in the way of you remembering an older memory (e.g., your old phone number or previous girlfriend's name).

Proactive interference: Opposite of above. An old memory (e.g., your old phone number or previous girlfriend's name) gets in the way of you remembering a newer memory (e.g., your new phone number or girlfriend's name)

Which of the following is retroactive and which is proactive interference?

After studying for your sociology test, you study for your psychology test. You then go take the psychology test and keep remembering the terms from sociology instead of psychology.

A Professor currently has a T.A. named Brian after having worked with another T.A. named Chris for several years. She keeps calling Brian by the name Chris.

You used to use a PC. You switched to using a MAC. When you go back to use the PC, you keep depressing the "command" key to get the PC to do what you want.

Motivated forgetting might also contribute to our tendency to no longer remember something. This idea is pretty controversial however. Two types of motivated forgetting:

Suppression (conscious attempt to forget information, as in Scarlett O'Hara's "I won't think about that now- tomorrow is another day"). In suppression, you know the event that is being "forgotten;" you're simply choosing to not think about it. Many express doubts about the deliberate forgetting.

Repression (unconscious attempt to forget information; what we typically think of when we say someone represses past abuse, etc.). This, too, is very controversial.