

UNIT 7: MEMORY

QUESTION #7.1: What is memory?

Memory is the amount of previously learned material that has been retained. Therefore, **retention** is another name for memory. There are two basic forms of retention: procedural and declarative.

Procedural memory is how to perform an action, in sequence. Athletic skills are one example of procedural memory. We learn the fundamentals, practice them over and over, and then they seem to flow naturally when we are in a game. Rehearsing for a dancing or musical performance would be other examples of procedural memory. Everyday examples might be remembering how to tie our shoes, drive a car, or get on the internet.

Declarative memory involves memory for facts, concepts and events rather than muscular procedures. Declarative memory may be episodic or semantic.

Semantic retention is for the type of knowledge we associate with books and school: **names, dates, and numbers**. But it can also include personal information, such as telephone numbers and addresses.

Episodic retention involves memories for specific events. Flashbulb memories are of particularly vivid events that persist in our minds. Some of these events became flashbulb memories because they were so important, or connected with intense emotions (pleasure, pain or pride).

Case Study: Mr. B, now in his 50s, has less than a dozen episodic memories that easily come to mind. Some of these flashbulb memories are probably shared by most of the members of his generation of Baby Boomers. Mr. B remembers coming out of swim class in November of 1963 to learn that President Kennedy had just been shot. In 1968 he was in his college dorm when he heard a great shout coming from the other students, and he learned that President Johnson would not seek re-election. He remembers walking home from the movies in June of 1968 to learn that Senator Robert Kennedy had been shot. Fifteen years later, he remembers the look on his business partner's face when he arrived at his office to learn that the space shuttle had just exploded. On September 11, 2001, he remembers flipping TV channels while he was on his aerobic exercise machine, when he noticed a news report from New York City. Mr. B also had personal flashbulb memories associated with intense joy (hitting a game winning grand slam home run at age 10), fear (getting held up at the point of a gun at age 24), worry (wearing the wrong shoes on his wedding day), terror (accidentally starting a fire at age 9), and pain (being verbally tormented by an adult when he was just 7).

QUESTION #7.2: How can memory be measured?

There are four measures of retention: redintegration, relearning, recall, and recognition.

Redintegration is the process of assembling a complete memory on the basis of partial cues. An essay exam would be an example of a test of redintegration: the question contains a few partial cues or suggestions about how to structure the answer. If the student knows the material,


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= about events =           =           =           = of painful =
= and normal   =====>= patient =====>= memories of =
= age related =           =           =           = her past   =
= activities   =           =           =           =           =
=====
=====
=====

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The skills (and agenda) of the therapist are major factors in the outcome of redintegration. What the therapist expects to be told, and what the patient is verbally reinforced for reporting have an impact on what is reported by the patient (and even what the patient comes to believe about the validity of a memory).

Case Study: Ms. W, age 33, has been having intimacy problems in her recent marriage. When she heard a lecture about Satanic Ritual Abuse at her church, she went to see a counselor who specialized in this area. At first, Ms. W described her own childhood in most favorable terms. The counselor accused Ms. W of denial. After more than a dozen sessions, Ms. W was able to reintegrate a horrible memory about her own father being a satanic priest, and the whole family having to watch sacrifices of little animals, and later all of the children were sexually abused. Both of Ms. W's parents, and her three older siblings completely deny these reports.

STIMULUS		ORGANISM		RESPONSE
=====		=====		=====
= accusation =	=	=	=	= redintegration=
= of denial, =	=	=	=	= of false =
= reinforce- =====>=		patient	=====>=	memories of =
= ment of her =	=	=	=	= her past =
= admissions =	=	=	=	= = =
=====		=====		=====

Satanic Ritual Abuse does exist, but so does **false memory** syndrome in which people become convinced that they have had an experience (such as Satanic Ritual Abuse, sexual abuse, or alien abduction) when all of the objective evidence suggests that the experience did not happen. Under hypnosis, or during intensive therapy, patients can be convinced what did not happen really did, and vice versa. Over a hundred years ago, **Freud** himself came to the conclusion that his female patients' reports of childhood sexual abuse were merely fantasies from a repressed Oedipus Complex. (He probably then erred on the side of discounting some accounts of real abuse later on.) One of the greatest challenges for psychotherapists is to investigate the patient's past in such a way as to liberate (but not fabricate) such painful memories. There have been so many overly exaggerated reports of Satanic Ritual Abuse in children's day care centers over the past two decades that we run the risk of having real cases go ignored, because law enforcement and juries may no longer believe any such claims.

Courtroom attorneys are well aware of the limitations of redintegrative memory in eyewitness testimonies. The lawyers know how to phrase questions in such a way as to shape the process of redintegration, both in the witness who is trying to remember what happened, and in the minds of the jurors who will have to remember what the witness said. An attorney may ask "How fast was the car going when it smashed into the tree"? fully aware that the word "smashed" will imply a greater speed than a different word like "hit" or "came into contact with." A lawyer may ask "What color was the man's hat"? and even if the witness cannot remember the answer, both witness and jury may now remember that the man was wearing a hat.

STIMULUS		ORGANISMS		RESPONSE
= question	=	=	=	=
= about the	=	= members of	=	= vote to
= hat worn	=	= the jury	=	= convict the
= by the	=	=	=	= defendant
= perpetrator	=	=	=	=

Relearning measures how much time it takes the subject to come up to a certain level of competence. Relearning can be employed with either procedural or declarative retention. The important thing for the researcher to measure is the time savings that can be attributed to retention of previously learned material. A ballerina has not danced the part of the Snow Queen in the Nutcracker for ten months. Now, in October, she is again assigned the part. One way to measure how well she remembers is to see how many hours of practice it takes to get her up to the same level of performance she had the previous December. If it takes her twenty hours to master the part this year, while it took her fifty hours during the first year she had the part, that savings of thirty hours can be attributed to retention.

MEASUREMENTS OF RETENTION				
Type of memory	Cues present	Format	Scores over time	Example of test
REDINTEGRATION	Yes	Qualitative	. . .	Essay
RELEARNING	Yes	Quantitative	Decline	Time savings
RECALL	No	Quantitative	Decline	Short answer
RECOGNITION	Yes	Quantitative	Decline	Multiple choice True / false

Recall asks the subject to repeat what has been previously learned, but **no cues are given**. The results of the test can be scored quantitatively as the number or percentage of right answers. Recall is often used with tests of declarative memory, and is represented by fill in and short answer tests.

Recognition is where the original content is reproduced, and all the subject has to do is to identify it as being correct. Both multiple choice and true/false tests would be examples of recognition. **Recognition usually gets the highest retention scores.**

QUESTION #7.3: What are the stages in the processing of memory?

Most of the experiences that you have had and things that you have studied are not retained (at least, we cannot measure their retention through any of the techniques discussed above). Your memory is not like a bucket, but more like a fishing net hung out over a bridge on a river. Miles of river water have passed through that net, but very little was retained: some debris and hopefully some fish.

The reason for this limited retention of human memory is that, in order to be retained, something must be processed through the various stages of memory: sensory, short-term, and long-term. Failure to successfully process at each stage means that the item will be forgotten (and that is the fate of most of what comes into the mind). Each of these stages are like different parking lots at the airport: you can only leave your vehicle there for so long before you get into trouble.

Sensory memory is the first stage. The retention at this level can only last for a few **seconds** at most. Iconic retention refers to visual images at this stage. Echoic retention refers to sounds that have just been heard. Memory at this stage is quite fragile, and quickly fades away if not further processed ("in one ear and out the other"). Notice what happens when you get a phone number after dialing 411: if you do not write it down immediately, or keep repeating it to yourself, you may have forgotten it by the time you try to dial the number.

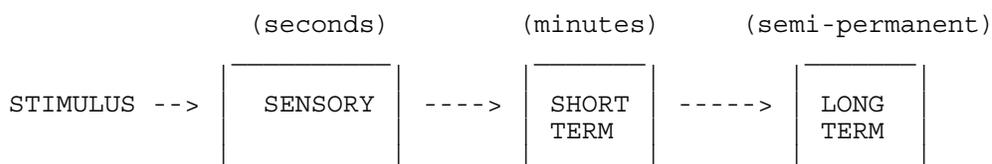
Short term memory is the middle stage, with a capacity of **minutes**, although this might cover a few hours in some situations (and seconds in other situations). During short term, memory is still pretty fragile. To use a computer analogy, if you are writing a document on the screen, and save your program only about every twenty minutes or so, what has been typed on the screen in the last few minutes is like short term memory, and may not survive an unexpected power outage.

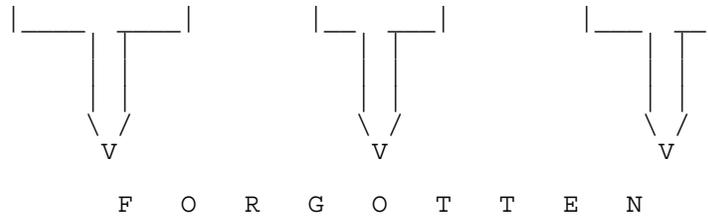
Case Study: Mr. R, age 43, was diagnosed with major depression. He had several trials of different medications, without any symptomatic relief. He has made no progress in psychotherapy. His psychiatrist recommended electro-convulsive therapy (**ECT**). Mr. R spent the night in the hospital. At 6 A.M. he was awakened and prepped for the procedure: a protective mouthpiece to prevent damage to the teeth or tongue, muscle relaxants to prevent bone fractures. The electric current passed through his brain served to induce a convulsion and depolarize his neurons. After a week of these treatments, he was more active and in a better mood, but there is one important side effect. Each treatment erases whatever was in his short term memory. When he awakens, he is groggy, and his head hurts, but he cannot remember the procedure or the prepping. Indeed, one of the reasons that he is being given his ECT so early in the morning is so that he will not lose important memories of what he is working on during the day or studying at night.

STIMULUS		ORGANISM		RESPONSE
=====		=====		=====
=	=	=	=	= depression =
= electro-	=	= depressed	=	= is reduced =
= convulsive	=====>=	= patient	=====>=	= but what was =
= shock	=	=	=	= in short term =
=	=	=	=	= memory is gone =
=====		=====		=====

Long term memory is the last stage of processing, and the **semi-permanent** stage. If we want to remember something tomorrow, it will have to be consolidated in to the long term stage today. Going back to our computer analogy: the long term memory is like the internal hard disk, floppy disk, or flash drive on which the computer stores its files. We say that after these files are saved they are "semi-permanent" because it is possible that they could be lost by a hard drive crash or other physical problem with the disks.

S T A G E S O F M E M O R Y





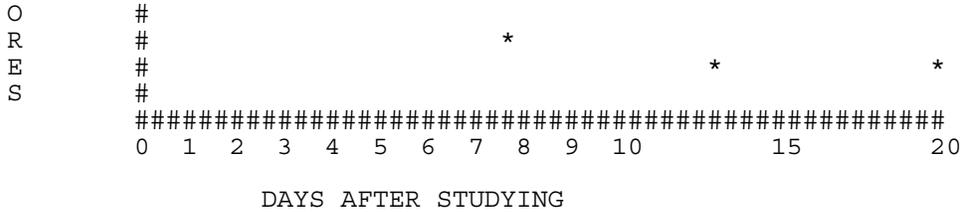
The hippocampus is the part of the brain that consolidates short term memory in to long term. Damage to the hippocampus would make it impossible for an individual to form any new long term memories, but he would still be able to use his previously created long term memories, as well as anything currently in the short term stage. A computer analogy might suppose that you could not save any new files, but you could still read from old, previously saved files, and print from new files you were creating on the screen (but as soon as you turn the computer off, those new files are gone).

Case Study: Back in the 1950s, Mr. E, then 25 years old, was diagnosed with a brain tumor. The neurosurgeons were able to remove the tumor and save his life, but during the operation there was substantial damage to the hippocampal area. Mr. E could form no new long term memories. His short term memory was still very good, and so was his retrieval of previously stored long term memories. An avid baseball fan, he could recount the details of each of the World Series games in which the Yankees faced the Dodgers (1947, 1949, 1952, 1953, 1955, 1956) occurring before his surgery. But show him a new sports magazine, he will read it attentively and be able to discuss it with intensity right afterward, but tomorrow you can show him the same magazine, and it will be like he is seeing it anew for the first time. When old high school friends came to visit, they could talk about old times, and talk about the baseball game on the television that they were watching together, but a couple hours later Mr. E would forget everything about that game, or even that his friend had been over to see him.

QUESTION #7.4: Why do we forget?

Forgetting is a natural, inevitable part of the learning process. This was established by some of the earliest laboratory research on retention by Hermann **Ebbinghaus** over a century ago. He had his subjects learn a list of "non-sense syllabus" composed of three letters (a consonant on each end and a vowel in the middle). All of these stimuli were therefore the same length, and Ebbinghaus tried to avoid having syllables that were similar to real words (just in case that would give some subjects any added help). Regardless of how the retention was measured (relearning, recall or recognition), **the longer after retention, the more forgotten.**

R	#		
E	#		
T	#	*	
E	#		
N	#		
T	#	*	
I	#		
O	#	*	
N	#		
	#		*
S	#		
C	#		*



In this research, the independent variable was the amount of delay selected by the researcher. The performance score of the subjects would be the dependent variable. Notice that the correlation is inverse (negative): the longer that Ebbinghaus waited to test his subjects, the less well they did in terms of retention scores. Also notice that the decline was not linear. The subjects tended to forget most in the first few days (or even hours), and then the decline leveled off as the subjects got down to the minimum that they would probably retain permanently.

Forgetting can take place at any stage in the memory consolidation process, but the most likely cause of that forgetting differs at these different points of the process.

Encoding failure means that the memory never got consolidated beyond the initial sensory stage. The subject was just not paying enough attention to move the item into short term memory. If you are listening to the radio and all of a sudden the phone rings (and you answer without bothering to turn off the radio) and then devote your attention entirely to the phone conversation, what is being said on the radio is not making it into your short term memory.

Case Study: Mr. B, only 53, has shown no signs of clinically relevant dementia. He has a good memory, which is helped out by the fact that he is a creature of habit, and may assume that his tools and other important objects can always be found in their proper place. For example, he keeps his keys in his right front pocket or else on the stand on top of the refrigerator. One day as he was arriving home, he heard the phone ring. He was expecting an important call, so he wanted to get to the phone as quickly as possible. He was wearing an especially tight pair of jeans that day, and the big ring of keys did not quickly go back to his right front pocket, so he just threw them on the little side table next to the front door. He remained on the phone for half an hour discussing some important details of one of his investments. Then he fed the cat, made a few more phone calls, wrote some checks, and decided to go to the post office to mail them. When he reached for his keys in his pocket, it was empty. He looked on the stand above the refrigerator, and neither were they there. He reasoned that he must have brought his keys from the car in order to get into the house, so he retraced his steps from the front door, saw the keys on the side table, and deduced the sequence of events that must have resulted in the keys being mislaid. The fact that he had put his keys on that table was not consolidated beyond sensory stage: encoding failure.

STIMULUS	ORGANISM	RESPONSE
= ringing	= man coming	= misplaces
= telephone	= in door	= his keys

Similar forms of interference can occur at other stages of consolidation. Especially during the short term phase, memory is vulnerable to **serial position effect**. When you have to learn several different items in a series, one right after the other, there is the danger that one will crowd another out of memory. **Proactive interference is when the first things crowd out the subsequent material.** The advantage of what is first learned is called **primacy: it gets there first and gets established.** Nothing has come before to cause a proactive interference with it. **Retroactive interference is when the things that come later disrupt our retention of what came before.** **Recency is the advantage of what is learned last:** nothing comes later to crowd it out with retroactive interference. If a subject has to learn a list of names (or non-sense syllables) the ones most likely to be remembered are the first and the last, while **the ones most likely to be forgotten are those crowded out in the middle: serial position effect.**

One practical application of this is to avoid studying two different things in one short time period, back to back. Suppose you have two final exams the next day, and need to study for them both. It would be wise to study one until you are done with it, then give yourself at least a half hour break from studying (e.g., go and have dinner) before getting started on the other one.

Another practical application would come in those forms of competition in which a series of contestants must compete on stage, one right after the other, before a panel of judges who will then announce their decisions after the last contestant has finished. Most speech, talent and beauty contests are set up in this fashion. Serial position effect says that it is not best to be in the middle, because these will be most easily forgotten.

POSITION ADVANTAGE OF CONTESTANTS IN A TALENT COMPETITION



Of course, if contestant number four were head and shoulders above the others in terms of talent, she may overcome the advantage of serial position effect, but if there is little difference between how well the contestants really did, the advantage of recency or primacy can be enough to determine who wins.

STIMULUS	ORGANISM	RESPONSE
=====	=====	=====
= fourth =	= =	= =
= contestant =	= =	= can't remember =

= was in the	=====>=	judge	=====>=	very much about
= middle of	=	=	=	= number four =
= seven	=	=	=	= =
=====		=====		=====

There is one type of contest in which primacy might be a great disadvantage. In those contests in which the judges must announce their ratings of each contestant as soon as that contestant finishes, and before the next contestant gets on stage (e.g., Olympic figure skating, gymnastics, diving), the judges have a motive to restrict the points awarded to the first contestant, out of fear that the next one will be even better.

This situation is akin to what is found in many job interviews in which the company will interview applicants as they become available, and keep on interviewing until the position is filled. Unless the company is really desperate to fill that position immediately, many interviewers may use that first interviewee as a calibration candidate to see what is out there in the labor market. No matter how good that first candidate looks, there may be someone better. Many interviewers in this situation hire the first acceptable candidate who was better than the first interviewee. (Of course, if the process of interviews first identifies a fixed number of candidates to be interviewed, and they are interviewed in short order, and the hiring decision is not made until the last one is interviewed, then the traditional advantage of primacy returns.)

Another application of interference applies to **prospective memory: our intentions to do things in the future**. One of the main reasons why people forget to do something is that they have become distracted by some newer event or thing to remember.

Case Study: Mr. V, age 33, is a student who works full time in a restaurant and is a father of two. In the beginning of the semester, the professor mentioned that the class would have a field trip on the first Saturday in November. Mr. V did not write it down, and his professor did not mention the date again. In the meantime, his daughter's soccer team advanced to the regional finals, and he eagerly volunteered to drive several children to the soccer game. When he returned from the game, he sat down to do a little homework, and then remembered that he had missed the field trip. It had slipped his mind because he had been distracted by thinking about the soccer game.

Retrograde amnesia can be caused by a physical trauma to the brain that **disrupts short term memory consolidation into long term**. The trauma can be an electro-convulsive shock (as seen in the case of Mr. R) or a blow to the head.

Case Study: Mr. Q is 25, married for three years, and father of a two year old son. One morning while riding to work on his motorcycle, he had an accident and suffered a severe blow to the head. He woke up in the hospital, with his wife by his side, but calling the name of his high school sweet heart. His amnesia had (temporarily) blotted out a large part of his life. His memories started to return, but in reverse order. A couple weeks later, he could remember graduating from high school and joining the army. A week after that he remembered being overseas when he got a letter from his then girl friend saying that she had met someone new. Later he remembered coming home, getting his present job, and meeting his wife, getting married, and the birth of his son. He eventually recovered almost all of his old memories, except for the morning of his accident, and he probably never will recover those

memories, because they were only in that vulnerable short term phase and never made it into the semi-permanent structure of long term.

Anterograde amnesia refers to the inability of the individual to form any new long term memories (as in the case of Mr. E with the damage to the hippocampus). Some blows to the head can produce anterograde amnesia as well as retrograde. **Perhaps the greatest cause of anterograde amnesia is dementia, such as Alzheimer's disease.**

STIMULUS	ORGANISM	RESPONSE
=	=	=
= blow to head =	= motorcycle =	= retrograde =
=	= rider =	= amnesia =
=	=	=
=	=	=
=====	=====	=====

Case Study: Ms. G was 90 when she was examined in the nursing home. The staff had identified her as a behavioral problem. She used foul and aggressive language, everything from barnyard vulgarities, to sexual innuendoes, to racial slurs. Ms. G would insult the other patients, staff, and even visitors. When the psychologist examined her, Ms. G had no short term memory abilities. She could answer questions about her past (e.g., that she had been a barmaid and singer in a speakeasy back in the days of prohibition) but seemed quite confused about when her family had last visited her in the nursing home. The psychologist inferred that Ms. G's unacceptable language was in part an attempt to get some attention and respect from the staff and other patients. The psychologist decided to find a more socially acceptable way to accomplish this, and so he arranged for Ms. G to play the piano in the recreation room. She chose one of the songs that she had played 50 years before back in some honky tonk. It was played well enough so that the other patients could recognize it, and they clapped when Ms. G was done, and even asked her for another one. Ms. G thought through her repertoire for a moment and then agreed to play another song, and she started, playing the same song. Ms. G could remember that old song (because that was in her long term memory) but she could not remember that she had just played it (because that would require a functioning short term memory).

When we no longer need a particular memory, it may decay. Most food servers find that once they have finished with a table, and focus their attention on other customers, the details of the old table quickly fade. **Passive decay associated with lack of use can occur even in the semi-permanent encoding of long term memory.** Trying to remember the mailing address or telephone phone number of a former employer may be difficult if you have not needed it for a while. It would be wise to copy down that information when you leave your employment for future references.

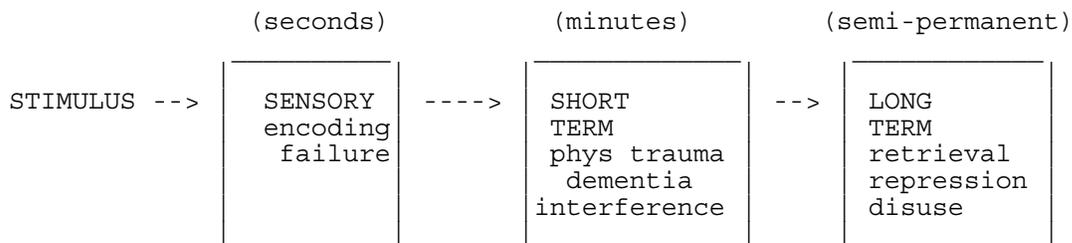
Retrieval failure describes the situation when the memory made it into long term, but now the subject is having difficulty accessing it. One example of this is the **"tip of my tongue" phenomena**. The subject has the right answer, and knows he has the right answer in his memory, but he cannot find it just now. A few moments later (or maybe the next time he needs it) the subject may be able to access that memory with no difficulty. One frequent situation in which the "tip of my tongue" phenomenon occurs is when you see someone you have not seen in a while, like an old classmate. You remember the person's face, and you know that you know the name, but you cannot think of it just now. One of the things that make this process more difficult is that some of the old

cues that you associated with the person (e.g., where she sat in class) might not be present. You might be able to help yourself out by doing a little redintegration, coming up with a few associations, and the rest will then come: she did well on the midterm exam, her brother was a star quarterback at our high school the previous year, number 14, starts with G, Gomez? No, Gonzalez!

Another example of frustrating retrieval failure comes in the situation of trying to remember where you hid something valuable. You probably have not thought of it (rehearsed the memory) since you hid it. Indeed, when you selected a hiding place you probably tried to think of a place with no logical connections, so that a burglar would not think to look there. The result of that process is that now you have no clue of where to look either.

One reason why recognition consistently gets the highest retention scores is that it gets around retrieval failure. It gets the answer off of the tip of your tongue, and you merely have to identify it as correct. If your old classmate had a sign around her neck reading "My name is either Gonzalez, Gomez or Garcia" you probably would have selected the right one.

HOW FORGETTING TAKES PLACE



Repression is an unconscious motive to forget an emotionally traumatic memory. The pain of reliving the experience creates an unconscious mental block that prevents us from recovering it. Repression was a major theory developed by psychoanalysis.

Case Study: Ms. Z, now 85, was a young woman in Poland during World War II. She has flashbulb memories for some of the events of that time, such as the day the war began on the morning of September 1, 1939. However, some of the painful events that occurred at that time (such as her rape by German soldiers) she has repressed. Whether it is best to try to get around the unconscious mental block and liberate the memory is a decision that a psychotherapist would have to make. Hypnosis and psychotherapy could get around the repression (or they could activate some false memories) and the net result could be counterproductive in some cases.

QUESTION #7.5: How can we improve memory?

Mnemonics are techniques for improving memory. Rote memorization is simple repetition of the stimuli over and over again without any real cues or understanding. **Rote** is one of the **least effective**, but most widely used mnemonics.

Eidetic images involve pairing semantic memories with **vivid visual** cues. Most children are better at this than adults are. Some individuals claim

to have a photographic memory in which they find it very easy to recall what has been visualized.

Case Study: Mr. B uses eidetic images to help his recall. Before going around town on errands, he takes an imaginary mental video of himself driving around to the bank, post office, grocery store and gas station. Within the grocery store, he sees himself getting cat food, cream cheese, and vegetables in the exact order in which they are arranged in the store. When he meets a new client, he tries to associate something about the person's face with the last name. When he met Maria Coronado, he imagined her coronation as a new queen, he visualized the archbishop ceremonially placing a crown on her head (in Spanish *Coronado* means crowned). The limits to this approach come from the fact that the subject can get mixed up about how the image relates to the name. Mr. B once tried to remember a Mr. Sherlock by visualizing him in the deerstalker hat used by Conan Doyle's fictional detective. Unfortunately, Mr. B then called him "Holmes" instead of Sherlock.

One way to improve retention of non-visual material is to associate it with things that can be visualized. This is a technique as old as the ancient Romans, and is known as the method of loci. Imagine walking through a familiar area, such as your home, or the campus of the college. As you come to familiar sites, imagine that you can see the things you need to remember. Suppose you have to remember the first four presidents of the United States: Washington, Adams, Jefferson, and Madison. Your apartment also has four rooms: living room, kitchen, bathroom, and bedroom (and this is the order that you would see them if you were walking into your apartment). So put the first president, Washington, in the first room, the living room. Imagine him standing on your sofa as if it were the boat on which he crossed the Delaware River standing (well, at least he was standing in the painting). Now, the second room is the kitchen, and so you would put John Adams there. Imagine him going over to the refrigerator, opening up and taking out a beer and remarking that his brother Samuel had brewed it. Next comes the third room, the bathroom, so put the third President Thomas Jefferson there. Remember that he was an architect who designed his own home at Monticello. Imagine Jefferson in your bathroom, amazed at the flushing toilet. Last comes the fourth room, the bedroom. Imagine James Madison in a night shirt with a night cap on his head under the covers next to his wife, Dolly Madison.

Songs and sayings can be effective mnemonics. When I was in the third grade, I remembered how to spell GEOGRAPHY with the saying *George Eagle's Old Grandmother Rode A Pig Home Yesterday*. Many advertising copywriters try to come up with little jingles that will stick in our heads to make us remember the names of their products.

Conceptual memory tries to associate details to be memorized with specific concepts, **categories** or goals. It is easier to remember a few key rules rather than tons of specific data. For example, instead of remembering that 40 degrees Celsius is 105 Fahrenheit, and 30 degrees Celsius is 86 degrees Fahrenheit, etc., it is just easier to remember the formula for conversion: $F = C \times 9/5 + 32$. The downside of conceptual memory is that it may distort our trace memories to match the convenient concepts and categories. Some voters try to remember who to vote for with a simple party concept (*Republicans good, Democrats bad*) but such a stereotype might ignore the exceptions (the Republican who is a professional politician, and the honest Democrat).

Research on conceptual memory	
Researcher(s)	Carmichael, Hogan & Walker

<i>Subjects</i>	Students
<i>Type of research</i>	Experiment
<i>Factors held Constant</i>	All subjects were shown the a series of vague figures
<i>Independent Variable</i>	Half of the subjects heard each figure described with a certain word, while the other half of the subjects heard the same figure described with a different word
<i>Dependent Variable</i>	Subjects had to draw as many of the figures as they could remember
<i>Results</i>	What subjects drew was influenced by the words they had been given
<i>Conclusion</i>	Using concepts as a mnemonic can distort the trace memory

Motor memory involves muscular practice. This is very prominent in procedural memory, and accounts for the relatively high retention of such things as riding a bicycle or swimming even after years of inactivity. The use of gesturing helps memories for semantic content as well if the subject can associate the two.

Overlearning refers to practicing the material even after the point where the subject can demonstrate perfect recall. Overlearning is a very powerful mnemonic for both procedural and semantic memories. Overlearning should not be confused with the idea that the memory is a muscle, and that practice by memorizing one thing will help you retain other things. You will not help your retention of the content of this course by going out to the parking lot and trying to strengthen your memory muscle by repeating the license plate numbers. If anything, that might produce a kind of interference with learning the content of the course. Overlearning means practicing and practicing the specific material to be retained.

Spaced practice is a better mnemonic strategy than massed practice. Spaced practice breaks up study time into smaller units, while massed practice is like a marathon. If you decide that you will devote a total of ten hours studying for one of your finals, it would be better to do two hours a day, for five days, rather than ten hours in one long period the night before. Such marathon study sessions lead to fatigue rather than better retention.

Sleeping right after learning is a good technique to reduce retroactive interference. Indeed, you can use an audio recording of some of the most important concepts in this course, and play it while you are trying to go to sleep. Once you are actually in the first stage of sleep, there is no real learning going on because during sleep it is hard to consolidate memories much beyond the sensory (which is another reason why we tend to forget most of our dreams). However, those things which you hear on the recording, just before you fall into sleep, will be very likely to be retained because of your relaxed and focused state of mind, and the advantage of the recency: nothing came later to crowd out these ideas.

Mood congruence is another possible mnemonic, but one not easily employed. People are more likely to be able to retrieve a memory if they are in the same mood state now as they were when the memory was formed. Notice how when a couple gets angry at each other, they can remember all the other times when they were angry with each other. When they are happy they remember the happy times more easily.

Environmental structuring is a mnemonic useful as part of a routine. In its simplest form, it means physically arranging things so that we will bump into them in time to remember to do them. Environmental

structuring is particularly useful as a technique for reducing prospective forgetting. We can put things in certain places so that we are more likely to remember to do them.

Case Study: Mr. B., a 53 year old businessman, is extremely vulnerable to encoding failure and retroactive interference: things are always occurring, demanding his immediate attention, and distracting him from things he was intending to do. He compensates for this by structuring his environment in several ways. Whenever he thinks about calling someone, he makes a note in his phone log. Whenever he thinks about an errand that he must make, he puts a note or some papers associated with the errand by the briefcase that he uses when he goes out to his car.

Another use of environmental restructuring is to guard against the type of memory loss associated with late life dementias: helping a patient remember what he has already done so that he does not have to worry (or go and do it again). One of the best uses of this approach would be those handy pill boxes which are coded to the days of the week, with seven little compartments labeled SMTWTFS.

Case Study: Ms. T, age 83, always enjoyed sending out greeting cards for the holidays. Her memory was failing, and she had to go live with her daughter. The first year, the daughter noticed that Ms. T sent out cards right after Thanksgiving, and then started getting cards from her old friends. She enjoyed getting these cards, but they would just make her nervous as she began to worry whether she had already sent a card to her friend (and so she would send another card just to be sure). Several of her old friends received multiple cards, and correctly inferred that Ms. T was getting confused. Next year, the daughter decided to employ a more systematic approach. When her mother sent out the cards, each name in the address book would get a sticker to indicate that the card had been sent for that year.

HOW TO REMEMBER THINGS		
<i>Mnemonic</i>	<i>Description</i>	<i>Retention</i>
Rote	Repetition without Understanding	Poor
Eidetic	Visual image	Good
Conceptual	Logical links	Good, but has some distortion
Motor	Uses muscles, Not just brain	Excellent
Overlearning	Repeated practice	Good
Spaced practice	Include rest breaks	Good
Sleep after learning	Make what you learn the last thing you do before sleeping	Good
Mood congruence	People more easily remember things when in the same mood as when it happened	Hard to use
Environmental restructuring	Arrange physical objects so that we will run into them in order to remember them	Good but, sometimes hard to use

