LECTURE 13
PSYC 200
Feb 29th

MEMORY

The Seven Sins of Memory
- three sins of forgetting
  - absent mindedness: caused by not paying attention to what you do, this lack of attention causes info not to be encoded into memory
  - transience: memories fade over time, tied to a concept known as 'storage decay' (memory/info/time tend to fade)
  - blocking: 'retrieval failure' keeps us from accessing stored memories, common phenomenon is the "tip of the tongue" expression
- three sins of distortion
  - misattribution: you can remember some parts of memory correctly but you will misattribute the context
  - suggestibility: memories are not exact replicas, they are prone to suggestibility
  - bias: your memories reflect and support your own personal bias, we do not accurately remember and when this happens we fill in the blanks with what we believe happened
- one sin of intrusion
  - persistence
    - example: post traumatic stress disorder

The function of memory
- **memory:** our brain's system for filing away new info and retrieving previously learned material
- How does memory differ from learning?

How is memory organized?
- types of memory
  - sensory memory: refers to the representation of the physical characteristics of a sensory stimulus, only lasts a few seconds, we are not aware of it, it provides an accurate representation of the original stimulus
    - function: appears to hold on to info long enough so that it can become part of the next form of memory which is called working memory
  - working memory: also known as 'short term memory', contains current and past info and we use all this info to guide our behaviour, it is limited in terms of capacity and duration (how much and how long)
    - example: phone numbers, 7 digits because it is the optimal amount that we can remember the best, if you don't pay attention to memory it will be gone
  - long-term memory: info is represented on a permanent/near permanent basis, has no capacity limit, long term memory happens due to physical changes that take place in the brain (new connections)

info processing: the backbone of human memory
info processing model contains cognitive components of memory:
- encoding: during this step, sensory info is converted into a form that can be used by the brain's memory system, TRANSDUCTION
- storage: process of maintaining info and memory
- retrieval: retrieving stored info and memory, process of locating and using stored memories,

when you retrieve info from long-term memory it goes to working memory

how are memories formed?

- step 1: we use our senses to collect information (see, hear, touch, taste), hold info in sensory memory very briefly
- step 2: some of the sensory info will be encoded into working memory, influenced by attention
- step 3: if you need to remember the info for more than a few seconds, that info will go through a second encoding process and becomes stored in long-term memory

Sensory Memory (important slide)

- the sensory registers
  - parts of the brain that make up sensory memory
- sensory memory and the brain
  - visual cortex
  - auditory cortex
  - sensory cortex
  - frontal lobe: this is where working memory is located, important area in brain for directing attention
    - if these cortexes are active all at the same time, you have to organize that info into a coherent whole, part of brain that is responsible for this is the frontal lobes
    - damage to the frontal lobe will damage ability to organize memories in a relevant order
  - somatosensory cortex
  - olfactory cortex
  - gustatory cortex
- important facts:
  - each sense (we have five) has its own register for holding on to sensory information
  - these registers have very large capacities, can store a ton of information
  - if you don't pay attention to this info in the sensory register, the info (which lasts 1-4 seconds) will be gone

Types of sensory memory

- iconic memory
  - sensory memory for visual images
  - it lasts for about 1 second, if you don't pay attention to it you forget it
  - Sperling's study: a row of letters was associated to a tone
- eidetic memory
  - the ability to recall detailed images vividly after only a brief exposure to them
  - can hold this info for about 30 seconds
  - "photographic memory" means you don't make any mistakes while recalling details about specific memories
- echoic memory
  - sensory memory for auditory sounds
  - they last longer so that we are able to understand speech, you cannot identify a word until

all of the sounds have been heard
    - hold initial representation of the sound until the entire word has been heard

Encoding into working memory

- how is it that some sensory info is encoded and others are not?
    - info that you pay attention to is transferred from sensory memory into working memory
- we can encode sensory info in 2 ways
    - conscious encoding: you are paying attention to sensory info that you want to remember
    - unconscious encoding: you are paying attention to sensory info without being aware of it
        - example: when asked where we were at 6pm last night, most would answer accordingly (at home, with friends). but did you explicitly want to remember this info? no, this info was stored through unconscious encoding
- which part of the brain plays a crucial role in working memory?
    - frontal lobes
    - if you damage frontal lobes, you don't decide coherently, instead you guess since you can't hold on to info properly

What do we encode? images, sounds, and meanings

- visual encoding
- auditory encoding
- semantic encoding

best way to encode info: encode the info's meaning (what does it mean?), make the info relevant to you, this way it is easier to encode and easier to remember later on

Storage in working memory

- organization and rehearsal
    - chunking: break large pieces of info into smaller, manageable pieces
    - rote rehearsal: repeating info over and over again either silently or out loud as a way to memorize
        - its not a great way of learning and memorizing, you are not grasping any sort of meaning of the info, you will forget most of the stuff you memorized through rehearsal by the end of your exam, not long-term

Retrieval from working memory

- serial position effect
    - our ability to retrieve sensory info we have just processed depends on when the sensory info occurred
        - recency effect: we can easily recall items near the end of a list because they are still contained in short term memory
        - middle portions of the film will be harder to remember because they were presented too long ago to still be in short term memory and so many items came before and after them that there was little opportunity for rehearsal, therefore limiting transfer into long term memory
        - primacy effect: we can easily recall the first few items in a list because the opportunity to rehearse them increases the likelihood that they are transferred into long term memory

Forgetting in working memory

- how do we lose stuff in working memory?
  - interference: distractions, disrupting rehearsal, prevented from paying attention to information
    - example: you're trying to study for an exam and you get distracted by a friend, your attention is being diverted from your studying to your friend's story, you will encode the words that you are reading but not their meaning because you are distracted
  - encoding: poor encoding strategies
- pseudo forgetting
  - occurs when you have forgotten a piece of info that was never actually encoded because of some form of interference
    - if you have not encoded the info in the first place, there is nothing to forget, this is why it is called pseudo forgetting
- cued forgetting: you are specifically told to forget a specific form of information
- example: you are given a phone number to remember and dial, once you hear the ringing, you will forget the numbers you dialled
  - backfire effect: you are told to not pay attention to a specific info, you will tend to remember it most clearly
    - example: judge tells a jury to discard specific piece of evidence, the jury will tend to remember this bit of info explicitly

Organization of Long-Term memory

- explicit memories: memories you are consciously aware of
  - semantic: memories for facts (capital of Canada, cars run on gasoline), you know these facts but you don't remember the time and place when you learned them
  - episodic: memories of events/episodes, you remember the time and place a specific memory was formed
    - example: what you did for summer vacation last year, what you had for dinner with friends 3 weeks ago
- Implicit memories: not consciously aware of them
  - priming: phenomenon in which we activate associations in memory that allows us to access information
    - example: if you are given a list of words rapidly, you wait for an hour and come back and what happens is that you are given only the last two letters of the words you were previously given and you are asked to remember the words, people get 80% of the words correct but they don't remember, they are not consciously aware of the words, they guess
  - procedural memory: learning how to ride a bike, tying your shoes, you just know the procedure, these types of memories are formed after hours and hours of practice, they become automatic
  - conditioning: classical and operant, associating a stimulus with a response

encoding into long term memory

- flashbulb memories: emotional memories are immediately stored into long term memory

    - example: survivors of 9/11 can still vividly remember the events, seared into their memories
- elaborative rehearsal: a type of conscious encoding, give meaning to an info so you can store it in long term memory
    - try to make connections between the new info you are encoding and the old info you have stored in order to best remember and best retrieve later on
- mnemonics: it is a memory aid that is going to give meaning to pieces of information in order to best remember them
    - My Very Educated Mother Just Served Us Nine Pizzas ---> planets in the solar system
    - On Old Olympus Towering Top A Famous Vocal German Viewed Some Hops ---> used to remember the cranial nerves in the brain

Storage in long term memory
- levels of processing
    - shallow processing: encoding based on sight and sound and working memory, it doesn't last very long, no meaning behind the encoded information
    - deep processing: you remember this info for a long long time

Long-Term Memory Storage and the Brain
H.-M. had a bilateral removal of his hippocampi, it was done to treat severe epilepsy, a day after his surgery, a nurse comes in and gives him his medicine and introduces herself, 30 mins later she comes back and H.-M. does not remember her and she needs to introduce herself again, he has memory issues
H.-M. could not remember anything that took place 2 years prior to the operation and could not form new memories, suffered from retrograde amnesia and anterograde amnesia (no memories from before and after)
this tells us that the hippocampus is the site of the formation of explicit long term memories and that it is not the permanent storage place for explicit long term memories
- hippocampus: explicit long term memories are first formed here, however they are not permanently stored there, once they are strengthened they are moved to other locations in the brain
- cortex
- cerebellum: plays a important role in implicit memories and procedural memories
- basal ganglia: plays a important role in implicit memories and procedural memories
- synapses: long term memories result in the formation of new synapses, depending on the content of the memory, it will influence the strength of these connections (how long we remember this stuff for)
- long term potentiation (LTP)

example: you will remember info that has high emotional content (you will remember details from the birth of your child even though it happened years and years ago because it is highly emotional)

Retrieval from long-term memory
- how do we retrieve memories from long term memory?
    - recognition: accessing memories with use of external information
    - recall: accessing memories without use of external information (used while answering multiple choice questions on a test)
- retrieval cues
    - context dependant retrieval cues: the context in which you learn info influences your ability to recall that info later on, you are better able to retrieve info if you find yourself in

the same context in which you learned it
        - for next exam, if you want to better remember information, study in the same classroom in which the exam will be held
    - state-dependant memory: the state in which you learn info will influence your ability to retrieve that info later on
        - example: you are better able to retrieve info if you find yourself in the same state in which you learned it, if you are happy while studying for a test and you are happy while doing the test, you will better remember what you learned
        - if you are stressed during the exam and you were happy and relaxed while you were studying, you will not remember everything properly

Retrieval Failure: Forgetting

memory failure can occur because of interference and because of decay

- interference
    - proactive interference: previously learned info will disrupt your ability to remember newer information (learning a new language, you are french-speaking and you are learning italian)
    - retroactive interference: recently learned info disrupts your ability to remember older information (you remember what you got for christmas this year but not what you got last year)
- storage decay: if you haven't forgotten something after 3-4 days, you will remember it for about 30 days, however your memories fade over time (this is storage decay), you don't remember things, you reconstruct them
    - forgetting curve

emotion, stress and memory

stressful/emotional memories are better stored in long term memory, you remember them more
exposure to chronic stress results in high production of cortisol which kills neurons that make up the hippocampus and destroys your ability to form and retrieve memories
not enough cortisol also impairs memories
you need the perfect amount of cortisol to be produced in order to best retain memories
your ability to remember and forget stuff is influenced by your level of arousal
if arousal levels

- yerkes-dodson law
    - hyper vigilance: arousal levels are too high (too stressed/anxious) this impairs memories
    - hypo vigilance: arousal levels are too low (decrease in attention and interest), this impairs memories
    - peak arousal levels: result in optimal memory function
- Amnesia
    - retrograde amnesia: you cannot access past memories
    - anterograde amnesia: you can no longer form new long term memories