

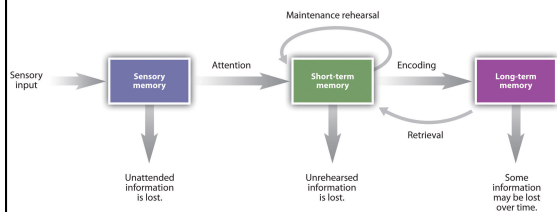
Psychology 1010

Unit 2

Memory

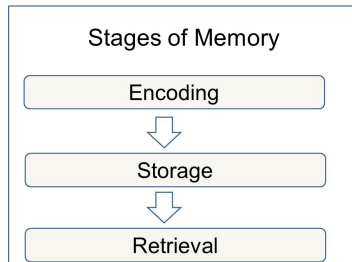
- **Memory** - the ability to retain knowledge.
- Processes like attention, sensation, perception, and learning are essential in forming a memory.
- Memories can be used for thinking and problem-solving.
- **I** _____ – continuum from attention through problem solving that includes memory.

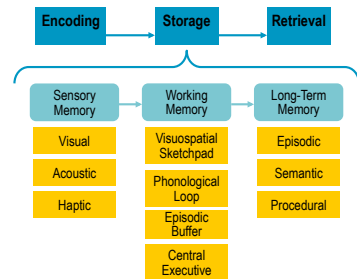
Atkinson-Shiffrin Model of Memory



Memory

- In general, memory has 3 steps:



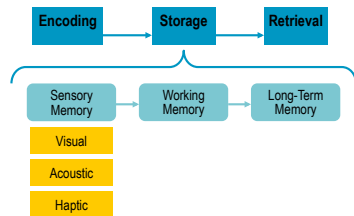


Memory

- _____ – the process of taking information and putting it into memory.
- _____ – taking information from memory and storing it.
- _____ – recovering stored information.
- People compare human memory to computers, but humans are much less accurate and reliable!

Memory

- Cognitive psychologists think memory occurs in stages, with forgetting possible at any point.
- _____ **memory** – all sensory information is held for a very brief time in sensory memory.
 - Acoustic information lasts slightly longer in memory than visual information.

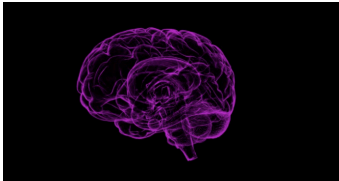


Memory

- _____ **memory** – a small fraction of sensory memory moves to short-term memory (STM).
- A small amount of information (“7 plus or minus 2 bits” – George Miller), can be held for a short (30 seconds or less) amount of time.

Memory

- chunking – putting information into meaningful chunks improves short term memory.

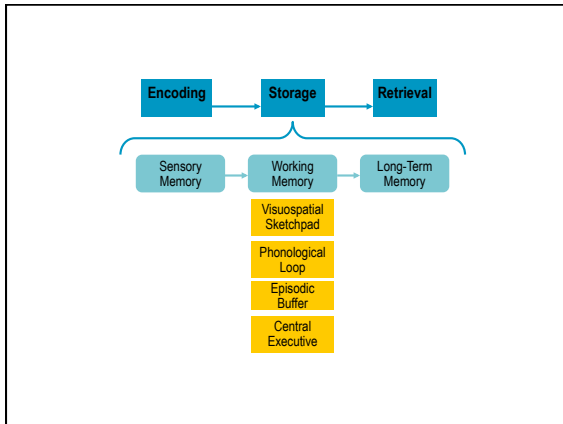


- Try to remember the following letters:

• F B I I
R S C I
A E P A

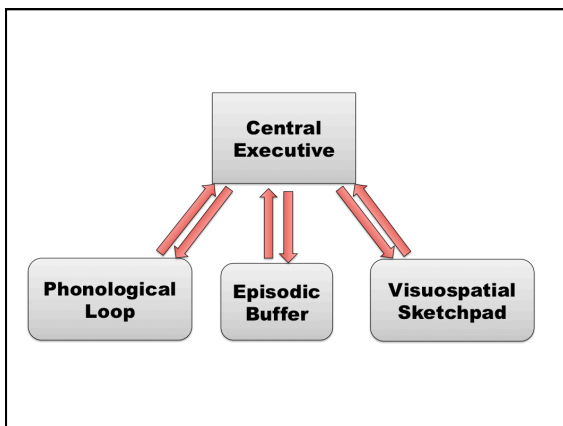
Memory

- long-term **memory** – similar to short term memory except multiple types of information (only a single type for short-term) can be actively manipulated (passive for short-term).



Memory

- Components of working memory:
 - **Visuospatial sketchpad** – remembering and manipulating things we see.
 - _____ – rehearsal of auditory information.
 - **Episodic buffer** – links different information together, and combines it with information from long-term memory.
 - _____ – directs appropriate amount of attention to each component.



Memory

- Brain areas involved in working memory:
- _____ (ACC). People with better working memory abilities show more activation in the ACC.



Memory

- _____ damage leads to people that can't change courses in a card-sorting task (same is true of small children).

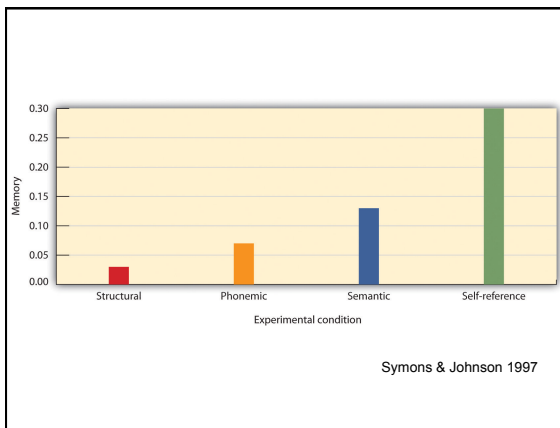


Memory

- **Long-term memory** – location of permanent memories. Large capacity and long duration.
- _____ – deeper levels of processing lead to a greater likelihood that something will be retained in long-term memory.
 - Sight or sound of a word (shallow) vs. meaning (deep).

Memory

- People tend to remember things that are relevant to themselves.
- In a study, people were asked to remember either characteristics of words (whether they were printed in capital letters), whether they rhymed with another word, what the meaning of the word was, or whether the word described themselves.



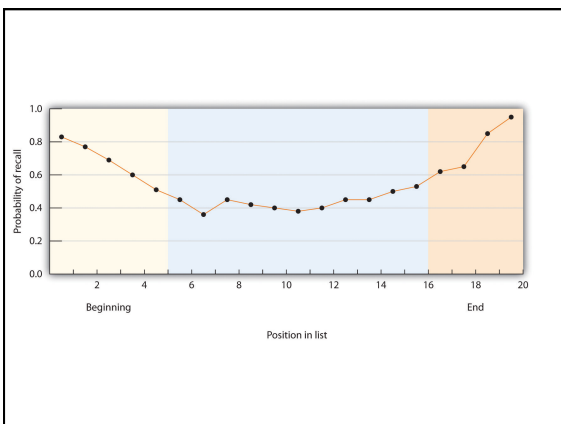
Memory

- Just because we have lots of exposure to something doesn't mean our memory of it will necessarily be good.
- Without cheating (looking at a penny), which penny on the following slide is the correct one?
- Most people aren't sure, because it doesn't really matter to our everyday lives.



Memory

- **Serial position effect** – when people are asked to recall a list of words, where a word is at in the list influences whether it's recalled or not.
 - **primacy effect** – words learned first are more likely to be remembered (rehearsal moved to long-term memory).
 - **recency effect** – words learned last are more likely to be remembered (still in working memory).



Memory

- The recency (not primacy) effect disappears after 30 seconds.
- People with different types of brain damage show that working and long-term memory are related to different areas of the brain...

Memory

- Patient H.M. had his hippocampus removed on both sides to control seizures.
- This experimental procedures left him mostly unable to form new memories (_____), though his personality and intelligence remained intact.
- In general, he could learn how to do things, but not new people or events.

Memory

- Patient K.F. had damage in his parietal lobe (phonological loops).
- K.F. had very poor working memory, but normal long-term memory, and he could form new memories.

Memory

- _____ **memory** – knowing “that.”
Memories about the world.
 - Tends to be **explicit**, i.e. we can tell others what our memories are.
- _____ **memory** – memories that are difficult to verbalize.
 - Tends to be _____, i.e. conditioned emotions, procedural memories.

Memory

- Amnesic patient H.M. could not form new declarative memories, but could form new nondeclarative memories.
 - H.M. learned how to perform a star tracing task as easily as someone without brain damage.



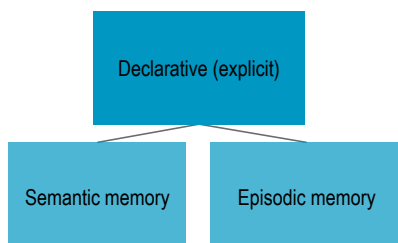
Chance

Memory

- Amnesic patient H.M. could not form new declarative memories, but could form new nondeclarative memories.
 - H.M. learned how to perform a star tracing task as easily as someone without brain damage.
- Tracts connecting the hippocampus to the temporal lobe are responsible for the formation of long-term memories.

Memory

- Declarative memories can be categorized as:
 - _____ **memories** – memories of facts, ideas, concepts. General knowledge.
 - _____ **memories** – memories of personally-experienced events.
 - **Autobiographical memories** – either semantic or episodic memories about oneself.



Memory

- Some types of nondeclarative memories:
 - _____ – we often have conditioned emotional responses to things we're not aware of.
 - _____ – how to do things. Usually difficult to describe. How would you explain to someone how to ride a bike?
 - **Priming** – exposure to one stimulus changes a response to a later stimulus.

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Memory

- Examples of priming:
 - People that heard “rude” words were more likely to interrupt an experimenter than people that heard “polite” words.
 - Individuals that heard words that relate to older people subsequently exited the testing area more slowly than people not primed with those words.
 - Holding a hot or cold beverage influenced how a person felt about an interviewer.

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Memory

- In general, many areas of the cerebral cortex are involved with declarative memories.
 - There are particular areas that are associated with faces, tools, animals, etc.
- The basal ganglia are involved with procedural memories.
 - People with Parkinson's and Huntington's have difficulty learning new tasks.

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Memory

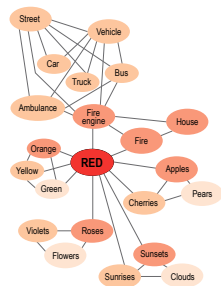
- The hippocampus appears to be important for spatial memory.
 - _____ had larger hippocampi than control subjects.



Memory

- How are memories organized?
- Memories that are more similar appear to be linked.
- _____ – people organize their memories based on how related things are in their own personal experience. Lots of individual differences.

Spreading Activation Model



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Memory

- When forming new memories, we often pay more attention to and retain things that conform to our expectations.
- _____ – our set of expectations about situations or things.

Retrieval

- Retrieval from STM:
 - We search through items in STM one at a time during retrieval.
- Retrieval from LTM:
 - _____ - stimulus that aids in retrieval of information.
 - _____ – when memories are encoded, lots of specific information is included. Some of this information can be used as cues.

Retrieval

- Memories are more likely to be accessed when in the same state (mood, state of mania/depression, after ingestion of a drug) as when the original memory was formed.
- _____ (TOT) – incomplete memory retrieval where part of a memory is recalled. Related to spreading activation.

Spreading activation explains that feeling when you can almost remember something, but not quite.



Retrieval

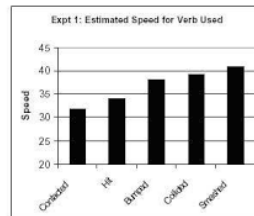
- Memory is _____, not recalled like stored data on a computer.
- Memories interact with more recent information, and can change over time.
- Each time we recall a memory, it has the potential to change the memory.

Retrieval

- Memories can change simply due to the power of suggestion.
- Asking eye-witnesses “how fast were cars going when they _____ each other” influenced memory of how fast cars were going.
- The word used (bumped, smashed, hit, collided, contacted) affected estimates.

Verb used	Average Speed Estimate
Smashed	40.8
Collided	39.3
Bumped	38.1
Hit	34.0
Contacted	31.8

Loftus and Palmer 1974



Retrieval

- **_____ memory** – vivid and detailed memory associated with a highly emotional event.
- Hippocampus and amygdala work together to form emotional memories, particularly negative ones.
- Retrieval of flashbulb memories also fades, but is still more accurate than most memories.

Forgetting

- **Forgetting** – decrease in the ability to retrieve a previously-formed memory.
 - Not the same as _____.
- Forgetting is probably adaptive... it allows us to focus on more important things, and pay less attention to less important things.
- We often remember more than we realize, and can “re-learn” things much more quickly than we learned them the first time.

Forgetting

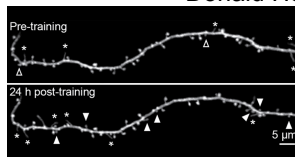
- _____ – newer and older information in memory might compete, potentially distorting memories.
- **Proactive interference** – reduced memory for information because of prior memories.
- **Retroactive interference** – reduced memory for information because of information learned afterward.

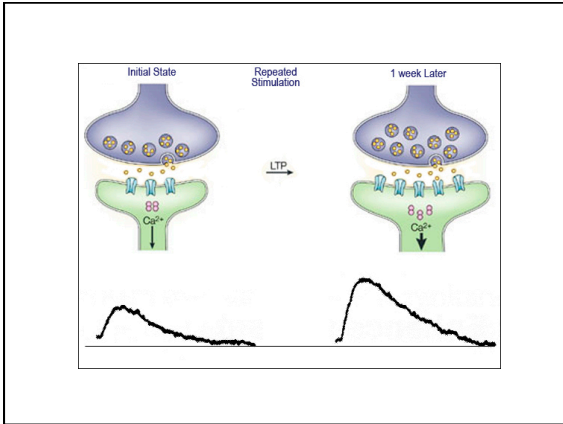
Forgetting

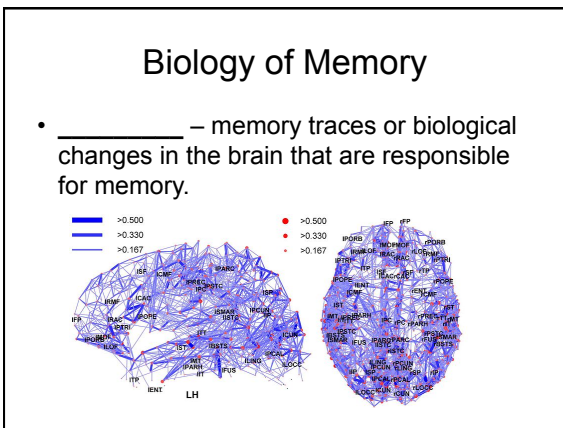
- _____ **forgetting** – failure to remember threatening or negative things.
- Memories can also be distorted for the same reason, and can lead to false memories and confabulation.

Biology of Memory

- _____ (**LTP**) – neurons that are regularly activated together become more efficient at communicating.
- “Neurons that fire together wire together.”
Donald Hebb







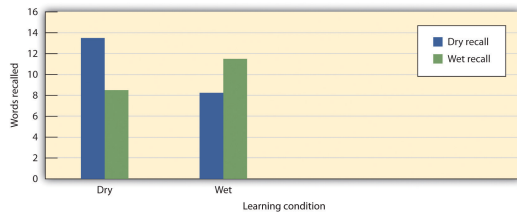
Biology of Memory

- Acetylcholine (ACh) appears to be important in memory.
 - Drugs that interfere with ACh interfere with memory formation.
 - Medications designed to reduce Alzheimer's symptoms boost ACh.
 - Rats with better memories for a maze task produced more ACh.
 - Bees with boosted ACh learn faster than other bees.

CC(=O)OCCN(C)C

Improving Memory

- Memory is _____.
- You're more likely to remember information when you're in the original environment you learned it in.
 - In a study, individuals learned lists of unrelated words either on dry land, or underwater (scuba divers).
 - More words were recalled when the individuals were in the same environment where they first learned the words.

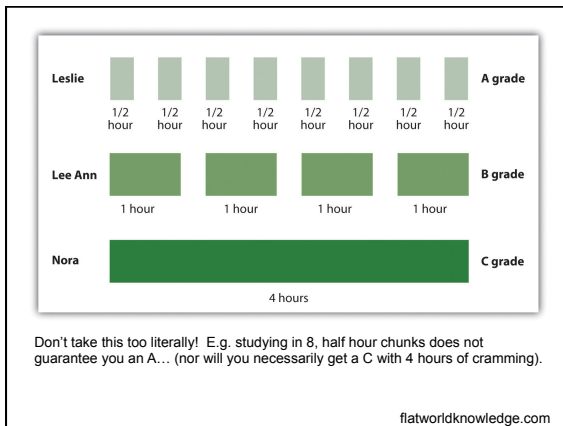


Godden & Baddeley 1975

flatworldknowledge.com

Improving Memory

- _____ **practice** – practice or learning distributed more or less evenly over time.
- _____ **practice** – practice or learning crammed into a short amount of time.
- Distributed practice is better than massed practice for learning.



Improving Memory

- _____(TPN) – brain networks that are active when the mind is focused on a task.
- _____(DMN) – brain networks that are active when the mind is wandering (daydreaming, ruminating, not focused on a particular task).
- Both networks don't tend to operate at the same time, but both are important to learning!

Improving Memory

- _____ **Technique** – when sitting down to study, set a timer for 25 minutes. Focus for 25 minutes, then take a break.



Improving Memory

- The _____ Technique:
 - Allows the mind to enter the default mode network for memory consolidation.
 - Helps to overcome procrastination.
- When thinking about a task we don't want to do, the same areas of our brain are active as when we are in physical pain. Once we start the task, that activation disappears.

Improving Memory

- _____ – studies indicate that studying different topics during a study session helps with learning compared with focusing on just one topic.



Improving Memory

- _____ – before starting a new unit, look at section headings/notes, and think about what's coming up, what you already know about the topic, how it might relate to earlier topics in the class etc.

Improving Memory

- Sleep is important for the consolidation of memories.
 - Staying up all night to study does not give the brain the opportunity to consolidate what was learned.



Improving Memory

- Repetition and recitation help memory. Practice makes perfect!
- _____ - explaining a concept to someone else can help you realize whether you understand a concept or not.
- _____ - taking tests can actually improve memory! Try making tests for yourself... mistakes early on actually help learning.

Improving Memory

- Don't try to multitask when it comes to learning!
- The human mind is actually not very good at paying attention to multiple things at once.



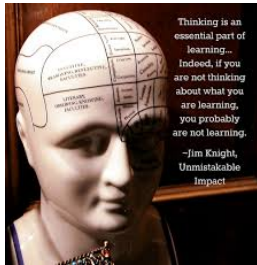
Improving Memory

- _____ – devices that link new information to something simpler or already well-known.

Mercury	Make	My	My	My	My
Venus	Very	Very	Very	Very	Very
Earth	Easy	Educated / Excellent	Eager	Easy	Easy
Mars	Mash	Mother	Method	Method	Method
Jupiter	Just	Just	Just	Just	Just
Saturn	Squash	Served / Sent	Served / Sent	Speeds	Simply
Uranus	Up	Us	Us	Up	Uses
Neptune	New	Nine	Nine	Naming	Nine
Pluto	Potatoes	Pies	Pizzas	Planets	Planets

Improving Memory

- _____ – “thinking about thinking.”



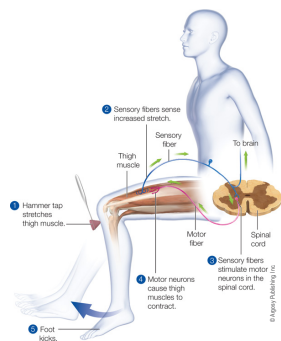
Week 5

Learning

- **Learning** - relatively permanent change in behavior (or capacity for behavior) due to _____.
- It's difficult to know if someone has learned something unless there is a change in behavior.
- Some types of behavior don't require experience...

Reflexes and Instincts

- _____ – relatively simple, automatic response to a stimulus.
 - Withdrawal from pain
 - Blink when something is in the eye
 - Salivation when something is in the mouth
 - Startle when surprised
 - Patellar (knee-jerk) reflex



Reflexes and Instincts

- _____ - stereotyped behaviors that occur in all members of a species without practice.
- _____ – sequence of instinctive behaviors that once started, continues to completion.

– Yawning





A baby kangaroo will climb into its mother's pouch immediately after it is born, with no help or instruction.

Reflexes and Instincts

- Problem with reflexes and instincts... _____!
 - Birds instinctively feed any small gaping mouth in their nest, even if it's not their own offspring.
- Problems with learning... takes time and effort, and costly neural machinery (i.e. brains).

Type of Learning	Cognitive Process	Examples
Associative	Form new connections among stimuli and behaviors	• Classical Conditioning • Operant Conditioning
Nonassociative	Change the magnitude of responses to a kind of stimulus	• Habituation • Sensitization
Observational	Learning by watching the actions and experience of another	• Imitation

Nonassociative Learning

- Habituation – decreased responding to the same stimulus presented repeatedly.
 - You notice the faucet drip in your hotel room at first, but after awhile, you don't notice it anymore.
 - The first time you walk by your neighbor's house after she gets a new dog, the dog jumps at the fence and startles you. Now you barely notice when the dog lunges.

Nonassociative Learning

- Sensitization – increased responding to a stimulus, that can also generalize to other stimuli.
 - You're a soldier in a war zone, and artillery shells are being fired nearby. The sound of each new explosion (as well as other loud noises) makes you more and more tense.
 - You're watching a scary movie, and each time something scary happens, you become more and more scared. Other unexpected movement or noises in your house make you jumpy, too.

Nonassociative Learning

- Why do we habituate to some stimuli, and sensitize to others?
 - We tend to habituate to _____, _____ stimuli.
 - We tend to sensitize to _____, _____ stimuli.

Type of Learning	Cognitive Process	Examples
Associative	Form new connections among stimuli and behaviors	• Classical Conditioning • Operant Conditioning
Nonassociative	Change the magnitude of responses to a kind of stimulus	• Habituation • Sensitization
Observational	Learning by watching the actions and experience of another	• Imitation

Associative Learning

- **Classical Conditioning (a.k.a. _____ conditioning)** - learning process that occurs when a previously neutral stimulus becomes associated with a biologically relevant stimulus.
 - Responses are almost always reflexive in nature (i.e. beyond conscious control).

Classical Conditioning

- While studying the physiology of digestion, Ivan Pavlov noticed that after being in the lab for awhile, dogs would start to salivate when presented with things other than food.
 - Bowl that held the food
 - Footsteps of the researchers
 - Person wearing a white lab coat

Classical Conditioning

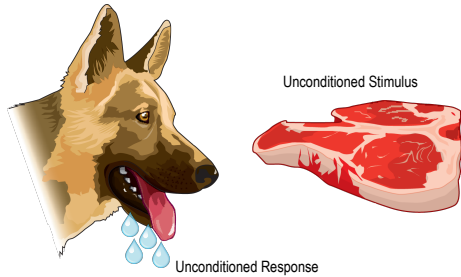
- Pavlov decided to switch to studying the “psychic reflexes” rather than digestion.
- Pavlov would pair a previously neutral stimulus (bell ringing) with a biologically relevant stimulus (food).
- After a number of pairings, the dogs would come to respond to the bell as though it were food.

Classical Conditioning

- _____(UCS) – elicits an unconditioned response *without prior training*. Automatic, reflexive responses to biologically important things.
- _____(UCR) – elicited by unconditioned stimulus. Does not require learning and is usually important to survival/reproduction.

8

The Unconditioned Stimulus and Response

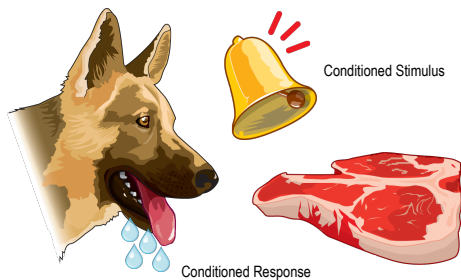


Classical Conditioning

- _____ **(CS)** – a previously neutral stimulus that comes to evoke a response after it becomes associated with the US (learning required).
- _____ **(CR)** – elicited by conditioned stimulus after a number of pairings of CS and US. Requires learning (note: the CR may or may not resemble the UR).

8

The Conditioned Stimulus and Response

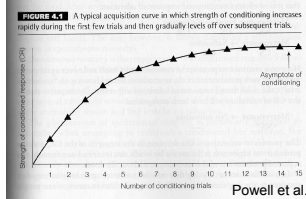


Classical Conditioning

After CS and UCS paired (i.e. meat and bell)...

Acquisition

- **Acquisition** – the process of obtaining a conditioned (Pavlovian) response through repeated pairings of a CS with a US.

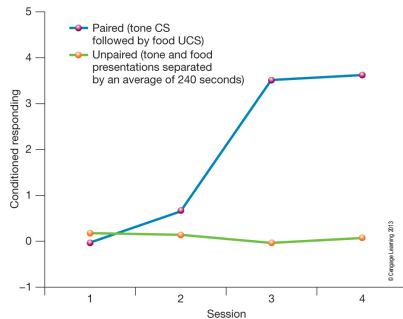


Acquisition

- _____ – how close in time or space two events happen.
- Pavlov felt there needed to be a close proximity between CS and UCS in order for acquisition to happen.
 - If you ring a bell, but don't present food to a dog for an hour, the dog will probably not obtain the conditioned response of salivating when it hears the bell.

Acquisition

Even a difference of four minutes between CS and UCS leads to no acquisition (green line)



Acquisition

- Acquisition also depends on contingency, or how often the CS appears with the US.
 - If a bell *always* leads to the appearance of food, a dog will quickly learn to salivate when hearing the bell.
 - If a bell *rarely* leads to the appearance of food, and food often appears without the bell, a dog will probably not learn to salivate when hearing the bell.

Extinction

- If a CS no longer appears with the UCS, the CR will weaken and eventually disappear – **extinction**.
 - If a bell is no longer followed by food, a dog will stop salivating when it hears the bell.
- Extinction is not the same as _____!
- Extinction is learning new associations... it doesn't "undo" prior learning.

Extinction

- Pavlov illustrated extinction in the lab by:
 - 1) training a dog to salivate at the sight of meat powder, then
 - 2) repeatedly presenting the food alone without giving it to the dog.
- Salivation became less and less with each trial.

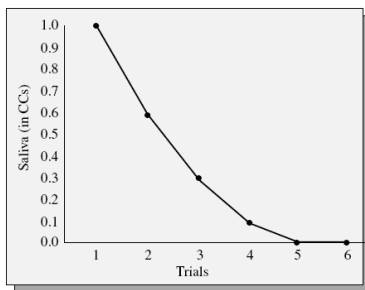


Figure 3-10 Extinction of a CR. A conditional response will extinguish if the CS (in this case, the sight of food) is repeatedly presented alone. (Compiled from data in Pavlov, 1927.)

Chance

- If there is a period of time between extinction trials, conditioned responding can return – _____.
- Pavlov discovered that after a response seemed to have been extinguished, if there was a break in training and then the CS was presented again, the CR would return (see following slide).
- Importance: Though extinction reduces the frequency of a CR to zero, it doesn't entirely undo the effects of prior conditioning!
- An extinguished CR can usually be reestablished more readily than the initial establishment.

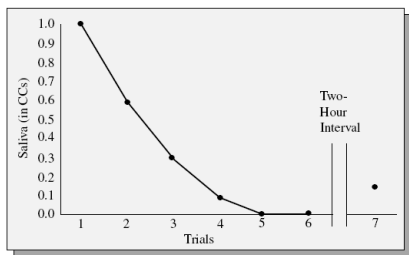


Figure 3-12 Spontaneous recovery. A conditional response will extinguish if the CS is repeatedly presented alone. Following a rest period, the CR spontaneously reappears. (Compiled from data in Pavlov, 1927.)

Chance

Inhibition

- If a CS predicts the *absence* of a UCS, then responding will be inhibited – _____ or **inhibitory conditioning**.
 - A bell reliably leads to food.
 - A bell + a light reliably leads to no food.
 - Bell alone = salivation
 - Bell + light = no salivation

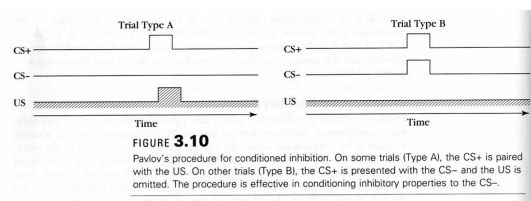
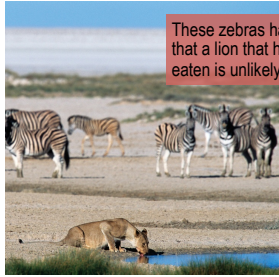


FIGURE 3.10

Pavlov's procedure for conditioned inhibition. On some trials (Type A), the CS+ is paired with the US. On other trials (Type B), the CS+ is presented with the CS- and the US is omitted. The procedure is effective in conditioning inhibitory properties to the CS-.

Domjan



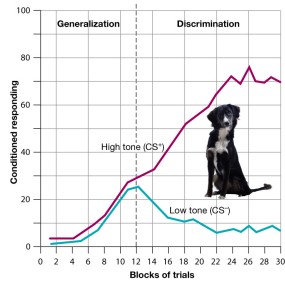
These zebras have learned that a lion that has already eaten is unlikely to be a threat.

- _____
- Organisms often respond to stimuli similar to the CS – _____.
 - A dog that has learned to salivate at the sound of a specific bell will probably also salivate at the sound of a different but similar bell.

- _____
- If only one, very specific kind of CS predicts a UCS, organisms can learn to only respond to that stimulus, and not ones like it – _____.
 - If a dog only gets food when it hears a bell of a particular pitch, but not bells of other pitches, it will only salivate to the bell that's associated with food.

8

Generalization vs. Discrimination of Conditioned Stimuli



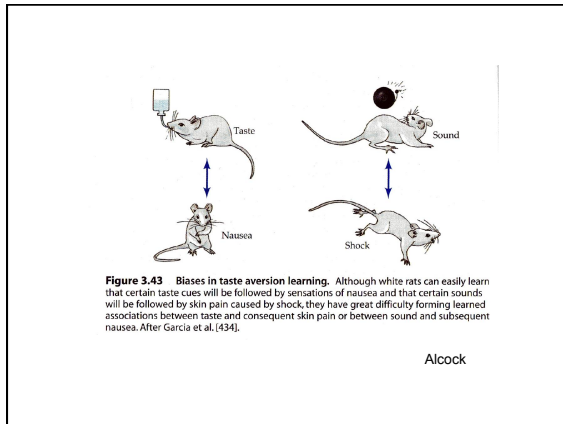
Classical Conditioning

- Pavlov felt any CS was as good as any other. _____ !
- In a classic taste aversion experiment, researchers paired either “tasty” water (saccharin-flavored), or “bright/noisy water” (click and flash of light), with illness, or a shock in rats.

Classical Conditioning

- Rats learned to avoid:
 - “tasty” water when they got ill
 - “bright/noisy” water when they were shocked
- Rats did NOT learn to avoid:
 - “tasty” water when they were shocked
 - “bright/noisy” water when they got ill





Classical Conditioning

- Flavors “go” with illness, and sudden noises and light “go” with shock (i.e. a predator attack).
- Conditioning happens easily when CS and UCS naturally go together, and can be much more difficult or impossible if they don’t.

Classical Conditioning

- J.B. Watson and his graduate student Rosalie Rayner studied fear in infants (1920).
- Albert B., the 11-month-old son of an employee at Johns Hopkins where the experiment was being conducted, was chosen as a subject.
- Albert was reported as being unusually _____: he almost never cried, and had never been seen to display anger or fear.

Classical Conditioning

- Albert was initially exposed to burning newspaper, a white rat, a monkey, a rabbit, a dog, a bunch of wool, and various masks. He showed no fear to any stimuli.
- Watson and Rayner then paired a loud noise (striking a steel bar with a hammer behind Albert's head, which causes a startle reaction) with the white rat.
- During the first trial of the first session, Albert "jumped violently and fell forward, burying his face in the mattress. He did not cry, however."

Classical Conditioning

- He became more fearful after more pairings of the loud noise with the rat.
- After more pairings, Albert "began to crawl so rapidly that he was caught with difficulty before reaching the end of the table."
- Albert's fear also generalized to other furry things such as a rabbit, a dog, a fur coat, and a Santa Claus mask.



Classical Conditioning

- Classical conditioning can produce fear to a previously neutral stimulus.
- Can it also help individuals overcome fear?
- _____ – pairing something feared with something an individual likes in order to condition a new response.

Classical Conditioning

- One of Watson's students had a patient named Peter who was afraid of rabbits.
- Peter was slowly introduced to rabbits while eating a favorite treat.
- Peter was eventually able to pet the rabbit while eating his snack – he learned a new, nice association with rabbits!

Classical Conditioning

- _____ - a treatment for feared stimuli where the stimulus is imagined or encountered while performing relaxation exercises.



Classical Conditioning

- People who regularly use drugs will have CSs that become associated with those drugs (e.g. certain people, places, etc.).
- When the CSs are encountered without the drug, the body “prepares” for the administration of the drug.
- The body’s preparatory response is generally _____ of that of the drug, and often makes people feel bad, leading to drug use.

Classical Conditioning

- When people enter a rehabilitation facility for drug abuse, their usual CSs for using drugs are not present.
- When people return home after rehabilitation, they often encounter their usual CSs for drug use, which can lead to relapse.
- Treatment programs that include _____ of the CSs are more successful than those that do not.

Classical Conditioning

- Advertisers use standard classical conditioning techniques to create associations between 2, often unrelated things.

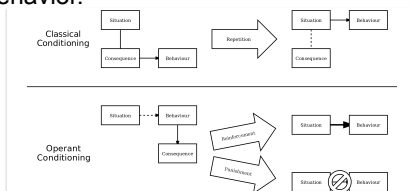


Week 6

- Reinforcement – the strength of a behavior increases or decreases depending on its consequences.
 - A rat presses a lever and gets food. It will be more likely to press the lever in the future.
 - You try a new food while out with friends and like it. You'll be more likely to try new foods in the future.
 - You ask someone out on a date and are turned down. You might be less likely to ask someone out in the future.

Operant Conditioning

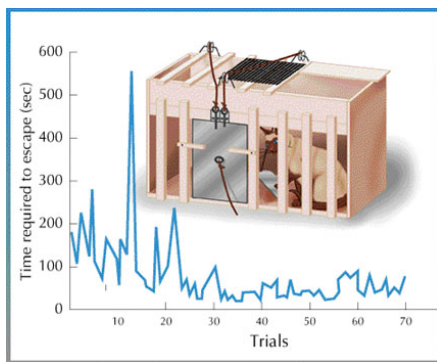
- Classical conditioning involves reflexive behavior.
- Operant conditioning involves voluntary behavior.



Classical Conditioning	Operant Conditioning
Association between conditioned & unconditioned stimuli	Association between behavior & consequences
Organism responds to environment	Organism acts on environment
Behavior is reactive	Behavior is instrumental
Involuntary behaviors	Voluntary behaviors

Operant Conditioning

- Edward Thorndike – put cats into “puzzle boxes” to see how long it would take them to escape.
- He noticed that with practice, it took less and less time for a cat to get out.
- Cats repeated behaviors that tended to get them out of the box.



Operant Conditioning

- Thorndike concluded that behavior typically has one of two consequences – a “satisfying state of affairs,” or “an annoying state of affairs.”
- He called this relationship the _____.

Operant Conditioning

- _____ – leads to the strengthening of a behavior.
- _____ – leads to the weakening of a behavior.
- Positive – means something has been added.
- Negative – means something has been taken away.

		Strength of Behavior	
		Increases	Decreases
Consequence	Stimulus Is Presented	Positive Reinforcement	Positive Punishment
	Stimulus Is Removed	Negative Reinforcement	Negative Punishment

Figure 5-5 Contingency square. In operant procedures, the strength of a behavior increases or decreases depending on its consequences.

Operant Conditioning

- _____ – something is added, and behavior is strengthened.
 - A student gets a cookie for practicing piano, and piano practicing increases in the future.
- _____ – something is removed, and behavior is strengthened.
 - Your nasty headache goes away after taking a medicine. You're more likely to take that medicine in the future.

Operant Conditioning

- _____ – something is added, and behavior is weakened.
 - When you try to cut across your neighbor's yard, he throws a newspaper at you. You no longer try to cut through your neighbor's yard.
- _____ – something is removed, and behavior is weakened.
 - Your parents take away your video game system when you stay out too late. Now, you're less likely to stay out past curfew.

Operant Conditioning

- Note that positive doesn't mean good, and negative doesn't mean bad!
- Positive – something was added.
- Negative – something was taken away.
- _____ are not implied!!!

Operant Conditioning

- Things that are punishing or reinforcing to one individual might not be so for another!
 - Getting in trouble with a teacher might be reinforcing for some students, punishing for others.
 - Physical pain is usually punishing, but can be reinforcing for some people.

Operant Conditioning

- _____ **reinforcers or punishers** – things that an individual naturally likes or dislikes, without learning.
 - Food, mates.
 - Electric shock, hunger

Operant Conditioning

- _____ **reinforcers or punishers** – things we come to like or dislike because they've become associated with primary reinforcers or punishers.
 - Money, good grades, accolades
 - Speeding ticket, bad grades

Operant Conditioning

- Rewards and punishments are most effective if they're _____ rather than _____.
- Punishments sometimes come with problems, so B.F. Skinner felt the best way to modify behavior was through a combination of reinforcement of wanted behaviors and extinction of unwanted behaviors (i.e. remove any rewards).

1. From the *child's* perspective, what is the consequence of screaming?

2. Is the child more or less likely to scream in the next boring store?

3. What type of consequence is this?

1. From the *parent's* perspective, what is the consequence of promising the ice cream?

2. Is the parent more or less likely to offer ice cream the next time the child screams?

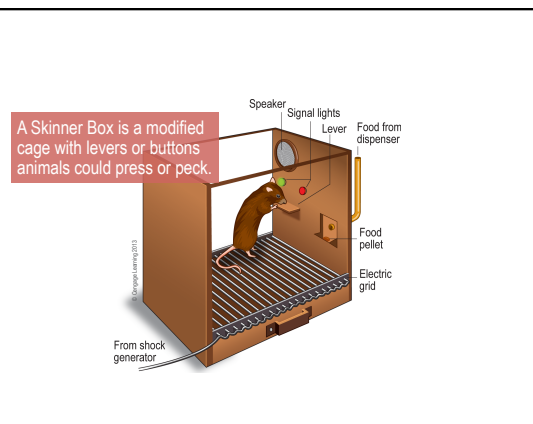
3. What type of consequence is this?

Operant Conditioning

- _____ – individuals naturally prefer certain activities/things over others.
- Preferred things can be used to reinforce less-preferred things.
- “If you eat all your vegetables, you can have dessert!”

Operant Conditioning

- “_____” reinforcement can lead to superstitious behavior.
- B.F. Skinner put pigeons in a Skinner box that randomly delivered food.
- Whatever the pigeons were doing when food was delivered happened to get reinforced.
- Pigeons soon started engaging in strange behaviors, like wagging their head back and forth or sticking their beak in a corner of the box.



Operant Conditioning

- Humans engage in superstitious behavior too...
- If you've ever had a lucky hat, shirt, pair of socks, or ritual you perform during a sporting event, you're engaging in superstitious behavior.

Schedules of Reinforcement

- Reinforcement can happen at various rates depending on the circumstances.
- How often reinforcement happens can have predictable effects on the rates of behavior.

Schedules of Reinforcement

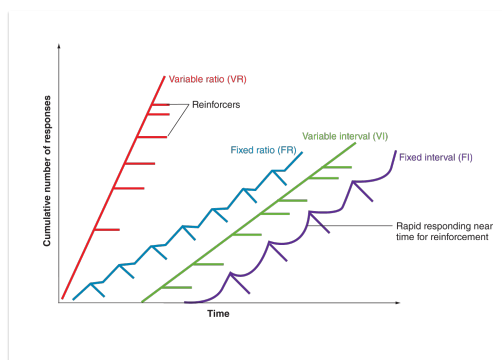
- Continuous **reinforcement** – a behavior is reinforced every time it occurs.
 - Continuous reinforcement is unlikely to happen in nature, but is good when first learning a new behavior.
- Intermittent **reinforcement** – reinforcement happens sometimes the behavior occurs, but not all times.
 - Leads to persistent behavior that's resistant to extinction.

Schedules of Reinforcement

- _____ **schedules** – reinforcement occurs every “X” times (or “X” times on average) the behavior occurs.
 - Continuous reinforcement occurs every single time a behavior occurs.

Schedules of Reinforcement

- _____ **(FR) schedule** – reinforcement occurs every “X” times the behavior occurs.
 - FR5 schedule – reinforcement happens after every 5 times the behavior is performed.
- Responding tends to be steady with a pause after reinforcement.
- Higher ratios lead to slower responses.

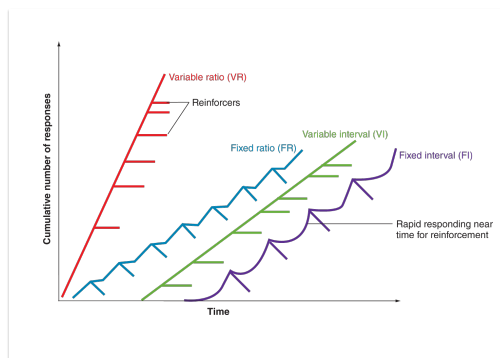




In the garment industry, workers are often paid "by the piece."

Schedules of Reinforcement

- **Variable Ratio (VR) schedule** – reinforcement occurs every "X" times the behavior occurs *on average*.
 - VR5 schedule – reinforcement happens every 5 times the behavior is performed on average.
 - Sometimes reinforcement happens after 1 time, sometimes after 10 times, but every 5 times on average.
- Responding tends to be high and steady with no breaks.





Slot machines “pay off” after a variable number of plays.

Schedules of Reinforcement

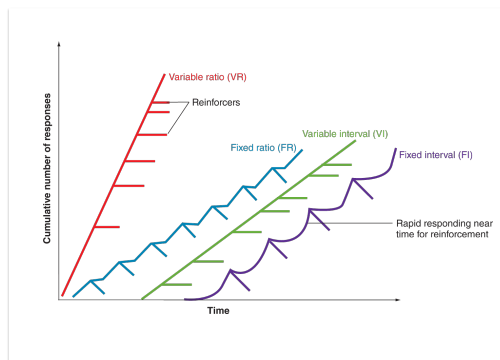
- _____ **schedules** - the behavior is reinforced the *first time it occurs* after an interval of time has elapsed.

Schedules of Reinforcement

- _____ **interval schedule** – an individual is reinforced the *first time* a behavior is performed after a fixed amount of time has elapsed.
 - A pigeon on a FI 5" (fixed interval 5 second) interval. Food is delivered at the first peck, then for the next five seconds pecking produces no food. After 5 seconds have elapsed, the next peck produces food.
 - Notice the pigeon still has to do something to get food... it's not automatically delivered every five seconds!

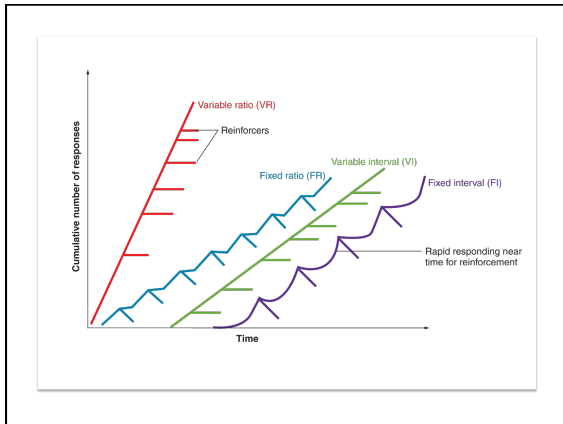
Schedules of Reinforcement

- With fixed interval schedules, there tends to be few responses right after reinforcement, with increasing responses as the interval draws to a close.
- “_____” rate of responding.
- An example: after abdominal surgery, morphine becomes available every 2 hours with a button push. Button pushes before 2 hours don't lead to anything. Responding increases as the time period is nearly expired.



Schedules of Reinforcement

- **Variable interval schedule** – an individual is reinforced the first time a behavior is performed after an average amount of time has elapsed.
- Example: checking e-mail. You might get an e-mail from your cousin overseas every 2 days on average, but you might get 2 in one hour, or nothing for a few weeks. You need to check your mail to find out!
- Steady rate of responding, no breaks.



Schedules of Reinforcement

- _____ - Behavior that has been maintained on an intermittent schedule is more resistant to extinction than behavior that is on continuous reinforcement.

Partial Reinforcement

- Though you usually discouraged your dog from jumping on you, you occasionally rewarded her by playing. But now you decide to stop the playing and not let her jump on you.
- Your neighbor used to let her dog jump on her every time, but recently decided to never let jumping happen.
- Your dog will persist with the "naughty" behavior longer than your neighbor's dog because your dog has been maintained on a partial reinforcement schedule.

Shaping

- What if we want to get an individual to perform a behavior that it rarely or never does on its own?
- Shaping!
- Reinforce small, successive approximations of the behavior until the target behavior is achieved.

Twiggy did not just hop on waterskis one day, and get a treat!



Possible Steps to Reward Twiggy

Step 1	Reward for sniffing at skis (not on water)
Step 2	Reward for walking on skis
Step 3	Reward for standing up on skis
Step 4	Reward for holding waterski bar
Step 5	Reward for doing 1-4 near pool of water
Step 6	Reward for actually waterskiing

Shaping

- One way to use shaping is with a “clicker,” or small toy that makes a clicking sound.
- First, pair the click sound with something that the individual being shaped likes.
- Then, use the click to precisely tell the individual when it’s doing something right.
- Clicker training has been used with a wide variety of animals in many different contexts.

Shaping

- _____ – putting together groups of already-shaped behaviors. Can lead to long sequences of behavior.



Observational Learning

- _____ – learning by watching others.
 - Humans appear to be particularly good at observational learning.
- Many different types of behavior, both positive and negative, are learned through observing others, and the consequences others receive.

Observational Learning

- Observation learning is more likely to happen if:
 - Attention – the individual performing the original action gets our attention.
 - – we're able to remember the behavior of another.
 - Reproduction – we're able to reproduce the behavior.
 - Motivation – we're motivated to reproduce the behavior (perhaps vicarious reinforcement).

Observational Learning

- Albert Bandura found that children were likely to explicitly imitate aggressive behaviors of adult models.
- – children closely imitated aggressive behavior and language used by adults toward an inflatable "Bobo doll."



Observational Learning

- Children were slightly _____ if they saw adult models being punished.
- Boys on average were more likely to be aggressive than girls.



Observational Learning

- Examples of imitation:
 - Rats or pigeons that watch others get food have an easier time getting food.
 - Monkeys learn to fear snakes by watching other monkeys react negatively toward snakes.
 - Humans and other species mimic gestures. We tend to mimic gestures of those we like, and like those who mimic our gestures.



We grow to like people who mimic our own behaviors.

Observational Learning

- Mirror neurons might be particularly important for learning to imitate others.
- People with higher empathy have more activation of mirror neurons than those lower in empathy.
- Autism may be due in part to a mirror neuron system that does not function the same as it does in most people.

Week 7

Cognition

- _____ – internal manipulation of information.
 - Helps us make inferences or draw conclusions.
 - Often used to reach a goal.



Cognition

- Thoughts can include _____. We can imagine a familiar face or piece of art, or mentally rotate objects.

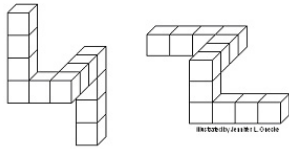


Figure 1: Based on Shepard & Metzler's 'Mental Rotation Task'

Cognition

- Artist Stephen Wiltshire can recreate entire cityscapes after seeing a location just once.



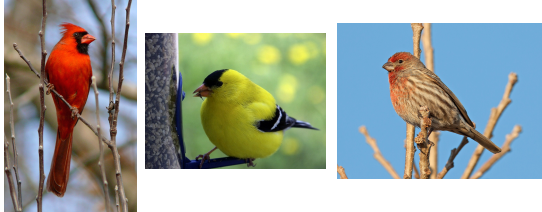
Cognition

- Thoughts can also include more abstract **concepts**, which are mental groupings of things, ideas, people etc.
- _____ – the most typical or standard instance of a concept.



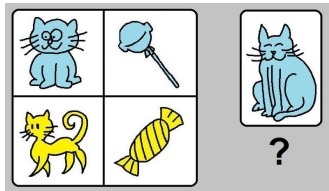
Cognition

- _____ – a specific representative of a category.



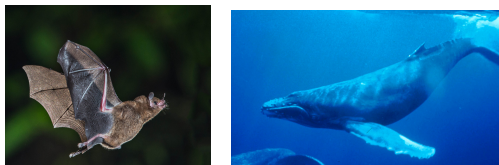
Cognition

- When we encounter something new, we compare it to the prototype and any exemplars we have to determine what category it belongs to.



Cognition

- Prototypes and exemplars don't always help us make a correct categorization, especially if we are inexperienced or if the item is unusual for the category.



Cognition

- People with brain damage might lose the ability to recognize items associated with certain concepts, such as “living” and “non-living.”



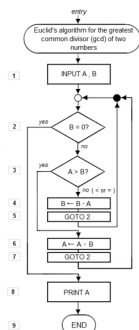
Cognition

- Individuals who were born blind have activation in the same brain areas as sighted people when thinking about concepts such as “vase” or “stapler.”
 - Visual processing is not necessary for concept formation.



Problem Solving

- Algorithm – step by step procedure that always leads to a correct solution.
 - To convert miles to kilometers, multiply the number of miles by 1.60934
- Some algorithms are too labor-intensive to be practical.
 - To unlock a phone you found, you could start with code 0001, then 0002 etc.



Problem Solving

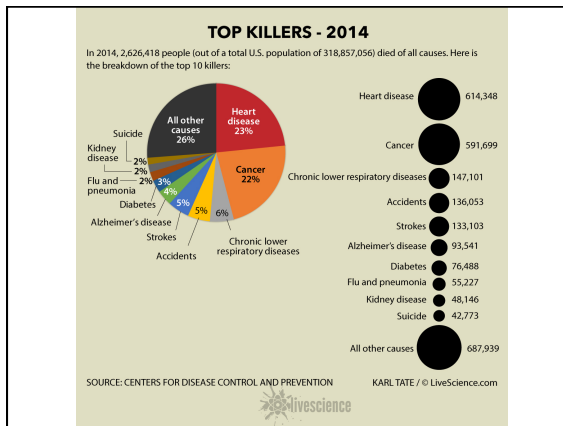
- _____ – shortcuts or rules of thumb we use in problem solving.
 - Pros: faster
 - Cons: don't always lead to the correct answer, and can sometimes lead to a wrong answer (and biases).

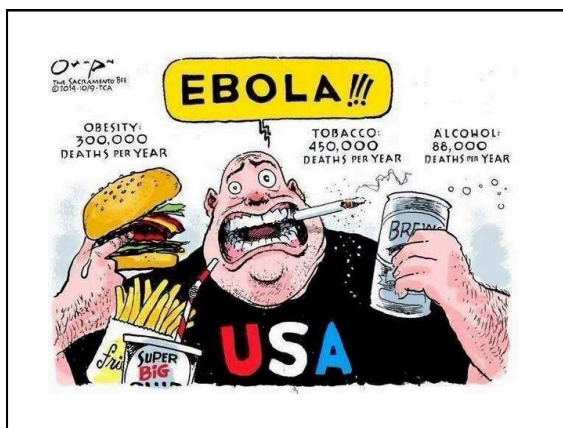
Heuristics

- _____ **heuristic** – we tend to think that an event is more likely if it's more easily remembered.
 - What's more common, death by shark attack, or death by selfie?
 - In 2015, there were 4 deaths due to shark attack, but 12 people were killed while taking a selfie.

Heuristics

- Is it safer to travel by car or airplane?
- According to the National Safety Council:
 - Americans have a _____ chance of dying in a car crash.
 - Americans have a _____ chance of dying in a plane crash.





- ### Heuristics
- **Heuristic** – people make judgments based on how closely something resembles a prototype.
 - Janine likes to listen to new age music, meditates often, and attends a spirituality group.
 - Is Janine more likely to be a holistic healer, or an elementary school teacher?
 - School teachers are much more common than holistic healers.

Heuristics

- **recognition heuristic** – people tend to place a higher value on things they recognize vs. don't recognize.
 - Which city has a higher population, Oxford or Lannion? Most people choose Oxford (which is correct), simply because they've heard of it.



Heuristics

- **affect heuristic** – when people are guided by their emotions or “gut feelings.”
 - **Somatic markers** – bodily reactions in response to emotions (e.g. raised heart rate).
- **forecasting** – predicting how we will feel about something in the future.
 - In general, people overestimate how happy they will be after a positive event (e.g. winning the lottery), and underestimate how sad they will be after a negative event (e.g. losing a job).



Heuristics

- Other things that influence our decision-making...
- **representativeness heuristic** – relying on a single piece of information when making a decision.
 - In a study (Ariely et al. 2006), students wrote down the last 2 digits of their SS number, then estimated how much they would pay for a variety of items. Those with higher SS numbers gave higher estimates than those with lower SS numbers.
 - Sales at stores work the same way...



Heuristics

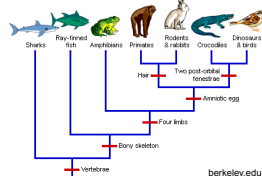
- _____ – the way something is phrased can influence our decisions about things.
 - In general, people are more sensitive to a loss (_____) than to a gain.
 - Would you take a class if you knew it had a 75% pass rate?
 - What if you were told it had a 25% fail rate?

Evolutionary Psychology

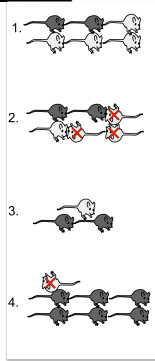
- **Evolutionary Psychology** – how our evolutionary history has shaped our traits, including our minds and behavior.
- Takes the perspective that much of human behavior is the result of evolved adaptations that solved problems that humans typically encountered in the past (and often still encounter).

Evolution

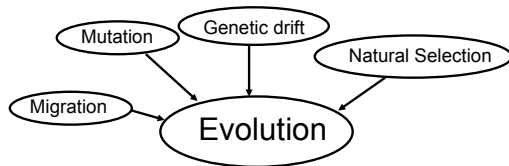
- **Evolution** – change in the gene frequencies of a population over time.
- This can mean larger changes over long spans of time, or small changes in just a generation.



- : the process by which certain individuals out-reproduce others in the population, thus causing the genes for the advantageous trait to be more common in the next generation.



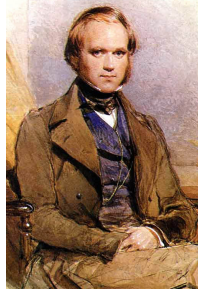
Natural selection is only **one** of the mechanisms that cause evolution. Others include mutation, migration, and genetic drift.



Mutation – a random change in DNA during replication.
Genetic drift – changes in population genetic structure due to chance.
Migration – individuals migrate from population to population.

Fitness

- **Fitness** - the extent to which an individual is well adapted to its particular environment. Usually measured as the number of offspring an individual is able to raise to adulthood (i.e. reproductive maturity) compared with others of the same population.
- The fittest individual in a population is the one that happens to have the most offspring, even if that individual is small, weak, sick, or dies young.



Who is more fit? Governor of California and youngest ever and 6 time winner of Mr. Olympia Arnold Schwarzenegger, or author of *The Origin of Species* and perpetually ill Charles Darwin?

Adaptations

- **Adaptation** - a trait that assists in survival and/or reproduction _____.
- Natural selection is the **only** evolutionary mechanism that leads to adaptations.



Adaptations

- The idea of adaptation isn't as simple as it seems at first...
 - Adaptations are not necessarily perfectly designed. Natural selection can only tweak traits, not completely redesign them.
 - Natural selection lags behind real time. The ancestral environment may or may not be similar to the present environment.

Behavioral Genetics

- **Behavioral genetics** – field that looks for links between genes and behavior in a population.
- Things to keep in mind about behavior:
 - Behavior is a phenotype like any other.
 - Behavior is _____ !
 - Behavior can be an adaptation.
 - Behavior can be heritable.

Heritability

- **Heritability:** the portion of phenotypic variation in a population that can be attributed to genotypic variation.
- Why we care... Natural selection can *only* act on traits that are heritable!
- In other words, if none of the variation that we see in a population is due to genetic differences, there are no genes that can be selected for.

Heritability

- A trait is only heritable if its phenotype _____ in a population.
- Since heritability is the “portion of the phenotypic variation in a population that can be attributed to genotypic variation,” if there’s no phenotypic variation, there can’t be a portion of phenotypic variation!



Dire wolf skulls from the Page Museum at the La Brea tar pits

Heritability

- Also, if all individuals in a population have the exact same genotype (even if phenotypes are slightly different), natural selection has nothing to act on.
- _____!
- E.g. each of us *inherits* the genetic instructions for the development of a nose from our parents. But since we *all* have the instructions for a nose, having a nose is not a *heritable* trait!

Evolutionary Psychology

- Evolutionary psychologists examine if/how our behaviors would have provided a survival/reproductive advantage to our ancestors (or more accurately, our ancestors' genes).
- _____ – any act that decreases the direct fitness of an actor and increases the direct fitness of a recipient.
- How could this be adaptive?

Relatedness

- (r) or the _____: the statistical probability that individuals share a particular gene in common as the result of RECENT common descent.

Common r values

- Some common values of r to know:
 - identical twins =
 - parent / offspring, sibling / sibling =
 - aunt or uncle / niece or nephew =
 - grandparent / grandoffspring, half-siblings =
 - great grandparent / great grandchild, first cousins =

r

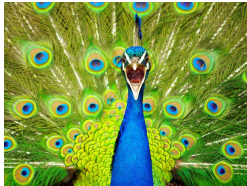
- The famous geneticist JBS Haldane said: "I would lay down my life for ___ brothers or ___ cousins". Can you see why?
- What other familial combinations would Haldane lay down his life for?
- Because of genetic relatedness, we predict that individuals will be "nicer" on average to related vs. unrelated individuals.

Evolutionary Psychology

- _____ – if unrelated individuals engage in repeated exchanges, both can benefit by helping each other.
- Other social behaviors besides altruism:
 - Cooperation – both parties benefit.
 - Selfishness – an individual engages in a behavior that is detrimental to another.
 - Spite – an individual engages in a behavior that is detrimental to both parties.

Sexual selection

- Darwin realized that males of many species have elaborate traits and females do not.
- Why?



Sexual selection

- Males tend to have much greater _____ in their reproductive success than females. This is because:
 - Most females in a population reproduce.
 - Some males in a population might get a disproportionate number of mates in a population, while others get none.

Sexual selection

- Since males can in theory reproduce much more quickly than females, we expect:
 - Males to compete with one another for access to females.
 - Females to be _____ about mates than males.

MHC

- The Major Histocompatibility Complex (MHC) is comprised of a suite of genes that affect the immune system, and is found in most vertebrates.
- MHC genes are quite variable, with one human MHC gene containing _____ alleles.

MHC

- Humans can tell the difference in the MHCs of other humans by smell.
- Women find attractive (Wedekind et al. 1995):
 - Men with _____ MHCs to their own when not on the pill.
 - Men with _____ MHCs to their own when they are on the pill (which mimics the hormonal effects of pregnancy).
