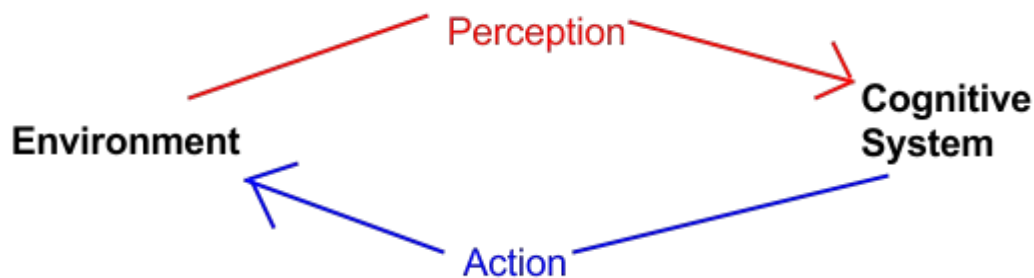


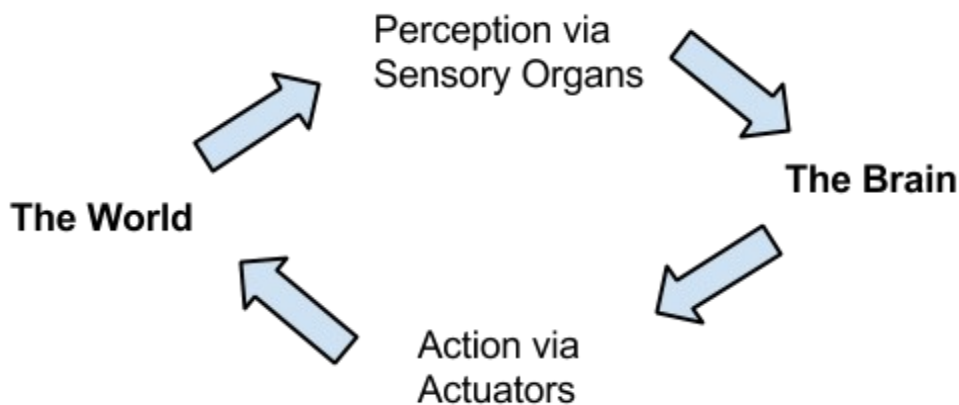
CGSC 1001 Mysteries of the Mind - Final Review Package

Lecture #1: Learning, Memory, and Representation*What is a Cognitive System?*

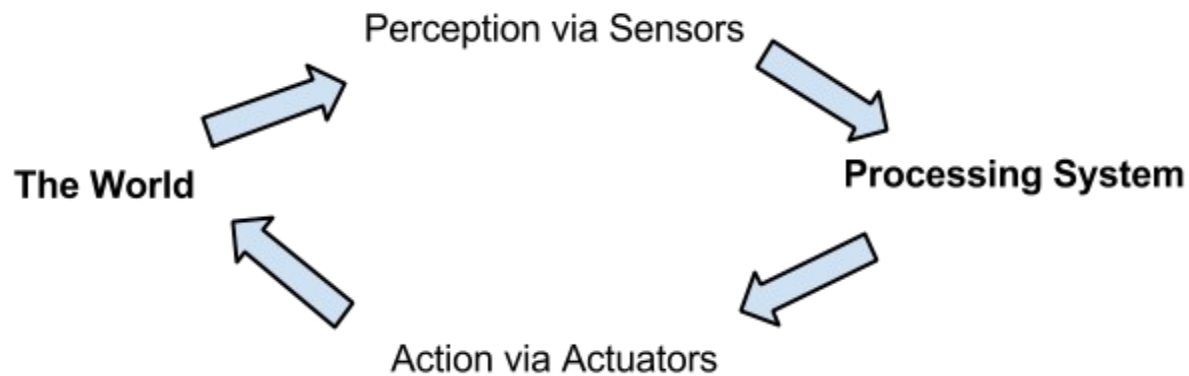
- A Cognitive System is the system in which an agent perceives the outside world around that agent.
- In the perception phase, it turns things from the environment into meaningful internal representations.
- In the action phase, it turns these perceptions into physical changes on the environment.

*How does the animal and human mind work?*

- The human mind works by perceiving the outside environment by using their sensory organs that include their eyes, ears, nose, and senses on their skin.
- Once processed, these perceptions are turned into actions using our bodies - these actions are meaningful physical changes on the world.

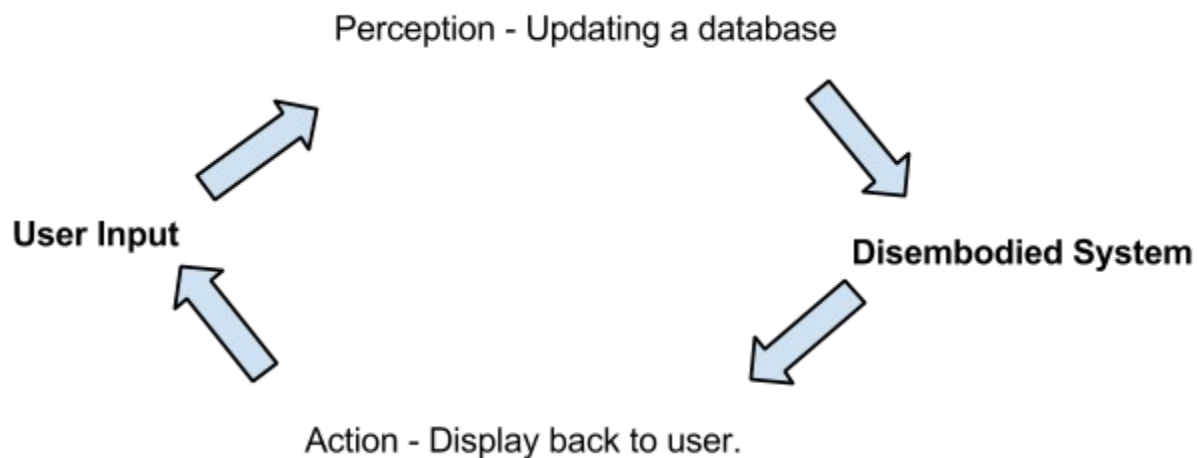
*How does the Robotic "mind" work?*

- The robotic mind works much like the human mind in the sense that they still perceive and process information to produce and action, although instead of using sensory organs and a body, robots use sensors and actuators.
 - robots perceive the world through using their sensors to understand the environment around them an example of these sensors would be light sensors to help perceive light inputs.
 - from the information taken and perceived by their sensors robots then perform and output using actuators which come in many different forms.
 - an example of this process would be a automated vacuum which uses its sensors to navigate around in order to clean.



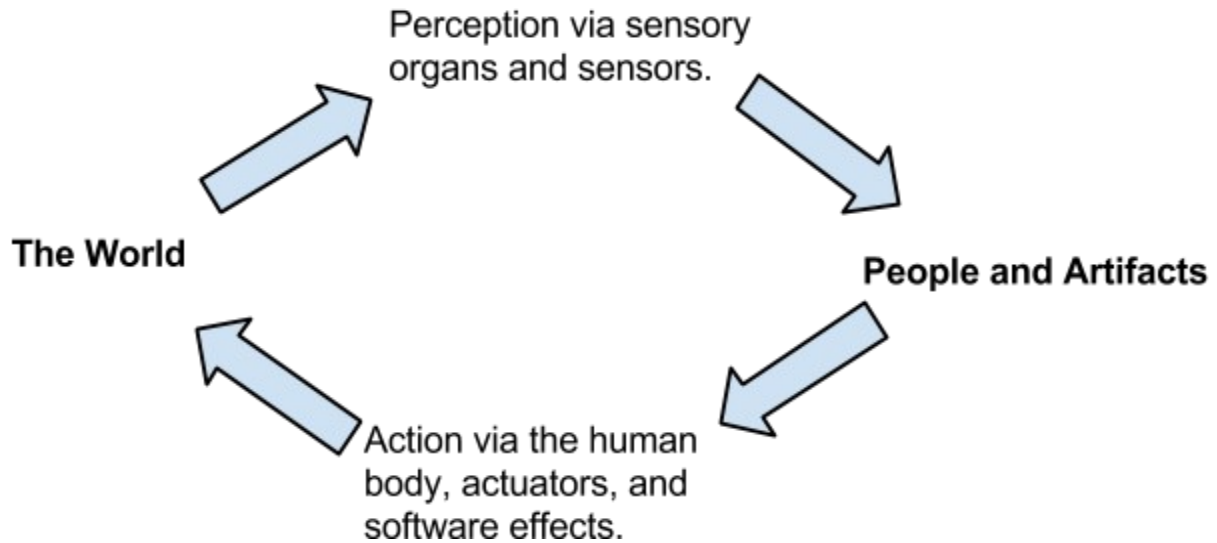
How does a Disembodied System work?

- A disembodied system functions much differently than the other cognitive system as it requires a user input in order to work rather than seeking out information within the outside world.
 - When a disembodied system is perceiving information it updates its database.
 - From here rather than performing an action it takes the information from the updated database and returns a display back to the user.



What is Distributed Cognition and how does it work?

- Distributed Cognition is the belief that information is not only embedded within an individual but in both their social and physical environment.
 - in distributed cognition perception happens through both sensory organs in humans and sensors in robots in agents and artifacts.
 - actions happen through using both the body and actuators.



Cognition as a manipulation of representations

- When an animal/robot sees something it activates neurons/pixels which hold location coordinates much like a grid that help us process the image for what it is.

How are Representations stored in Memory?

Animals	Software	Distributed Systems
Within animals memory is stored in the brain within both long-term and short-term.	Within software systems memory is stored in databases and symbols.	Within distributed systems it is stored within several systems which include the brain, paper, disk, and environmental manipulations.

How does the Human memory remember facts & perceptions - NOT skills!

Sensory memory - sensory memory is like a scratchpad where memories can be overwritten with new memories, this scratchpad is re-written every few seconds.

Short-term memory - short-term memory acts like a temporary storage of memories, some things from your short-term memory end up in your long-term memory.

Long-term memory - Memories in your long-term memory are stored here forever although we might have difficulty retrieving these memories.



What is Learning? And the different kinds of Learning?

Learning - Learning is defined as changing memory to prepare a mind for better action in the future. An example of this would be studying for my Mysteries of the Mind Final at 2:34am on a Friday night.

- Learning includes: habituation, sensitization, classical conditioning, practice, imprinting, observational learning, testimony and classical conditioning.

Learning // Habituation - The reduction in a behavioural response with repeated exposure to a particular stimulation.

- an example of this would be someone screaming, you are shocked the first time but as they scream more and more your reaction starts to diminish and you become less shocked as it happens.

Learning // Sensitization - The increase in a behavioural response with repeated exposure to a particular stimulation.

- an example of this would be someone having barbeque sauce for the first time. As they have barbeque sauce more often they become hooked on barbeque sauce.

Learning // Classical Conditioning - Classical conditioning is learning from associating two previously unrelated stimuli, what this means is that you react similarly to stimuli A as you would for stimuli B.

- an example of this would be a dog and a leash. The dog starts to associate grabbing the leash with a walk even though they are not definitively related to one another as you could just be moving the leash off the table.

Learning // Kinds of Operant Conditioning - There are four kinds of operant conditioning:

Positive reinforcement, negative reinforcement, positive punishment, and negative punishment.

- Positive Reinforcement: Positive reinforcement is the strongest kind of operant conditioning in regards to promoting behaviour. It is when you make a behaviour more likely by presenting someone with a reward.
- Negative Reinforcement: Negative reinforcement is when you present someone with a item in order to remove an annoying behaviour.
- Positive Punishment: Positive punishment is when you present someone with a punishment in order to diminish that unwanted behaviour from happening.
- Negative Punishment: Negative punishment is when you take away an item of desire from someone in order to diminish an unwanted behaviour.

Learning // Practice - Practice is the repeated action of doing something over and over again and learning how to do that particular task better. Practice can use both reinforcement and punishment in order to perfect the skills.

- play is theorized to be a form of practice among children for future events such as running, fighting and caretaking when kids play house.

- motor skills become more efficient over time due to automatization.

Learning // Imprinting - Imprinting is a time sensitive learning within animals where they believe that a different entity plays the role as their parental figure.

Learning // Observational Learning - Observational learning is learning through watching what other people are doing and copying them. An example of this would be watching how to cook on YouTube.

Learning // Testimony - Testimony is learning through someone telling you something, this can be auditory or read. Typically university learning is testimonial.

Learning // Cultural Learning - There are three types of cultural learning they are as follows conformist bias, prestige bias and content bias.

conformist bias - do what everyone else is doing.

prestige bias - do what the most successful are doing.

content bias - do what the best idea is.

Lecture #2: The Cognitive Level

Learning at the Cognitive level // Productions, what are they and what do they do?

- Productions are little information processing rules that are fired by the mind when it wants to do something.
 - IF you are HUNGRY, and you SEE FOOD, then you will EAT the FOOD.
- Productions affect us as when something good/bad happens those productions used to reach that state will be made more/less likely to happen again in the future.

Learning at the Biological level // Synapses and Synaptic change

- synapses is the spaces between neurons where communication happens. There is a theory called "Hebbian Theory" that states that neurons that fire together wire to together which means that synapses becomes more effective with repeated use. This idea of synapses is how associations are learnt since these neurons can coactivate with one another.

Learning at the Chemical Level // Synaptic change in taste receptors

- At the chemical level some of the learning occurs in the form of synaptic change. As you age your taste receptors change too, learning how to tolerate more bitter foods. This explains why kids are often nauseated by the bitter foods that adults tend to enjoy.

Learning at the Physical Level // A bad level for Description

- The physical level is a poor level for the description of learning.

How can we tell if a level is Legitimate?

- we can tell a level is legitimate if we can make successful casual predictions using the ontology of that level.
 - Ontology - a set of things that is said to exist.

Why are Scholars dismissive of the levels above the one they work? // Reductionism

- Scholars are dismissive of the level above them, because they believe that the regularities found at higher level are or will be deducible from lower-level regularities. This is a form of reductionism.

Why do we need the Sociological Level? // Group Behavior Phenomena

- we need the sociological level because it helps describes certain group behaviours such as strikes, which otherwise would be difficult to do on an individual basis.

Why do we need the Psychological level? // Influences of social context

- we need the psychological level because in addition to the sociological level to help explain behaviors that are not influenced by their social context.
- we need it in addition to the cognitive level since it is a place for non-causal statistical models.

Why do we need the Cognitive level? // Information Processing Level

- we need the cognitive level in addition to the psychological level because it acts as an explanation for certain behaviours that need the language of information processing otherwise it would be to vague.
- we need the cognitive level in addition to the biological level because both mental states and processes are defined functionally not anatomically.

Why do we need the Biological Level?

- we need the biological level in addition to the cognitive level because sometimes the biological structure influences behaviours in particular ways that the cognitive level cannot explain.
- we need the biological level in addition to the chemical level because certain brain structures appear to be used in different ways chemically.

Why do we need the Chemical Level? // The effect of drugs

- we need the chemical level in addition to the biological level because it helps describe certain behaviours particularly with people who are under the effects of drugs.
- we need it in addition to the physical level since physics doesn't tell us much about human behaviour.

Proximate and Ultimate Description in Cognitive Science // Why do we eat?

Proximate: we eat because we enjoy the taste of food and it satisfies our hunger.

Ultimate: we eat because we need the nutrients and it is necessary for survival.

The Cognitive level // Information Processing Level

- cognitive science prefers descriptions of information and how it is represented and changed.
 - an example of this is a theory cognitive scientist have come up with that individual memories have certain "activation levels" that determine how easily that memory can be accessed.

Lecture #3: The Fields that Compose Cognitive Science

- Cognitive science composes of three (3) different fields they are historically core fields, contemporary fields, and secondary fields.

Historically Core fields of Cognitive Science

- The historically core fields of cognitive science composes of psychology, computer science, linguistics, and philosophy.

Historically Core Fields // Psychology

- Psychology is characterized as the study of natural minds, mostly human. Psychology is also broadly interested in cognitive functioning, even when it is erroneous which means it is wrong.
- Methods in studying psychology include laboratory experiments, statistical analysis, and computer cognitive modeling.
- The subfields of psychology include...
 - cognitive psychology - broad field of basic research in human internal mental processes.
 - human factors/human-computer interactions - how humans interact with human-designed artifacts such as user interfaces.
 - evolutionary psychology - how our evolutionary history has made our minds what they are.
 - Psycholinguistics - the study of language with experiments
 - comparative psychology - compares animal cognition to humans.
- The critiques of psychology include...
 - There isn't enough model building, which means we cannot play 20 questions with nature and win as we don't know the answers.
 - Dustbowl empiricism, which means that there isn't enough theory in psychology as there are not theoretical psychologists.
 - methodologically limited, cognitive science is made possible since psychology refuses to embrace the methods of other fields.
 - Underestimation of the complexity of language, psychology is naive to the several complexities that are present in language.

Historically Core Fields // Philosophy

- psychology is characterized as the study of big questions such as what the concepts in life mean. Aside from this philosophy is quite broad.
- methods in studying philosophy include traditional thinking and writing as well as thought experiments, conceptual analysis, argumentation, and theorizing from evidence from other fields and commonsense observations.
- the subfields of philosophy include...
 - philosophy of the mind - An example of this would be, which animals feel pain?
 - philosophy of science - An example of this would be, how is science practiced today?
 - philosophy of language - An example of this would be, how do words connect to have meaning?
- the critiques of psychology include...

- They don't spend enough attention to empirical study, they don't look at studies that have been based on actual and objective observations or experiments.
- They believe that the existence of a word implies the existence of its intended referent.
- They are too concerned with unimportant issues, why should we care about how unicorns came to be?

Historically Core Fields // Computer Science

- computer science is characterized as the study of how mental processes can work on machines and as well as how humans can interact with computers effectively.
- the methods involved in computer science are typically building and testing computer programs.
- the subfields of computer science include...
 - artificial intelligence - artificial intelligence is building and understanding mental systems.
 - human-computer interaction(HCI) - HCI is designing computer interfaces that humans can effectively interact with.
- the critiques of computer science in particular artificial intelligence include...
 - insufficiently concerned with natural intelligence, what this means is that AI researchers don't care about if the programs work the same way that people or animals do.
 - they are overly optimistic about the future of AI, to mimic the basic human functions like picking up an object is very difficult to mimic on a computer program so it will take many years to even master such a basic function.

Historically Core Fields // Linguistics

- linguistics is characterized as the study of spoken human language or signed natural language. This does not include computer, animal or written language.
- the methods involved in linguistics include sound analysis, grammar creation and corpus analysis.
- Linguistics is strongly characterized by both its subject matter and methods. The subfields of linguistics include:
 - phonology - how sounds are organized and used within language
 - morphology - how sounds morph to interact in words to have different meanings.
 - syntax - how words are organized within a sentence
 - semantics - the meaning in language
 - pragmatics - how words interact with sentences to change meaning.
- The Critiques of linguistics include...
 - Linguist build models of language but don't know what to do with them after.
 - Linguist do not attempt to nor are they familiar with other findings about the mind and how it works.
 - Linguist are only concerned with their part in cognition.

Contemporary Core Fields // Neuroscience

- Neuroscience is characterized as the study of how the brain processes information and creates cognitive processes. Neuroscience is the biological functions of mental phenomena.

- methods in the study of neuroscience include neuroimaging, single-cell recording and genetic analysis.
- Neuroscience overlaps with biology, physiology and psychology.
- the critiques of neuroscience are that...
 - Neuroscience underestimates the complexity of language and other thought processes.
 - Neuroscience cannot shed light on the subjects that other people are interested in.
 - In neuroscience they tend to be dismissive of other approaches or reductionist.
 - They lean too far on the nature side of the nature vs nurture debate.

Secondary fields // Education

- Education is characterized as the study of how people, typically children learn. Education also looks at how to design education to help people learn effectively.
- The methods involved in education are naturalistic observations of case studies and empirical studies.
- the critiques of education are that...
 - The case studies that are performed in education are worthless or close to it.
 - Education is applied and cannot or does not tell us very much about cognitive processes as it is the straight application of these processes.
 - The control studies in education are very poor, due to extreme difficulty and expense.
 - Education only deals with a single part of cognition.

Secondary Fields // Anthropology

- Anthropology is characterized as the study of social organization and human culture.
- The methods involved in anthropology include performing fieldwork, ethnographic observation and interviewing. There is a strong emphasis on qualitative study in anthropology which means non-numerical studies.
 - anthropology includes archeology and cultural anthropology includes cognitive.
- the critiques of anthropology are...
 - Anthropology tends to lean too far onto the nurture side on the nature vs nurture debate.
 - research is too qualitative and expensive.
 - the research found in anthropology is not general enough to be applicable.
 - They are "splitters" not "lumpers"
 - Splitters - they characterize and categorize information into subcategories.
 - Lumpers - they generalize and group information into larger groups.

Lecture #4: How Cognitive Science Can Help You Through School

Learning Styles

- There are some interesting theories about learning styles, but scientific evidence that people have different learning styles is very weak.
 - What this means is that some students and teachers are bad at learning and teaching, but it's not the learning style that affects their ability to learn.

Taking Notes

- Handwritten notes are better than typing notes because it forces the brain to mentally process what you are writing which invokes a deeper thinking process.
- You also get more distracted by the web.

Multitasking

- multitasking is not real, people cannot do it.
- When people attempt to multitask they are reducing their performance in both tasks drastically.

Writing

- writing is key to thinking clearly
- writing is one of the most important skills to have in university

Where to Study

- It is better to study in a variety of places as it increases retention of knowledge when studying in multiple environments.

Sleep

- Sleep is necessary for encoding long-term memories.
- when you're awake your brain is active, when you're asleep your mind strengthens the connections to make your mind more efficient.

Adults with Learning Disabilities and Effective Study Habits**The Working Definition of a Learning Disability**

- A learning disability is a unexpected academic underachievement
- These learning disabilities affect a specific psychological processes
- Specific impairments are:
 - Associated with dysfunction of the brain
 - It is present with you since birth
 - It is not primarily explained by cultural, psychosocial, psychiatric factors or lack of educational opportunity.
- It is distinct from global learning intellectual impairments
- There is no sign of academic improvement after intervention.

Academic Achievement**Reading**

- These are learning disabilities that are associated with reading: word recognition/phonology (dyslexia), fluency, and comprehension.

Math

- The learning disabilities that are associated with math: Problem-solving, accuracy (computations) and fluency.

Written Language

- The learning disabilities that are associated with written language are: handwriting, spelling, fluency, written expression. An example of this would be the organizing thoughts and the flow of ideas.

Oral Language

- Expressive or receptive
 - Expressive - Effectively conveying thoughts and ideas.
 - Receptive - Able or willing to receive something: especially signals or stimuli.

Specific Processing Impairment

Specific Cognitive Weaknesses:

- Visual Processing: Generating, storing, and retrieving images.
- Auditory Processing: Processing sounds.
- Working Memory: Manipulating information.
- Processing Speed: Performing simple tasks quickly.

Pattern of Strengths and Weaknesses

- Essential Features:
 - a. Average to above-average intelligence
 - b. a specific academic weakness
 - c. a specific cognitive processing weakness
 - d. there is a meaningful relationship between the cognitive deficit and the academic deficit.

Lecture #5: Cognitive Science and the Real World

Law // Lineups

- Lineup: Where a victim or a witness look at a panel of people to point out a suspect.
 - When looking at the methods of lineups it has been proven that sequential lineups are more effective than simultaneous lineups. This is because sequential lineups re-jog one's memory whereas simultaneous lineups compare people.

Law // False Memory

- False Memory: False memory is where someone takes an accusation as an actual memory. False memory is an issue as many innocent people were wrongly convicted for crimes they didn't commit due to children taking the false memory of them being abused.




Law // Case-Based Reasoning

- Case-based reasoning: Case-based reasoning (CBR) is an artificial intelligence paradigm that reasons what to do based on similar situations. In law, lawyers need it to find similar cases to the ones they are working on.

Medicine and AI

- The earliest forms of artificial intelligence programs were created to diagnose patients, they were called "expert systems" which were AIs intended to mimic human behaviour. They were designed too...
 - Perform diagnosis on patients
 - Retrieve medical information on patients
 - Perform image recognition and interpretation
- These expert systems were never used because they do not fit into the current structure and function of medical establishments.

Human-Computer Interaction (HCI)

- HCI is how humans interact with computers and it is judged on (3) things:
 - a. Usefulness - How useful is the computer? 
 - b. Usability - How easy is the computer to use? 
 - c. Learnability - How easy is to learn how to use the computer? 

Politics // Metaphors

- Metaphor - Theory that we think about abstract concepts as metaphors with more basic, usually typical concepts.

Consumer Behaviour // Behavioural Economics

classical period - during the classical period it was believed that economics allied with psychology.

neo-classical period - during the neoclassical period it was viewed that humans were rational: homo economicus or the "rational man" assumption.


- psychology and cognitive science influence shows the flaws in the homo economicus assumption.
 - What is Watson? Watson is a computer program that was designed by IBM as a "question answering" machine.
 - What is Deep Blue? Deep Blue was a computer program that was designed by IBM as a chess playing program.
 - What is Aaron? Aaron is a computer program that makes art.
 - What is the Turing Test? The Turing Test tests how good a computer program is by seeing if it can resemble human language.
 - What is the Loebner Competition? The Loebner Competition is a competition where people gather and test their programs by using the Turing Test to see which programs are the best.
 - What are Visual Analytics? Visual Analytics are computer visualizations that are created to help solve an underlying problem.

Lecture #6: Perception

Perception - Perception is the process by which an agent interprets and organizes sensations to produce a meaningful experience of the world around them.

- From a cognitive science perspective, it means turning information from one form into new and meaningful representations.

Typical Sensory Modalities

Physical Signal	Perceptual Modality
Light	Vision
Air Vibrations (Sound)	Audition (hearing) and echolocation 
Physical Pressure	Haptics (touch)
Chemicals	Taste and Olfaction (smell)
Body Position	Kinesthetics and Proprioception
Senses in bowel and stomach	Atypical

Human Vision

Extramission Theory - Rays of light emanating from the eye in combination with the light in the world allow us to see.

Introumission Theory - Rays of light reflected from objects into the eye allow us to see.

Rods and Cones on Retina

Rod - The most light sensitive photoreceptor cells in the retina used of night vision and peripheral vision.

Cones - There are (3) types of cones that correspond to colours...

- **Short = Blue**
- **Medium = Green**
- **Long = Red**

Depth Perception

- Size: The bigger the closer that object is to you.
- Perspective: Things are smaller on the fovea as they move away.
- Occlusion: When something is in front of something else, example that tree is occluding that house.
- Texture, Shading, Saturation: The closer things are the more saturated and texture gradient.
- Multiple Images - Includes both motion and binocular vision, when we see things move it helps us determine how big it is.

Dorsal and Ventral Stream

Dorsal Stream - The dorsal stream runs along the top of the brain like the dorsal fin of a shark, it is the "where" pathway. It is associated with motion, representation of object location and the control of both sets of arms and eyes.

Ventral Stream - The ventral stream runs along the bottom of the brain and is the "what" pathway. It is associated with form recognition and object representation and it is also associated with the storage of long-term memories.

How Does Audition Work?

- Audition works by taking acoustical energy which are sound waves and vibrates the eardrum when in the air. When underwater, it vibrates through your body so that you can hear.
- Localization is like depth perception for your ears, and it works by listening to the differentiation between the sounds in your ears to determine where an object is.
- What is echolocation? Echolocation is determining where something is by using echoes and the information they provide. Echolocation is used by both bats and dolphins.

Haptics (Touch)

- Haptics is crucial for the manipulation of objects, particularly in combination with proprioception. We feel through the sensors in our skin.
 - There are (2) action perceptions going on all the time
 - i. Haptics
 - ii. Vision

Olfaction (Smell)

- For smell there is no clear energy continuum like there is for sound and light.
- Much of what we experience in taste, actually comes from our smell.
 - Which is why food taste bland when our noses are stuffy.
- What is the Smelly T-Shirt studies? The smelly t-shirt studies were studies that found that based on smell women could detect immune system compatibility, whereas men were able to detect ovulation.
 - What do Animals use Smell for?
 - They use it to establish territory
 - Sense fertility
 - Ant Pheromones

Proprioception, Kinesthesia and the Vestibular System

Proprioception - You know where your body parts are without physically seeing them.

Kinesthesia - Knowing how your body moves.

- What is Phantom Limb? Phantom Limb is believing that a missing limb is still there. Phantom Limb is needed for an artificial limb to be effective.
- What is interoception? Interoception is the perception of bodily functions such as the perception of hunger, need of digestive elimination and heart rate.

Lecture #7: Analogy

Analogy - An analogy is a comparison between two things, typically on the basis of their structure and for the purpose of explanation or clarification.

- The Steps in creating an analogy are:
 - 1) Retrieval - Retrieval is the process of finding something in memory to make an analogy with.
 - 2) Mapping - Mapping is finding correspondences between elements of the two analogues.
 - 3) Transfer/adaptation - The transfer/ adaptation step is using (and changing) knowledge of one analogue to learn or invent something about the other one.
 - 4) Evaluation - The evaluation phase is where you determine if the transfer did what you wanted it to do.
 - 5) Storage - Storage is the final process where the analogy is indexed in memory so that it can be used in the future.

Analogy by Other Names

- Exemplar-based reasoning - Exemplar based reasoning is reasoning based on particular examples rather than on prototypes or rules.
- Memory-based reasoning - Memory-based reasoning is reasoning based on memories rather than on using more abstract reasoning rules.
- Instance-based reasoning - Instance based reasoning is reasoning based on a particular instance in time, much like exemplar-based reasoning.
- Case-based reasoning - Case-based reasoning is an AI field that reasons from "cases" in memory

Metaphor

- Primary Scene - Primary scene is cognitive representation of experiences that everyone shares, such as swallowing.
- Correlation-based Metaphor - A correlation-based metaphor, the base metaphor is sensory and the target is abstract. An example would be “prices have fallen sharply”.

Lecture #8: Language and Communication

What is Language? Language has two descriptions as Functional and structural description.

- Functional Description - Language is a complex code by which agents can communicate information. When we say “complex” we are not referring to animal language such as bird calls.
- Structural Description - Language is a set of symbols that can be arranged in a certain way, also known to the English language as words and sentences.
- Some forms of language include: Natural Language, artificial language and computer language.
 - Natural language - natural language is language that is created by the culture of humans.
 - Artificial language - artificial language is language that is created by small teams and individuals.
 - Computer Language - computer language is language that is created as an artificial language for communications with computers, it typically lacks in ambiguity.

Animal Communication

- Animal communication is also referred to as “zoosemiotics”.
 - zoosemiotics works through the use of gestures, expression, gaze following, vocalization, olfactory communication, and colouration.
 - the function of zoosemiotics is to establish dominance, courtship, ownership, food alert, raise alarm and metacommunication.
 - The vervet monkeys used different calls to alert the other monkeys of the different predators.
 - the honeybee’s use a waggle dance to signal where food is relative to the sun.


Human Language

- Human language has structure, but that structure is implicit.
- We all know how to use language, but we don't know how we do it. Much like other phenomenon we must study it.
- Our knowledge of how to speak is implicit.

Disciplines of Linguistics

- Phonology - phonology is how sounds are organized and used in language
- Morphology - morphology is how sound and meaning interact in words.
- Syntax - syntax is how sentences are put together.
- Semantics - semantics is meaning in language.
- Pragmatics - pragmatics is how sentences interact with context to change meaning.

What is Logic?

- Logic - Logic is a formal and normative system of reasoning.
- Symbolic logic specifies ways that sentences can be represented unambiguously.
 - For all x (if cat(x) then mammal(x)) 
- Typical logic is very limited in its semantics

Lecture #9: Cognitive Biases

Anchoring

- What is anchoring? The anchoring is a processes of comparing something when you evaluate. The "anchor" is what you compare something to when you evaluate it.
 - An example would be comparing a movie to another movie when you say its good.
- Restaurants use anchoring by putting a very expensive on the menu to make other items look more reasonably priced.

Bandwagon Effect and Herd Instinct

- What is the Bandwagon effect? The bandwagon effect is believing things because everyone else around you believes the same thing. An example of this can be seen in sports when people are called Bandwagons for liking a team for doing good.
 - The bandwagon effect is why cults try to keep their members from talking to people outside of the cult so that they are not influenced by outside influences that are opposing the views of the cult.
- What is the herd instinct? The herd instinct is believing what everyone else does to avoid any social conflict. An example of this would be someone is vegan because their spouse is a vegan.

Confirmation Bias

- Confirmation Bias - A confirmation bias is when you accept, seek out, and remember things that will support your views. You also interpret information in a way that supports your views.

Contrast Effect/Context Effect

- Contrast Effect - The contrast effect is if you are observing two things at the same time, you will focus more on their differences when evaluating.
 - When men look at beautiful women, they will rate their wife as less attractive.
- Distinction bias - Distinction bias, things appear more different when viewed simultaneously.

Endowment Effect/Loss Aversion

- Endowment Effect - The endowment effect is people will demand more to give up an object than they were willing to pay to get it. This is due to the fact that once you own something, you find it more valuable.
- Loss Aversion - In economics and decision theory, loss aversion refers to people's tendency to strongly prefer avoiding losses to acquiring gains. Most studies suggest that losses are twice as powerful, psychologically, as gains.

Hostile Media Effect - The Hostile media Effect is when you watch the news, you tend to think they are hostile to your political views.

Temporal Discounting - Temporal Discounting is the fact that we value things in the future less than things now, in a chaotic environment temporal discounting is at its extreme as the future is uncertain we value things much more in the present.

Moral Credential Effect - the moral credential effect is thinking of yourself as having acted morally allows for yourself to act immorally or behave badly. People will compensate between good and bad to reach an equilibrium with things such as bike helmets and dieting.

Negativity Bias - The negativity bias is the bias that people pay more attention to the negative information, this is possibly due to our evolutionary history gearing our minds to focus on the negative as the negative back then could've been a great threat to life.

Omission Bias - The omission bias is we think that doing harm is than not doing something that causes equal harm. Is it better to kill someone or do nothing to stop someone's death?

Outcome Bias - The outcome bias is when judging a decision based on what ended up happening rather than on the information provided at the time the decision was made. An example of this is drunk driving, is it right to punish someone who kills someone more severely than on who got lucky and doesn't.

Planning Fallacy - Planning fallacy is the fact that we underestimate how long it will take us to complete tasks in the future, this makes it easy for us to overbook ourselves.

Wishful Thinking - Wishful thinking is believing something because you want it to be true, an example of this would be mothers who believe that their guilty son is innocent.

Availability Heuristics - Availability heuristics is assuming that things that are most easily brought to memory are more common or probable, a issue with this is vivid and emotional things are easier brought to memory.

- When shown news of murders, it makes you think that murders are more common than they really are.

Base Rate Neglect - Base rate fallacy, also called base rate neglect or base rate bias, is an error in thinking. If presented with related base rate information (i.e. generic, general information) and specific information (information only pertaining to a certain case), the mind tends to ignore the former and focus on the latter.

Belief Bias - Belief bias is the tendency to judge the strength of arguments based on the plausibility of their conclusion rather than how strongly they support that conclusion

Conjunction Bias - The conjunction fallacy is a formal fallacy that occurs when it is assumed that specific conditions are more probable than a single general one.

Gambler's Fallacy - The gambler's fallacy, also known as the Monte Carlo fallacy or the fallacy of the maturity of chances, is the mistaken belief that if something happens more frequently than normal during some period, then it will happen less frequently in the future, or that if something

happens less frequently than normal during some period, then it will happen more frequently in the future

Clustering Illusion - Clustering illusion is different ways for us to see patterns where none actually exist.

Primacy and Recency Effect - The primacy and recency effect is that we remember what happens at the beginning and end more than what happens in between. This has been tested with colonoscopies to make it more pleasant.

Just World Phenomenon - The just world phenomenon is that you believe the world is a just place, you will have a tendency to believe the victims of crime and misfortune did something to deserve it.

Actor-Observer Bias - The actor-observer bias is the tendency to explain the behaviours of others in terms of stable traits, and to explain one's own actions in terms of reactions to the situation.

Risk Compensation - Risk compensation is a theory which suggests that people typically adjust their behavior in response to the perceived level of risk, becoming more careful where they sense greater risk and less careful if they feel more protected.

Lecture #10: Cognitive Myths

We only use 10% of our Brains

- This is not true, we use all of our brain for a matter of fact if any part of our brain gets damaged, you will suffer deficits.
 - Evolution would not "waste" energy building vast parts of your brain you do not use.
- Why would we believe that? We believe that we only use 10% percent of our brain due to availability cascade, wishful thinking, and people want to make money from you.
- What is true? What is true is that we can lose whole hemispheres and still function relatively normally due to the brain having redundancy.
 - If we remove 70% of your neurons randomly, we're not sure how badly off you will be.

Extrasensory Perception (ESP)

- ESP is not real, but we believe it due to confirmation bias, neglect of negative results and wishful thinking.

Listening to Mozart makes babies smarter

- This is not true, but we believe it because we hope it is true.
- the effect is small, short term, and only based on arousal from listening to the music
- The baby can get the same effect from gearing a scary passage from a Stephen King Book.

IQ Test Are Biased

- If IQ test were biased, they would underpredict later success for certain groups and overpredict for others BUT this does not happen.
- Huge panels of scientists with widely varying viewpoints have concluded that IQ test are not biased.
- A process called item analysis is used to identify bad IQ test questions.

Happiness

- Money and Happiness - Money correlates with happiness until you're making about \$75k per year in Canada, then happiness begins to level off.
- Life events do not affect happiness - Winners of lotteries and people who have just lost a limb have changes in happiness for a couple of months but then return to normal.
 - This is due to much of our happiness being genetics, roughly 60% is genetic.
- There are two kinds of happiness:
 - 1) Pleasure, which is day-to-day happiness.
 - 2) Life Satisfaction, which is a long-term happiness

Childhood Abuse Leads to Psychological Disorder

- It has been shown that childhood abuse and psychological disorders weakly correlate with one another with a correlation rating of 0.09.
- On the other hand it has been shown that conflict-ridden homes are much more likely to cause anxiety, depression and eating disorders.

Artificial Intelligence is a Failure

- This is not true, for a matter of fact our economy would collapse without the finding of AI researchers.
- People refer to AI as "Almost Implemented"

The Full Moon Makes People Act Differently

- This is not true, people believe this due to confirmation bias.

How Science Works

- Generation of a Theory - A theory is an explanation that suggests the existence of a theoretical entity that cannot be measured directly.
- These "Theories" can make predictions about the real world.
 - These predictions become hypotheses that can be tested with experiments and quasi experiments.
 - Experiments have control over participants and conditions, they manipulate some factor to see results.
 - Quasi-experiments are observations in the real world, most political science lessons are learned from quasi experiments since you cannot manipulate an entire country.

Results and Statistics

- Hypothesis and Falsifiability - The possibility that something is false.
- For something to be significant a threshold greater than 0.05 is needed also referred to as the "alpha level".
 - What this means is that 1 in 20 experiments will turn out finding significance just by chance.
- We need statistics to turn a large list of numbers into something meaningful.

Science as a Culture

- Replicability - The premise of replicability is that the scientific community can correct for these flaws.

- Science's self-correcting nature - When scientist publish their articles they make it public meaning that other scientist can critique their findings. From here other scientist will attempt to disprove your theory which is good as it makes sure the true findings are out there.
- Science as an epistemology - No other knowledge-generating enterprise as a rigorous and self-correcting mechanism.

Lecture #11: Dreaming

Sleep and Dreaming

- Dreaming can occur in both REM and NREM states.
 - REM - Rapid Eye Movement sleep, or REM, is one of the five stages of sleep that most people experience nightly. It is characterized by quick, random movements of the eyes and paralysis of the muscles.
 - NREM - Non-Rapid Eye Movement, sleep is dreamless sleep. During NREM, the brain waves on the electroencephalographic (EEG) recording are typically slow and of high voltage, the breathing and heart rate are slow and regular, the blood pressure is low, and the sleeper is relatively still.
- 75% of our sleep is NREM.
- NREM dreams tend to be short, dull and undreamlike.
- REM sleep is characterized by Rapid Eye Movement, muscle atonia, and often dreaming.

Interference from the World

- Dreaming you need to urinate, which probably means you need to urinate.
- Speculative - Dreaming of teeth falling out caused by tooth grinding, which 70% percent of people do during sleep.

The Dreaming Brain

- The brainstem is very active, sending information forward.
- The DLPFC is deactivated, perhaps explaining our reduced reasoning ability during dreams, and our not noticing what's weird but also our difficulty in remembering dreams.
 - The DLPFC is a part of the frontal lobes toward the top and side.

Dream Recall

- We typically forget dreams.
- This correlates with visuospatial skill and individual differences in working memory.
- Both animals and infants cannot report dreams.
- Commonly people assert there was much more to their dream than they can report.

How to Record Dreams

- The scientifically best way to remember your dream is to wake people up at many points during the night and get them to report their dreams. Other ways include:
 - Ask people every morning to report their dreams.
 - Ask people to keep a dream diary.

- Ask people what their dreams tend to be like.

What are Dreams Like?

- During dreams scene shifts are common.
- They tend to be narrative, and tend to be experiential in first person.
- Dream emotion tends to match content - Dreams can be bizarre, but not often in this way.
- They are always animated.
- Dreams are rarely bizarre, but when they are we often do not really notice it until we are awake.
 - Selection bias: Bizarre dreams are easier to remember and are often talked about.

What are Dreams NOT like?

- Dreams are not films, visual images, recent social situations, and pre sleep behaviour are rarely incorporated into dreams.
- Recent episodic memories even salient ones are rarely incorporated into dreams.

Threat Simulation Theory (TST)

- A theory developed by philosopher Antti Revansuo
 - A major function of dreaming is to practice dealing with threats that were common in our ancestral environment.

Support for TST

- Animal dreams are highest in kids and decrease with age.
- Negative emotions in dreams appear twice as often as positive ones.
- The only kind of recurring dream with any frequency is being threatened by animals, monsters, people, or natural disasters, and the response was watching, running, or hiding.
- Westerners dream of things we rarely experience
- Ancestral threats are over represented
- People react appropriately to dream threat 94% of the time.

How You can affect your dreams

- you can affect your sleep with pre-sleep attention to a specific concern, this is called "dream incubation".

AIM Model of Conscious State

- Activation - Basic level of brain activation
- Information Flow - sensory input vs. internal fictive input
- Mode of Information Processing - Aminergic-cholinergic neuromodulation
- Activation-Synthesis Hypothesis - Dreams are the cortex trying to make sense of chaotic inputs from the brainstem.

Support for the Activation-Synthesis Hypothesis

- dream emotion seems to shape dreams, not the other way around.
 - an "anxiety dream" will often shift from one anxiety producing scene to another.
- Dream recall cessation is almost always caused by forebrain lesions.

Dreams and Waking States

- People who have no dream imagery tend to also have waking deficit in imaging memories.

Lucid Dreams

- A lucid dream is where you know you're dreaming and can control your actions and sometimes your dream content.
- You can only control your eyes in the real world.
- Could be a reactivation of the DLPFC, which allows you to see dream content for what it is, and control yourself.
- Training: dream diaries and reality checks

Sleep Paralysis

- In Sleep Paralysis, you feel awake and you might feel chest pains.
- When you are in a lucid dream you cannot move, caused by carryover of muscle atonia from sleep to waking.
- You have hallucinations, often of the presence of a malevolent character.
- You feel abject terror.

Lecture #12: The Cognitive Science of Religion

Person Permanence

- Person Permanence - Person Permanence is the belief that people are still here with us even though they are dead.
 - This does not seem to shut off immediately when someone dies, leading to the belief that their mind still exists.
 - Studies show that most people, even self-described atheists, attribute mental states to the dead.

Is This Learned or Innate?

- If something is learned, we predict that it gets stronger during enculturation.
- The opposite happens with attributing mental states to the dead. Kindergarteners were more likely to do this than older children.
- This suggests that there is an innate component - Are we natural dualists?

Pascal Boyer's Counterontology Theory

- We have subsystems for understanding different things in the world: contagion, persons, living things, tools, physical objects. These form "ontologies".
- We find fascinating things that belong to one category but have one (or close to one) thing from one another.
 - A ghost or god is a person without a body
 - A zombie is a person with no mind.
 - A crying statue is an object with one biological property
- Studies show that people find these one-violation concepts the most plausible.

Old Brain and New Brain

- Our old brain is intuitive, we are conscious of its outputs, not its processing.

Dead Bodies are Naturally Counter Ontological

- We are fascinated with corpses, because they bring up intuitions from different systems that are contradicting.
 - Religion comes in to fill the gap left by these intuitions.
 - Our contagion system fears dead bodies as they bring illness and disease, our natural instinct.

- Our theory of mind makes us think the person is still alive and we might feel love.
This helps us cope with losses

Explaining Dual Funerals

- The second burial signifies the acceptance that the person is gone and will only exist in their memory.
- The first burial is to remove the body for health purposes.

Theory: Religion Encourages Pro-social Behavior

- Imagine how a monkey's reputation can be hurt by stealing a banana.
 - Without language, the monkey's reputation can only be hurt in the mind of those who directly see you.
 - With language, a reputation can spread and affect someone for years.
 - One theory states that people evolved to have beliefs in the supernatural agents to keep us from behaving poorly when no one was watching.
 - This requires group selection which is controversial.
 - Group Selection - Group selection refers to one mechanism of evolution in which natural selection acts at the level of the group instead of at the more conventional level of the individual.

Evidence

- People are more pro-social when primed with supernatural concepts.
 - People think that gods have "strategic" knowledge.
 - Gossip is theorized to have a similar function, and it also focuses on strategic knowledge.

Why are Individuals Religious?

- Religiosity is about 50% genetic and 50% environmental, specifically;
 - 47% genetic
 - Environment
 - Family upbringing = 11%
 - Non-family environment = 43%

We create or call upon religious ideas when we encounter something strange

- Humans see patterns in completely random events and use religion to explain them.
 - i.e. there is a drought and people blame it on angry gods.

Lecture #13: Cognitive Science in Film

- What is Transient Global Amnesia? Transient Global Amnesia is a sudden, temporary episode of memory loss that can't be attributed to a more common neurological condition, such as epilepsy or stroke.

Memento

- Henry Molaison is the most famous case, he was an American memory disorder patient with anterograde amnesia.
 - Henry was able to learn procedural but not declarative memory so he could learn how to do things like ride a skateboard but not vivid memories.
 - People who get their hippocampus lesioned now are warned and can prepare, so that they'll have memory of it after the procedure.

Lecture #14: The Cognitive Science of Morality

Why do we have Morals?

- Morals were evolved to help us take care of the other people in our groups, not not so much people outside of our groups.

The Expanding Circle

- Self interest - Self interest is caring about myself and my family.
 - All animals have instincts for gene-preservation.
- Friendship - Friendship is caring for historical cooperated partners.
 - This is shared with chimps
 - Sharing food used to be a life-and-death matter for us.
- Tribalism - Tribalism is caring about us, but not them.
 - Tragedy of Commons
 - Evolved morals in humans took care of this
 - Anthropological survey shows that ethnocentrism is universal.
- I care about all people or creatures that can have positive or negative experiences
 - Tragedy of commonsense morality
 - This requires abstract reasoning and values

How do we know Morality evolved?

- In general, the evolved and well-learned behaviours work faster than deliberate ones.
- When you force people to play a prisoner's dilemma game quickly, they are more likely to cooperate.

Footbridge/Trolley Explanation

- Greene's experiment reveals that there are two competing systems for our moral considerations:
 - 1) Some kind of rational, utilitarian calculus which makes switch cases permissible.
 - 2) An emotional reaction caused by a dislike of "getting our hands dirty"

Haidt's Moral Foundation Theory

- Care/Harm
- Liberty/Oppression
- Authority/Subversion
- Fairness/Cheating
- Loyalty/Betrayal
- Santity/Degradation

Moral Dumbfounding

- A man brings home a ready-to-cook chicken has sexual intercourse with it than cooks and eats it.
 - Did he do something wrong? Most would say yes, but can't really explain why.

Should You Trust Your Instincts?

- People look to their feelings to judge whether something is moral or not.
- You can make people think something is more immoral than it is with bad smells or bitter tastes.

- Feeling vs. Principles, does it feel right? does it conflict with moral principles?

Politics and Morals

- Right-wing people tend to have all six moral foundations fairly strong.
- Left-wing people tend to have only care/harm and liberty/oppression strong .
- Libertarians tend to only have liberty/oppression strong.
- This is mostly genetics, which means your politics is mostly genetic.

Lecture #15:Cognitive Architectures

What is a Model?

- Across fields, it is a representation of something that excludes unimportant detail and information. Some examples include:
 - A scale model of a home made of cardboard
 - A categorization scheme for the students in a lecture
 - A simulation of a hurricane

What is a Cognitive Model?

- Typically, a cognitive model is a computer program that models some aspects of thought. For example, it might model how people do categorization or how a mouse learns to navigate a maze.
- The model makes predictions that can be compared to data.
- if the predictions match the data, it supports the theory underlying the model.

What is a Cognitive Architecture?

- A cognitive architecture is a programming environment or set of tools for making a cognitive model.
- typically, it includes constraints on how cognition works in all people - speed of learning and memory retrieval are some examples ignoring cultural and learned aspects.
- making a model in an architecture is easier in some ways and harder in others.

Kinds of Cognitive Architectures

- Symbolic - operates at the level of discrete symbols
- Sub-symbolic - operates using numbers representations, which in aggregate constitute symbols.
- Hybrid symbolic/sub-symbolic
- Brain - model cognition at the level of biology, but speak to cognitive issues.

Symbolic Architecture

- What is symbolic architecture? Symbolic architecture refers to the classical view of the architecture of the mind. In this approach the mind is viewed as a process in which symbols are manipulated. Symbols are moved between memory stores such as long term and short term memory and are acted upon by an explicit set of rules in a particular sequence.

Typical Characteristics of Symbolic Architectures

- Declarative/procedural memory distinction
 - Justification: Henry Molaison and other damaged patients.
 - Our inability to consciously retrieve and reflect on procedural memories.

- Goals are subsets of declarative memory
- Production compilation models automatization.

Lecture #16: Why Cognitive Science is the Most Important Thing in the World

What are the Worlds Problems?

Problems that are on the decline: War and Torture, Crime, Starvation, Disease, Short Life Span, and Inequality

Problems that are getting Worse: Environmental damages and social capital.

How Do We Fix Climate Change?

- Reduce Carbon Emissions - This is a cascade of events that need to occur in order to work which is very difficult.
 - There is a technological solution to come up with an alternate energy source. In order for this to happen we need to fund science and engineering to do it. In order to fund we need more people to care, which now raises the problem of marketing the problem of climate change.
 - There is a social solution which is to convince people to use much less oil. Again this needs to be marketed which needs money.

All Problem are Intellectual

- The reason why we can't solve all the problems in the world is simply because we do not know how to do it.
 - Figuring out how to solve these problems requires thinking and problem solving, which is the field of cognitive science.

Cognitive Science and Problem Solving

- The human modeling side of cognitive science studies how people actually solve problems, and all of the other cognitive functions it takes to do it.
- The AI engineering side of cognitive science tries to make programs that can solve problems for us, often times better and more efficiently than we can.

Ways Artificial Intelligence is Better than Us

- Artificial Intelligence is better than us in stock trading, arithmetic and statistics, scheduling, search engines and aggregating, and many games.

Ways We are Still Better than Artificial Intelligence

- We are better than AI when it comes to language, physical movement, creativity, science, social interaction, vision, many games, and most everyday tasks.
 - However, AIs and other programs can make humans more effective, used as tools.

Perhaps Cognitive Science can Help Us Solve All of These Problems

- Even if there is some other problem you think is more important, you can apply cognitive science to the problem solving in that problem.

Lecture #17: Cognitive Development

- Universal Grammar Theory - The universal grammar theory states that the mind has a bunch of switches that get set when you learn a language as a child.

- Critical Stage: 3-5 - In these stages children learn 2-4 new words per day to their productive vocabulary, and twice that for understanding.
- That is about 1 or 2 words every hour for many years.

Jean Piaget's Developmental Stages

- Sensorimotor - from birth to 2 years old
- Preoperational - from 2 years old to 6 years old
- Concrete Operational - from 7 to 11 years old
- Formal Operational - from 11 years old to death.
 1. Sensorimotor Stage (birth - 2 years)
 - Simple reflex action to symbolic processing.
 - Progress is seen on 3 fronts
 - Adapting to and exploring the environment - focus on intentional behaviour
 - Understanding objects - Object permanence
 - Using symbols - An example would be waving and gestures.
 2. Preoperational Stage (2 to 6 years)
 - Use of symbols to represent objects and events
 - Characterized by egocentrism and centration.
 - Egocentrism - difficult in seeing the world from another's viewpoint.
 - Centration - narrowly focused thought (only one part of a problem, no conversation of liquid)
 3. Concrete Operational Stage (7 to 11 years)
 - Mental operations to solve problems and reason.
 - Problems thinking abstractly and hypothetically.
 4. Formal Operational Stage (11 years and up)
 - Can apply mental operations to abstract entities
 - Abstract and hypothetical thinking

Piaget's Lasting Contributions

- Constructivism - that children are active participants in their own development.
 - counterintuitive discoveries, puzzles that other scientist needed to solve.

Problems with Piagetian Theory

- A problem is it underestimates infants and overestimates adolescents.
- it is vague on processes and change mechanisms
- Does not account for variability - stages are not clear cut
- Underestimates social and cultural influences

Lev Vygotsky

- Focus on social and cultural
- Intersubjectivity - shared understand among participants of an activity.
- Guided participation - cognitive growth results from children's' involvement in structured activities with others who are more skilled.
- Zone of Proximal Development - the difference between what a child can do alone from with help

- Scaffolding - teaching a style that matches the amount of assistance to the learner's needs.
- Private Speech - comments not directed to others but intended to help children regulate on their own.
- Inner Speech - thought, internalized, private speech, serving the same function.

Information Processing Perspective

- Children improve in the following ways:
 - Better strategies
 - Increased working memory
 - better inhibitory and executive functioning
 - increased automatic processing
 - increased speed and processing

Core Knowledge Theories

- Distinctive domains of knowledge, some of which are acquired early.
- Explains why kids learn language but not calculus early
- Against the general intelligence approach to development and cognition.
- Suggestions: Language, objects, people, living things.

Lecture #18: Evolutionary Psychology

Evolution

Evolution occurs whenever these three things exist:

- Generation of diversity - mutation and crossover
- Selective reproduction and survival - reproduction of the fittest
- Transmitted change - genetic, taught, and imitated

Biological Evolution

- this occurs with natural, sexual, and artificial (breeding) selection.

Evolutionary Psychology

- evolutionary psychology explains traits as evolutionary adaptations.
 - Adaptationism - adaptationism is theorizing about evolutionary causes for phenotypes.
- Evolutionary psychology generates hypotheses, but these must be tested.
- Many people will believe an evolutionary story without any evidence.

Different Kinds of Genetic Influence

- Predetermination - Predetermination is mostly independent of the environment such as the colour of your eyes.
- Some traits are useless - male nipples are useless whereas female nipples constitute a minor nutritive cost.
- Exaptation - somethin evolved for one purpose is used for another such as female orgasms.
- Overridable - to prevail of have dominance over, such as bitter foods and drinks such as coffee.
- Baldwin Effect (predisposition) - We evolved to learn something easily such as language.

- Cortical and Neural Recycling - We like the taste of aspartame (a really sweet substance) that has no nutritive value.
- Cultural feedback loops - In climate change, a feedback loop is the equivalent of a vicious or virtuous circle – something that accelerates or decelerates a warming trend. A positive feedback accelerates a temperature rise, whereas a negative feedback decelerates it.

Neoteny in Humans

Neoteny - Neoteny is the retention of juvenile features in adult animal. Neoteny in humans include a small jaw, upright posture, big head, less developmental change, less aggression, and sexual and natural selection.

- more violent people get killed
- 10% of people in hunter gatherer societies are killed through capital punishment.
 - We domesticated ourselves.

The Mind From the Perspective of Evolutionary Psychology

- Our minds evolved, mostly during the Paleolithic era (the Environment of evolutionary adaptation.)
- Our minds are a collection of special-purpose mechanisms for dealing with specific kinds of problems. it is “modular” rather than “general purpose”.
 - Modular - employing or involving a module or modules as the basis of design or construction.
 - General Purpose - having a range of potential uses; not specialized in function or design.
- these adaptations might not longer be beneficial

Mate Selection

- evolution has predicted that men will be most attracted to healthy women who can bear children and women should be most attracted to men who will provide resources to help raise the offspring.
- according to evolution, men like a low waist-to-hip ratio of 0.7, and low ratios produce smarter children and healthier women.

What Women Want

- Smelly T-Shirt Experiment
 - Women want compatible immune systems with their mates.
 - Men prefer shirts of women who are ovulating.
- Testosterone makes men look more masculine - too much interferes with the immune system.
 - women prefer masculine faces when ovulating
 - women prefer more feminine faces when not
 - women guess that more masculine faced men will be poorer parents.
 - Testosterone correlates with divorce, infidelity and violence.
- Women prefer high prestige men for long-term commitments, and dominant men for short-term sexual affairs.
- 3-4% if babies come from extra-pair copulations

Memory

- Prediction - We should remember better things for survival

- in a word memory test, this was found to be true.

Selfish Genes and Kin Selection

- Hamilton's selfish gene theory
 - we care about people to the extent that they overlap with us genetically
 - this is why animals sacrifice their lives for their offspring

Our Taste in Food

- Fat, salt, protein and sugar are important nutrients that were rare in the vast majority of our evolutionary history
- Now we live in a society that has an abundant of fat and sugar.
- We didn't evolve to deal with massive quantities of it - never had to.

Lecture #19: Social Cognition and The Evolution of Intelligence

Evolution of Cognition

- What we know of our ancestors' bodies come from fossils, but there are two problems with this...
 - 1) Behaviour is not fossilized - thus we rely on scant artifacts, but even those appear relatively recently
 - 2) Fossils are very rare - It is thought that one bone in a billion become fossilized. Human fossils are very rare.
- Keep in mind we share 70% of our DNA with mice.

How long have Humans been Around?

- the oldest fossils of fully-formed humans are only 50k to 100k years old. That's only 2500-5000 generations of 20 years.
- if language is an instinct, then it probably had to have been evolving for longer than humans have been around.
- Australopithecines had hands evolved for manipulation. We don't know that they didn't use tools or not.
 - However, only stone and metal tools last, and most modern hunter-gatherer societies of today have more biodegradable tools than stone ones.

Standard Timetable for Human Evolution

- We differentiated from something 100-200 thousand years ago.
- We differentiated from chimps much longer ago.
 - We know this because of mitochondrial eve which is the most distantly historical female that is the ancestor of all humans.
 - She need not to be human herself
- Mitochondria are weird - they have their own DNA, they were probably one a parasite.
- They were the inspiration of the midocholoriana in Star Wars.
- The oldest fossils were found in Africa, dating back 100,000 years ago.
 - However some stuff found in Zaire has modernish-looking tools, bu were dated 75k years ago.
 - This is like finding a Pontiac in da Vinci's attic.

Fossils Continued

- Most living things leave no record at all.
- It is estimated that 1 in 10 thousand species get fossilized.

- This is possibly due to most creatures not dying in sediment.
- 95% of fossils are from marine creatures in shallow parts of water.

How Did Humans Get So Smart?

- Possibly Pinker's Vision Theory
 - Relying on vision is important because it is inherently 3D, unlike olfaction.
 - Olfactory animals, such as dogs, keep their heads close to the ground most of the time to smell the world around them and perceive it.
 - it's a "two-dimensional flatland viewed through a one-dimensional peephole"
 - 3D thinking requires more brain power.
- Possibly Group Living Theory
 - Human lives differ from other primates mostly in part to their social environments.
 - We evolved smarter brains for...
 - Communicate important information
 - Keep track of everybody else and maintain social relationships
 - results in a social cognition arm race.
- Possibly Wand/Walking Upright Theory
 - Walking upright allowed us to accept our hands for different functions, which would make good use for more intelligence.
 - Hands allow us to carry things, which allows us to create complex objects with parts from different geographical areas.
 - This requires planning, imagination, and working memory which all require brain power!
 - However, there is no evidence of artifacts from the million and a half first years of bipedality.
 - There are 12 theories of why humans became bipedal
 - More of Upright Posture
 - Upright posture puts pressure on pelvis to be small.
 - to maintain the intelligence arms race, evolution discovered a different strategy of altriciousness.
 - altriciousness - means more infant care by parents
 - more infant care means more male attention and pair-bonding.
- Hunting Theory (ecological hypothesis)
 - In general, carnivores are more intelligent than herbivores
 - it takes more brains for a wolf to hunt a rabbit than for a rabbit to hunt a lettuce head - mental map sizes differ between the two, the wolf having the larger one.
 - Meat is nutritious. relying on meat allowed for brains to trust that nutrition will be in the environment, allowing brains to grow bigger.
 - big kills encourage socialization, you can't eat the whole deer by yourself before it goes bad. Make a deal with your neighbour, so they'll share with you when they get lucky.

Lecture #19: Consciousness

The Meaning of Consciousness

- Awake - Awake meaning no asleep.
- Conscious of Something - This means that you are aware of something such as an oncoming car, although we are much less aware of things than we think.
- Conscious of Self - Descartes's "I Think therefore I am", since you are able to produce ideas and thought you must be real because there is no way to make that artificial.

Automatization

- Automatization - we get better at things, they become easier to do and faster, and we think about other things while we do them such as washing dishes and driving.
- We become less conscious of the activity - it gets so fast that making yourself think about it makes you mess up performance.
- Perhaps babies are more conscious than we are, because they are habituated to nothing.

Consciousness is not the Main Event

- AI has the potential to all kinds of stuff without consciousness
- We just don't know enough about it to know.

Intuition

- Intuition - When we perceive or decide or believe something without having a notion of how the idea came to be.
 - Intuition can be caused by automatization
- We have genetic and learned intuitions - we cannot tell the difference between the two.
- Old brain processes are mostly impenetrable

Qualia

- The experience of consciousness.
 - What color red looks like, or what pain feels like.
- There is a debate in philosophy regarding whether qualia are reducible to physical processes and states.

Weird Consciousness Disorders

- blindsight
- hemisphere neglect
- Cut corpus collosum
- though alienation

Zombies

- in philosophy, a zombie is a being that is like a human, but has no conscious experience.
- Behavioural Zombie - behaves just like a human but without any consciousness.
- Neurological Zombie - a behavioural zombie, the brain states of which are indistinguishable from a human.
- If zombies are possible, then perhaps some form of dualism is correct.
- Dualism - dualism is the belief that there is some kind of mental substance that is not physical.

Dennett's Multiple Drafts Model

- There are multiple processes in the mind that interpret things. These are like multiple drafts of the same story, such as picking up a glass of water.
- They compete for control over other parts of your mind.

- There is no set point at which something becomes conscious.

Lecture #20: Imagination

Things We have no trouble imagining

- a large spoon, a large cat beside a bed, and a enormous raven in a car.
 - If we've never seen an enormous raven in a car how are we able to imagine this?

Laboratory Theory - Imagination reflects visuospatial memory

- When we are asked to imagine an enormous raven, when we have never seen one...
 - We make an analogy with something enormous that is similar to a raven such as a crow.
 - We then transfer the "enormous" means from the crow to the raven. That is how we imagine things.

The Two Stages of Imagination

- 1) Training Phase which is perception
- 2) Visualization phase which is imagination.

Episodic Memory

- Episodic Memory - Episodic memory is the memory of autobiographical events (times, places, associated emotions, and other contextual who, what, when, where, why knowledge) that can be explicitly stated. It is the collection of past personal experiences that occurred at a particular time and place.

Semantic Memory

- episodic memories are created each contributes to a prototype in semantic memory representing the average distribution for that phrase and attribute. For example, a large raven's size will contribute to the prototypes: **Large + Raven = Large Raven**

Lecture #21: Cognitive Science - History, Present and Future.

Pre-history of Cognitive Science

- 400 BCE: Ancient Greek philosophers made theories of mind.
 - At this time science had not yet been invented.
 - Little was known about the world; these guys philosophized about whole lot.
 - This is also the prehistory of all disciplines
- Philosopher dominated the pre-history until about 1800.

1800: Birth of Psychology

- Psychophysics: relationship between perception and stimuli.
- 1875: Wilhlem Wundt opened the first psychology laboratory.
- Ebbinghaus did some of the first experiments in memory
- 1890s: Frued and the case-study techniques, William James published "Principles of Psychology" which is still often quoted today.

1913: Behaviourism

- 1908: Pavlov's salivating dogs experiment
- 1913: John Watson's manifesto for behaviourism published.
 - held that we cannot directly study mental processes, only stimulus and behaviour.
 - In response to case studies and introspection

- Tried to make psychology like physics

Chipping away at Behaviourism

- 1930: Jean Piaget
 - Problems helping pilots who were already experts
 - behaviourism started to try to explain difficult things such as language... (bad?)

Early 1900s: Cybernetics

- □Analog brain modeling (pre-computer)
- □Inspired by collaboration of psychologists working with engineers and communications people in war efforts
- □Was killed by artificial intelligence, but made a bit of a comeback with neural networks

Pre-Computers

- Charles Babbage
 - 1821: Difference Engine. Mechanical calculations
 - Analytical Engine (never built)