Cognitive Systems

- A system that takes in information and then executes an action
- Transforms things in the environment to internal representations.
- Turns desires to act into physical changes in the environments- like humans.

How The Animal Mind Works (&Human Beings)

- Most of our cognition is our brain.
- We have ways to perceive our environment- Eyes, nose, ears, skin, tongue, etc..
- We also have actuators- Body parts that allow us to do and move things.

Robots

- Also cognitive systems.
- Robots have sensors and actuators as well.
- They can move and operate and some robots have sensors that humans don't even have, such as a built-in GPS.

Disembodied Software

- User input, perception—-> action? Ex. Youtube and Amazon recommended items and videos.
- It has an environment, the web browser. And it reacts depending on what you click on, as well as its data base/memory.

Distributed Cognition

- When there are several things happening that together form a cognitive system.
- Ex: Two people working on a laptop, you and another person. The cognitive system writing the paper is these two people and a computer. The idea is that you have a group of objects and or people, that together form the cognitive system that performs the specific class.

What Is Cognition

- **Cognition** is the manipulation of and changing of representations.
- A representation is something that represents/stands for something else.

Representations Get Stored In Our Memory

- In an animal, we have brain, long-term memory, short-term memory.
  - Two kinds of long-term memory: **Declarative** and **implicit.**
    - Declarative: Facts, things you can declare. Ex. My name is Faisal, Justin Trudeau is the prime minister, etc.
      - Declarative memories are broken up into two types, semantic and episodic.
        - Semantic is your knowledge of how the world works. Stuff with meaning.
        - Episodic: Episodes of your life. Ex. What I had for breakfast this morning.
          -
    - Implicit: Things that can't really be declared. My ability to ride a bicycle, my ability to write, etc.. I can't really articulate what it is. Ex. I could be standing up, but I don't know how many muscles in my body I have to use to do so. My body and mind know how.
- In a software, there are databases with codes and symbols.
- In a distributed system: Ex. 4 students trying to figure something out. This have the environment, a piece of paper, a laptop, their memory. Their memory is their biological memory, but also the laptops memory and the white board or their notebooks.

Human Memory Of Fact And Perceptions (Not Skills)

- If someone tells us something, what we are doing is taking in sound, transforming that sound into words and sentences almost immediately
- Short term memory is a temporary store. Some things from it end up becoming long term memories.

- Sensory memory is like a scratch pad for vision or a recording tape for hearing, that can be overwritten with new things. It is re-written every few seconds by new perceptions
    - Sometimes you'll be working and then someone will ask you a question like "Do you want to go get bubble tea", and then you finish typing your sentence, and then you look up and you think about or interpret what your friend just say. We have a short term sensory loop in our brains.

Biology Of A Human Brain

- We don't know much about where declarative long term memories are stored.
- The hippocampus is very important for transforming short term memories into long term memories.
- Procedural memory appears to happen in the cerebellum.

Learning

- Learning is changing memory with the purpose of preparing a system for better action on the future.

Habituation

- Diminution of a behavioural response with repeated stimulation.
    - Ex the first time you hear a loud noise, you might jump, but afterwards you stop jumping.

Classical Conditioning

- cearning to associate two previously unrelated stimuli.
- Typically, this means that you learn to behave similarly to stimulus B as you do to stimulus A.
    - Ex: The dog learns that when you pick up the leash, a walk is soon to follow.
        - The dog has learnt to associate the leash and the walk.

Imprinting

- A time-sensitive learning in an animal that is insensitive to behavioural outcomes.

- Ex: A goose learning who its mother is happens 13-16 hours after hatching.

Observational Learning

- Learning that happens by observing another individual do something.
  - Ex: Copying a Michael Jackson dance moves on YouTube.
- Much of culture learning (Called "Enculturation") is observational, but some is explicitly taught.

Testimony

- When someone tells you something.
  - Ex: How to start a web browser, or that orcas are mammals.
- It can be read or heard aloud.
- We also get facts by figuring them out, but this is better described as "Reasoning" or "Inference" than “Learning".

Mentorship

- We learn from others, and can teach each other.
- Observation is just a part of it.
- Think being taught to cook.

Learning Over Human History

- **Genetic**
  - When environments change very slowly.
- **Cultural Learning (Imitation)**
  - When environments change relatively quickly
  - Content bias
    - Imitate the best Idea
  - Prestige Bias
    - Imitate the most successful
      - Ex: Celebraties

- Conformist Bias
  - Imitate the most common ways of doing.
    - Do what everyone else is doing.

Kinds Of Operant Conditioning

- Positive Reinforcement (The Strongest)
  - Someone smiles at you when you hold the door for her.
- Negative Reinforcement
  - A baby screams until you give them candy. Then she stops. (Adults learning NR, baby learning PR).
- Positive Punishment
  - You get burned by touching the hood of a car in the sun.
- Negative Punishment
  - Your parents cut off your allowance because you lied.

Perceptions

- Perception is the process by which agents interpret and organize sensation to produce a meaningful experience.
- From a cognitive science perspective, it means turning information from one form into new, meaningful representations.

Typical Sensory "Modalities"

Physical signal	Perceptual modality
Light	Vision
Air vibrations (sound)	Audition (hearing), echolocation
Physical pressure	Haptics (touch)
Chemicals	Taste and olfaction (smell)
Body position	Kinesthetics / proprioception

Human Vision

- Extra-mission Theory
  - Rays of light emanating from the eye in combination with light in the world allow us to see
- Intromission Theory
  - Visual perception is accomplished by rays of light reflected from objects into the eyes.

Rods and Cones on Retina

- 1.) The image is severely distorted and inverted.
- 2.) The most light sensitive photoreceptive cells in the retina (Night vision):
  - 100 times more sensitive then cones;
  - Information is received by a convergence or pooling from many rod cells resulting in a loss of visual acuity.
  - Convergence of information makes peripheral vision sensitive to movement (Seeing something vague out of the corner of your eye.
- 3.) Cone: Three types:
  - 1.) Correspond to short(blue)
  - 2.) Medium (green).
  - 3.) Long wavelengths red; works best in bright light fewer cone cells exist for peripheral vision.

Depth Perception

- Size
  - We know how big things are.
- Perspective
  - Things are smaller on the fovea as they get farther.
- Texture, Shading, Saturation.
  - Closer things are more saturated. Texture gradients.
- Focus Multiple Images:
  - Including motion and binocular vision.

Dorsal And Ventral Streams (Front is ventral, back is dorsal)

- **Dorsal Stream**: “Where” pathway: Associated with motion, representation of object locations, and control of the eyes and arms, especially when visual information is used to guide saccades or reaching.
- **Ventral Stream**: "What" pathway: Associated with form of recognition and object representation. It is also associated with storage of long term memory.

How Audition Works

- Acoustical energy (Sound waves) vibrate the eardrum (in air) or bones (Underwater or through your own body, as when you hear your voice).
- Localization is done by examining the differences between the sounds in two ears, somewhat like how depth is done with binocular vision.

Echolocation

- Biosonar: Send out sound, determine spatial information form echo.
- Bats, toothed whales, dolphins, and two kinds of birds.
- Humans: The boy who sees without eyes - Real story.

Haptics (Touch)

- Critical for manipulation of objects, particularly in combination with proprioception.
- Sensors are in the skin.
- Active perception:
  - Haptics.
  - Vision.

Olfaction (Smell)

- Detection of chemicals- no clear energy continuum as there is for light and sound waves.
- Some similar chemicals smell different; some different chemicals smell the same.
- Much of what we experience as taste is actually smell.
  - This is why food tends to taste bland when you have a stuffy nose.

Smell For Animals

- Territory
- Fertility
- Ant pheromone traces.

Gustation (Taste)

- Chemical receptors in taste buds last for a week or two then wear out.
- The tongue detects flavours such as salty, sour, bitter, umami and sweet.
- Pain receptors react to spicy food.
- The experience of food is very complex, involving feel, temperature, taste, smell, and pain.

Kinesthesia, Proprioception, and the Vestibular System

- Proprioception and kinesthesia are how you know where your body parts are and how they are moving.
- Sensors in the inner ear, and in muscles.

Interception

- Perception of hunger, need for digestive elimination, heart rate, the need to sneeze, breath, or cough, etc.

Music And Humanity

- Found in all cultures - Universal.
- Music generation requires training.
- Involves many aspects of cognition, especially perception, creativity and emotion.

How Music Is Used In Culture

- Social bonding.
  - Parties
- Emotional regulation.
  - Listen to music to depending on our mood or activities.
- Mother-infant reaction.
- Healing.
  - Meditation or scientifically proven to help Parkinson's disease.
- Religion.
- Aesthetic experiences.
  - Fun

Did We Evolve To Have Music

- Two Views:

- No, it's a spandrel. (A spandrel is something that came about, but serves no evolutionary purpose.
- Yes, we evolved to have it.

First View: Music Is Not Evolved

- In terms of survival and reproduction, music is useless.
- Byproduct of other things:
  - Motor control
    - Able to talk, move our jaw and so on.
  - Sensitivity to speech
    - Or calls, sighs, laughs, cries.
- "Auditory Cheesecake
  - As in, we don't need cheesecake for evolution, but we do need water, fat, sugar, etc.. for survival, the ingredients of cheesecake.
    - For example, music can help physical activity, something necessary for survival.
  - Supernormal stimulus.
- Steven Pinker's view.

Support For: Music Is Evolved

- Ancient
  - 42,000 BCE, we found ivory pipes.
  - Cross cultural.
  - Triggers Emotions.

Darwin's Sexual Selection Theory

- Music is like peacock's tail.
  - It is used to attract mates, along with dancing.
  - It is a signal of health, intelligence, etc..

- Bird songs are used in courtship.

Robin Dunbar's Social Bonding Theory

- Social bonding replaced grooming.
- Used to form alliances.
- Synchronized movements release endorphins.
- Listening releases opioids.
  - And serotonin and dopamine.

Coalition Signalling Theory

- Hagen & Bryant
- Evolved from coordinated territorial defence signals.
- Mated birds sing together to protect territory.
- Coyotes howl at periphery.
  - Only as a pack, never alone.

High And Low Pitches

- Why are pitches considered to be high or low?
  - Has to do with wavelengths / frequency.
- Verb direction.
- Example of Star Wars song in major and minor keys.
  - What sort of emotions do we feel from major vs minor.
    - Minor key is more suspenseful, sad, scary, intimidating.
    - Major key is more happy, etc…

Sad Music

- Low pitches
- Dissonance

- Slow tempo
- Minor key
  - Sad speech is in a minor key.

Sad Music

- L

- Doodling actually helps people stay focused.
- Guessing an answer (Even if you're wrong) before you see the right answer, facilitates memory more than not guessing.
- Tests also help a lot.
  - Flash cards are useful.
- Learning styles are apparently a myth.
  - Therefore you should never use your preferred learning style as an excuse.
- People' can't multitask
- Time Management
  - Categorize what is most important, aka what you need to get done and when.
    - Make a daily schedule.
- "Half-hour method"
  - Working on things everyday for a bit, etc…
- Take a walk before studying.
- Writing is key to thinking clearly.

Class 8

Learning At The Sociological Level

- "A culture can learn something that no individual in the culture has learnt."

- It’s that for whatever reason, women that avoided eating fish, had healthier babies than those who did, and therefore the society learnt something.

Learning At The Psychological Level

- An individual might notice that after eating a certain kind of food, some people get sick.
  - Ex: Eating fish for some people.

Learning At The Cognitive Level: Adjusting Parameters On Production

- One cognitive theory is that the mind does what it does by firing little information processing rules called “Productions".
  - Basically: If this is the situation then do that. Ex: If there is chocolate in front of you, then eat it.
    - When we do the thing, or the production, we get some kind of feedback; punished, rewarded, happy etc… And as a result, our mind changes the probability of us doing this in the future.
- The cognitive level deals with information and how it is processed.

Learning At The Biological Level: Synaptic Changes

- Synapses are the spaces between neurons, where communication happens. Synapses get more efficient with repeated use. This is "Hebb Theory”.
- Neurons that fire at the same time, strengthen their connection together. “Neurons that fire together, wire together”.
- So if you have some neurons representing the concept of poison, and others representing the eating of a certain kind of fish, then those neurons will be more likely to co-activate in the future.

Learning At The Chemical Level:

- Synaptic changes in taste receptors to tolerate bitter foods.
- Children often vomit when eating bitter foods that adults enjoy.
- This happens, in part, because of synaptic changes.

Learning At The Physical Level:

- Not a good description of learning yet.
- Some people believe that quantum effects are directly related to consciousness but most cognitive scientists do not take this position seriously.

How Do We Know If A Level Is Legitimate

- If it can successfully make casual **prediction** using the ontology of that level.
- Ontology: A set of things set to exist.

Why Are Scholars Often Dismissive Of Levels Above The One They Work At

- Because they believe that the regularities found a higher level are or will be deducible from lower-level regularities.
- This is one form of reductionism.

Why Do We Need The Sociological Level

- Certain group behaviour phenomena, such as a group going on strike, are difficult to explain with individual psychology.
  - If one person goes on strike, he’s just skipping work, it's not a strike. But if many people do it then it is a strike.

Why Do We Need The Psychological Level

- We need it in addition to the sociological level because some behaviours are not heavily influenced by their social context. Ex: Babies look at faces when they were born (Professor gave an example in class of babies preferring to look at human faces than images or other things).
- We need it in addition to the cognitive level because we need a place for non-casual, statistical models (Nutrition influences IQ).

Why Do We Need The Cognitive Level

- We need it in addition to the psychological level because the explanation of certain behaviours without the language of information processing is too vague (Ex. How people do multiplication)
- We need it in addition to the biological level because mental states and processes are defined functionally, not anatomically.
- Ex:You and I are both happy to be here, even though our brain states are quite different.

Why Do We Need The Biological Level

- We need it in addition to the cognitive level because sometimes the biological structure influences behaviour in ways that the information processing perspective cannot explain. Ex: Number/ colour synesthesia because of co-located gyri.
  - Some people associate numbers, or days of the week with colour.
- We need it in addition to the chemical level because certain brain structures appear to be used for particular things (Ex. The hippocampus and short term memory).

Why Do We Need The Chemical Level

- We need it in addition to the biological level because chemicals can effect behaviour (Ex: Drug effects).
- We need it in addition to the physical level because, well, physics doesn't tell us much of anything about human behaviour. It's important for plenty of other things though.

Proximate And Ultimate Descriptions In Cognitive Science

- **Proximate Explanation:** We eat because it satisfies our hunger and it tastes good.
- **Ultimate Explanation:** We eat because we need nutrition in order to stay alive.
- Why do people want to have sex for example? As in what is the reason why people want to have sex.
  - People who didn’t have sex wouldn’t reproduce.

- What is the reason people like food. Because it was necessary for survival and people who didn't like food would die.

The Cognitive Level Is The Information Processing Level

- Cognitive Science prefers descriptions of information, and how it is represented and changed.
  - For example, cognitive scientists have theorized that individual memories have "Activation levels" that determine how easily they can be retrieved from memory.
  - We accept the idea of an activation level if it helps us predict behaviour. We also like it if we find some biological basis for it.
- Cognitive scientists prefer to describe the working of the mind at a level as detailed as describing how we get a computer to execute a task.

Functionalism

- The idea that some things are what they are because of how they function with other pieces of information.
- Holds that mental states and processes are determined by their functional properties.

Language: What Is It?

- **Structural** description: a set of symbols that can be arranged in certain ways
- **Functional description**: a complex code by which agents can communicate information.
  - We say "complex" because we don't want to include animal communication, such as bird calls, as language.
- **Natural Language:** Created by cultures of humans.
- **Artificial Language:** Created by individuals or small teams.
- **Computer Language:** Artificial language for communication with computers, typically lacking in ambiguity.

Animal Communication

- Known as “Zoo-semiotics”
- Works through gesture, expression, gaze following, vocalization, olfactory, communication, and electric, colouration.
- Function: Dominance

Human Language

- It has a structure, but that structure is implicit.
- We all know how to do it, but we don’t know how we do it, so we have to study it like any other phenomenon.
- Our knowledge of how to speak is implicit not explicit.

Language Is A Brain Interface

- Like a computer programming language, natural language allows interfacing between might be two very different brains

Disciplines Of Linguistics

- **Phonology**
  - How sounds are organized and used in language.
- **Morphology**
  - How sound and meaning interact in words.
- **Syntax**
  - How sentences may be put together in a language.
- **Semantics**
  - Meaning in language.
- **Pragmatics**
  - How sentences interact with context to change meaning. Ex: “How are you”, or “Do you have the time?”

Phonetics Puzzles

- Why can you say “Somethin’”, but not “Anythin’”.

Morphology

Rules For Using Affixes

- **-ant can only be used with words of Latin origin.**
  - “Assistant” is okay
  - “Helpant” is not

Semantics

- Some English verbs have manner
  - Rolled, slid, limped.
- Romance languages, like French, differ.

Logic

- Logic is a formal, normative system of reasoning.
- Symbolic logic specifies ways that sentences can be represented unambiguously.
- For All x: If Cat(x) then mammal (x).
- But typically logic is very limited in its semantics

Teaching Animals Human Language

- Chomsky says that getting non-human animals to try to talk is like trying to teach bees to build beaver dams.
- Linguistics agree that animals do not have language - what they do is primitive compared to what humans do that it is not even deserving of the word.
- Animals require hundreds of trials.
  - They have to use associative learning to associate a sound or picture with a concept. With humans, we do it naturally.

Intra-Brain Communication: The Language Of Thought

- Jerry Fodor put forward the notion that our minds use “Mentalese ,” or a Language of thought
- The fact that you have trouble sometimes expressing what you want to say supports this view. How could you know what you wanted to say if the internal language were natural language?

Class 10

Language Development

- U-shaped grammar curve
  - Went, goed, went
- Universal grammar theory
  - The mind has a bunch of switches that get set when you learn language as a child.
    - Ex: "Subject omission switch”. In Spanish you can omit the subject of a sentence, but in English you cannot.
      - “Hables Espnagnol?” Vs “Speak Spanish”

Critical Stage: Ages 3-5

- During this time, children learn 2-4 words per day to their productive vocabulary, and twice that for understanding.
- That’s 1 word every one or two hours awake for 20 years.
- They are learning words that they don’t hear that day, how is that possible?
  - Recall. Ex: Suddenly understanding a joke you heard many years ago.
- Most psychologists and linguists believe there is a genetic component to learning language.

Jean Piaget’s Developmental Stages (Theory)

- **Sensorimotor (Birth-2)**
  - Simple reflex action to symbolic processing.

- Progress is seen on 3 fronts
  - Adapting to and exploring the environment.
    - Focus on international behaviour.
  - Understanding objects.
    - Object permanence. (Peek-a-boo, or taking away an object and knowing it is not gone forever)
  - Using symbols
    - For example, waving and gesturing.

- **Pre-operational (2-6)**
  - Use of symbols to represent objects and events.
  - Characterized by:
    - Egocentrism: Difficult in seeing world from another's view point.
    - Centration: Narrowly focused thought (Only one part of a problem, no conservation of liquid)

- **Concrete Operational (7-11)**
  - Mental operations to solve problems and reason.
    - Ex: Induction- When you reason from specifics to a generality. (You go to a club and see five guys wearing jeans; you assume that everyone wears jeans in the club.
  - Problems thinking abstractly and hypothetically

- **Formal Operational (11-Death)**
  - Can apply mental operations to abstract entities
  - Abstract and hypothetical thinking.

Piaget's Lasting Contributions

- The study of cognitive development at all.
- Constructivism: That children are active participants in their own development.
- Counterintuitive discoveries, puzzles that other scientists needed to solve.

Problem With Piagetian Theory

- Underestimates infants, overestimates adolescents.
- Vague on processes and change mechanisms.
- Does not account for variability (Stages are not that clear cut).
- Underestimates social and cultural influences.

Lev Vygotsky

- Focus on social and cultural.
- **Intersubjectivity**: Shared understanding among participants of an activity.
  - When you hold the door for someone, you try to go out of there way and they try not to touch you etc… That whole interaction has intersubjectivity. A share understanding of what is happening.
- **Guided participation:** Cognitive growth results from childrens' 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.

Information Processing Perspective

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

Core Knowledge Theories

- Distinctive domains of knowledge, some of which are acquired early.
- Explains why kids learn language but not calculus easily.

- Against the general intelligence approach to development and cognition.
- Suggestions: Language, objects, people, living things.
- Looking Paradigm.

Why Do We have Morality

- Humans tend to naturally have morality. They evolved to help us take care of the other people in our (Social) groups. But not so much people outside our groups.

The Expanding Circle

- 1.) Self-Interest: I care about myself and my family.
  - All animals have instincts for gene-preservation (With exceptions).
- 2.) Friendship: I care for historical cooperation partners.
  - Shared with chimps.
  - Sharing food used to be a life-and-death matter for us.
- 3.) Tribalism: I care about us, but not them.
  - Tragedy of the commons.
    - “If a lot of people have access to a shared resource, then a lot of people will neglect to take care of it”.
  - Evolved morals in humans took care of this.
  - Anthropological survey shows that ethnocentrism is universal.
- 4.) I care about all people or creatures that can have positive or negative experiences.
  - The tragedy of common sense morality
  - Requires abstract reasoning and values.

How Do We Know Morality Has Evolved

- In general, evolved and well-learned behaviours work faster than deliberate ones.

- When your force people to play a prisoner's dilemma game quickly, they are more likely to cooperate.
  - “If you confess and rat out your friend, we’ll give you a lighter sentence”. Do you screw your friend over or screw yourself over?
  - People are nicer under cognitive defect/load (Busy).

Footbridge/Trolley Explanation

- Greene's experiment reveals that there are two competing systems for our moral considerations:
  - The first is some kind of rational, utilitarian calculus which makes switch cases permissible.
  - The second is an emotional reaction cause by a dislike of "Getting our hands dirty”.
    - Ex: Not wanting to cut open your mom for a necessary surgery.
  - **Utilitarianism** vs. Deontology
    - Utilitarinism= ‘Smart’ thinking in a way.
  - “If you’re hiding from someone with a bunch of other people and you’re carrying your baby, do you suffocate him to death so you guys are not heard and killed?”.

Haidt’s Moral Foundation Theory

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

Mnemonic: CLAFLS (Clah-fuls)- This is the abbreviation.

Disgust

- People who disgust us (Hippies, the obese, people we view as "trashy") we judge more harshly for purity-related moral infractions.
- Such as keeping your cubicle clean vs not tipping a server.
- Police are more likely to arrest obese people for purity related crimes, such as drugs, prostitution, and lewdness.

Moral Dumbfounding

- A man buys a ready-to-cook chicken to his house and has sexual intercourse with it. Is it wrong?
- Moral dumbfounding: “Most people say this is wrong but don’t know why it's wrong.

Should You Trust Your Instincts (Should you trust your old brain or your new brain).

- People look to their feelings to judge whether something is moral or not.
- You can make people think something is more immoral with bad smeels or bitter drinks.
- Feelings vs. Principles.
- They did an experiment on this by giving people bitter drinks or providing bad smells, and their behaviour was observed.

Animal Morality- 20 minute ted talk.

- Chimpanzees reconcile after fighting.
  - Bonobos reconcile through sex.
    - The principle is that you have a valuable relationship that is damaged by conflict, and so you have to do something about it.
- Funny video example of chimpanzee asking another chimpanzee for help to get it food, and then eating all the food for itself.
  - However, some animals follow the idea of reciprocation, in which the favour will be returned.

- Form of empathy: Example of a chimpanzee watching a tv screen of a animated chimpanzee yawning, then yawns itself.
- Chimpanzees also show consolation: Ex: Comforting an individual after losing a fight.
- Another example of how capuchin monkeys reject unequal pay.

  - Pro sociality.
  - Empathy and condolence.
  - Fairness, reciprocity, friendship in chimps.
    - Chimps kissing after fights.

Evolution

- Does not only occur for living things. It happens to cultures, etc..
- “Change of characteristics of this population to be more fit for its environment”.
- Occurs whenever these three things exist:
  - Generation of diversity.
    - Mutation, crossover
  - Selective reproduction and
    - Survival and reproduction of the fittest.
  - Transmitted change.
    - Genetic, taught, initiated.

Biological Evolution

- Natural Selection

    - Some aspects of the general environment that causes differential reproduction. So for example a slow animal might die, or a volcano might erupt and half of the population dies.
- Sexual Selection
    - Ex: Humans.
    - Or how female peacocks are attracted to male peacocks with long tails.
- Artificial Selection (Ex: Breeding)

Another example of evolution would be that the moths in England were light brown, however, after the industrial revolution, the trees turned darker, and so did the moths in order to camouflage.

The Beak Of The Finch: A Story Of Evolution In Our Time

- By Jonathan Weiner (1995)
- Finch beaks evolve with the weather!

Evolutionary Psychology

- Explaining psychological traits as evolutionary adaptations.
- Adaptationism: Theorizing about evolutionary causes phenotypes.
    - Then idea that a trait of species is a response to some evolutionary pressure.
- Evolutionary psychology generates hypotheses, but these must be tested.
- Many people will believe an evolutionary story without evidence.

Different Kinds Of Genetic Influence

- Predetermination
    - Mostly independent of environment (Ex: Eye colour)
- Some traits are useless
    - Male nipples
        - Nipples form before sex is determined. They are useful for females but only constitute a minor nutritive cost for males (As in it doesn’t require something like

a lot of food to maintain, they're just there; but there is no pressure to change them.

- Vestigial organs (Ex: Appendix)
- Exaptation
  - Something evolved for one purpose is used for another (Ex: Female orgasm in primates, bird feathers, jaw bones exapted to inner ear bones in humans).

- Overridable
  - Ex: Bitter foods and drinks, such as coffee.
- Baldwin Effect (Predisposition)
  - We evolved to learn something easily
    - Ex: Language
- Cortical & Neural Recycling
  - We like the taste of aspartame (Sweetener), which has no nutritive value.
    - In a way we trick our minds to think we're eating sugar.
- Cultural feedback loops
  - Less hair leads to fewer pests, making fire and clothing allows it to happen.

Neoteny In Humans

- Small jaw
- Upright posture
- Big head
- Less developmental change
- Less aggression
- Sexual & natural selection
  - More violent people get killed.
  - 10% of people in hunter gatherer societies are killed through capital punishment.

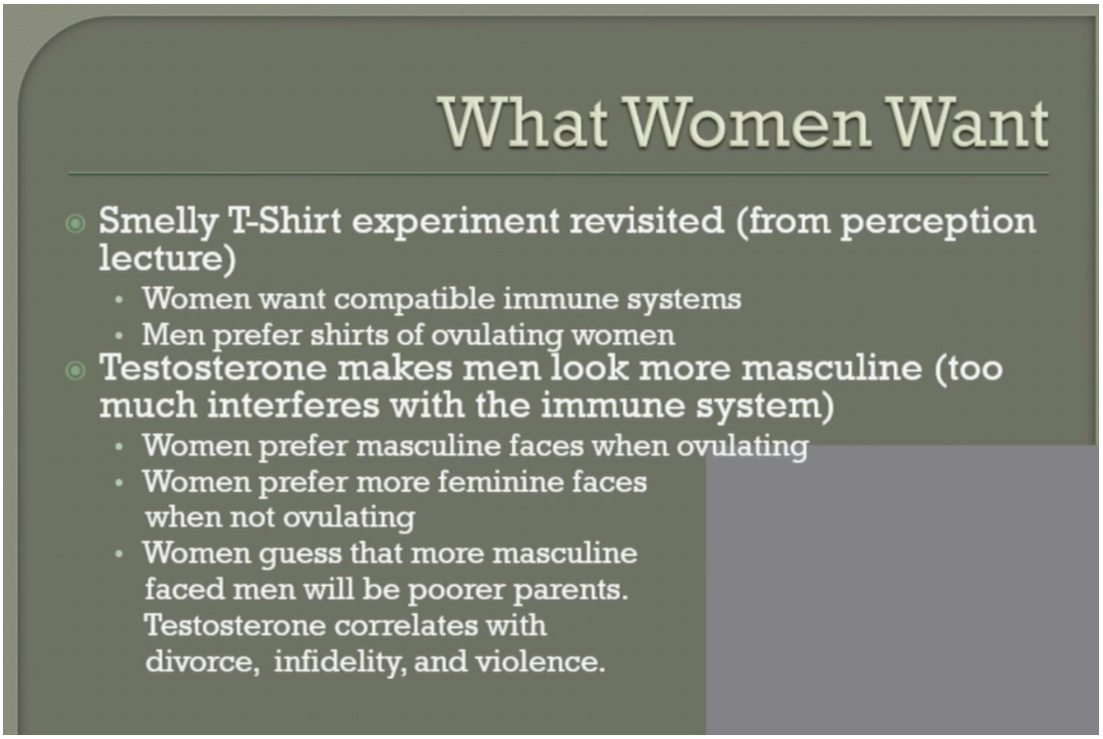
- We domesticated ourselves.

The Mind From The Perspective Of Evolutionary Psychology

- Our minds evolved, mostly during the Pleistocene/Palaeolithic time (The environment of Evolutionary Adaptation, or EEA)
- Our minds are a collection of special-purpose mechanism for dealing with specific kinds of problems.
  - It is "Modular", rather than "General purpose".
- These adaptations may no longer be beneficial.

Mate Selection

- Evolutions predicts 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.
- Men like a low waist-to-hip ration (.7), and low rations produce smarter children and healthier women.



Evolution Of Cognition

- What we know of our ancestors' bodies come from fossils, but there are two problems with this.
  - **1.) Behaviour is not (Directly) 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 becomes fossilized.
    - That means: For the population of Canada at 34 million, six of the human bones around today will end up getting fossilized.
      - That’s bones, not skeletons!
      - And that's not even to say they'd ever be found. Human fossils are incredibly rare.

How Long Have Humans Been Around

- The oldest fossils of fully-formed humans are only 50k-100k years old. Thats only 2500-5000 generations of 20 years.
- If language is an instinct, like Chomsky says it is, 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.
- However, only stone & metal tools last, most modern hunter-gatherer societies of today have more biodegradable tools than stone ones.
- The oldest human fossils were found in Africa, from about 100,000 years ago.
- However, some stuff found in Zaire has modernish looking tools, but they were dated 75k years ago.
  - This is like finding a car in Da Vinci's attic.
- Most living things have no record at all.
- It is estimated that 1 in 10 thousand species ever get fossilized.
- Most creatures don’t die in sediment.

- 95% of fossils are from marine creatures in shallow parts of the waters.

Standard Timetable For Human Evolution

- We differentiated from something 100k-200k years ago.
- We differentiated from chimps much longer ago.

- Mitochondrial Eve is the most distantly historical female that is the ancestor of all living humans. She does not need to be human herself.
- Mitochondria are weird- they have their own DNA. They were probably once a parasite.
- Mens mitochondria doesn't get passed on.

How Did Humans Get So Smart

- **Pinker's Vision Theory**
  - Relying on vision is important because it is inherently 3D, un like olfaction (Smelling).
  - Olfactory animals such as dogs, keep their heads close to the ground much of the time.
  - It's a "Two-dimensional flatland viewed through a one-dimensional peephole."(From how the mind works)
  - 3D thinking requires more brain power.
- **Group Living Theory**
  - Dunbar's paper that you read.
  - Human lives differ from other primates, mostly in terms of their social environment.
  - We evolved smart brains to:
    - Communicate important information.
    - Keep track of everybody else and maintain social relationships.
    - Results in a social cognition arms race.

- **Hunting Theory (Ecological Hypothesis)**
  - In general, carnivores are more intelligent that herbivores.
    - It takes more brains for a wolf to hunt a rabbit than for a rabbit to hunt a lettuce head. Mental map size.
    - Meat is nutritious. Relying on meat allowed brains to trust that nutrition will be in the environment, allowing brains to grow bigger.
    - Big kills encourage socialization. Meat from a wild bull can feed 1000 people. Make a deal with your neighbours, so they'll share with you when they get lucky.
      - People couldn’t preserve the meat for long anyways.
- **The Hand/Walking Upright Theory**
  - Walking upright allowed us to exapt our hands for different functions, which could make good use of more intelligence.
  - Hands allow us to carry things, which allows us to create complex objects with parts from different geographical areas.
    - Requires planning, imagination, working memory.
  - These things work in a positive feedback loop.
  - 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.

Cumulative Cultural Evolution

- Many cultures don't know why their customs work.
- Naskapi caribou hunters and heated shoulder bones.
  - Even though it makes no sense, it works because it’s random.
- Important they don’t understand.

Evidence

- Over-imitation: When learning new skills, chimps drop irrelevant factors, human children do not.
- Chile Peppers
  - Antimicrobial
  - Naturally aversive
- Prestige vs. Dominance
  - Other animals only dominance.
- Killer Whales and Elephants
  - The only other animals who live long past reproductive ages.
  - Also teach their young.