Origins and Evolution of Language
Week 3: Introduction to evolutionary theory

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Tutorial allocation for late sign-ups

I have allocated everyone who emailed me last week (check your email).

If you have not been allocated to a group, grab me in the break or email me asap – tutorials start this week!

Assignment brief now on the course page

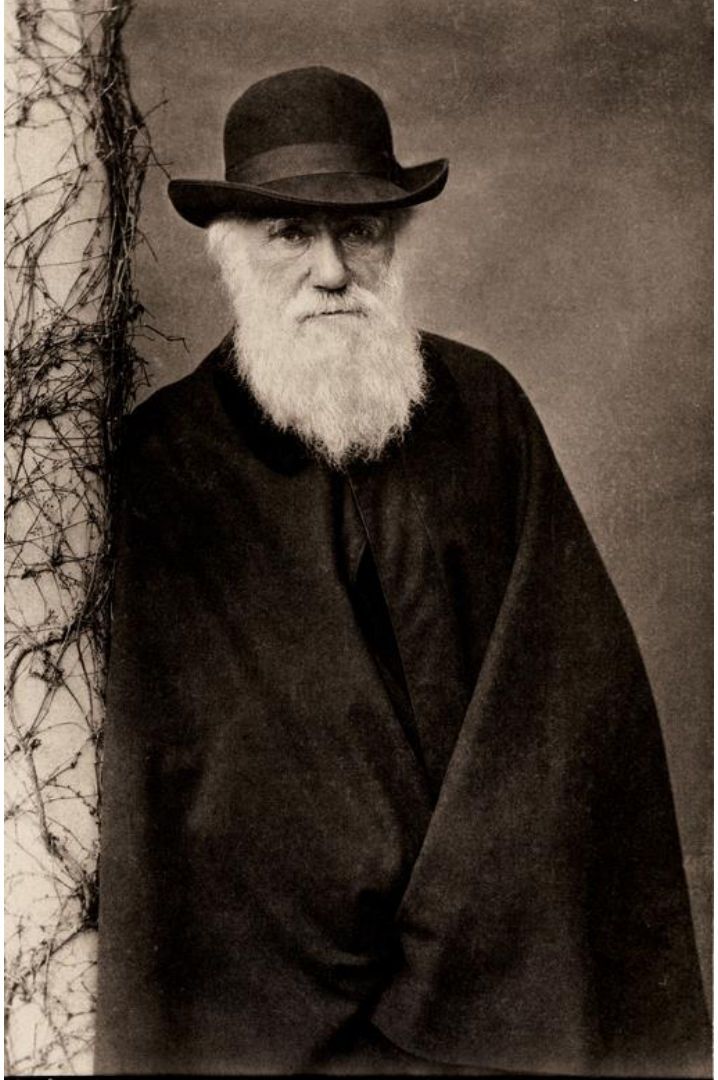
Note link between essay questions and tutorial content

- The essay questions are not the same as the tutorial discussion
- But the tutorial discussion will be highly relevant

Note the link to the FAQ, example essays from previous years, and deadlines for questions

From last week

- Language is just like any other adaptive feature of an organism's biology
- It's an **innate** feature of the human mind
- It evolved by natural selection under pressure for communication



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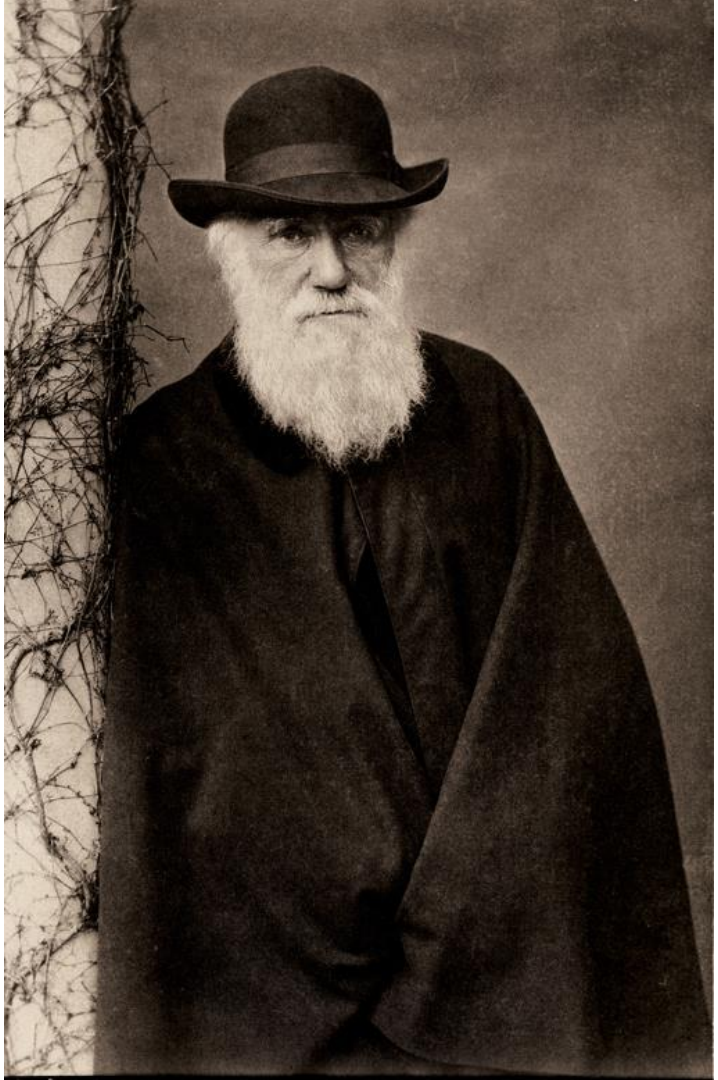
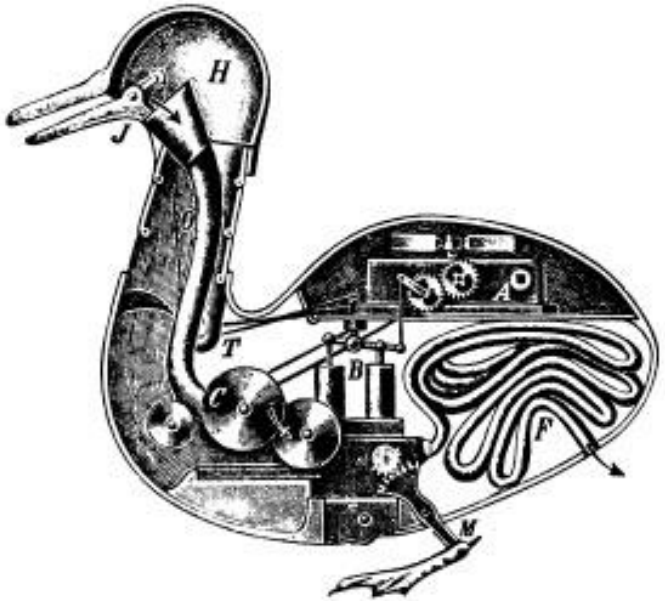


Plan for today

- **Natural selection and adaptation**
  - Heritable variation in fitness
- Homology and analogy
- Language as an adaptation

Design in life

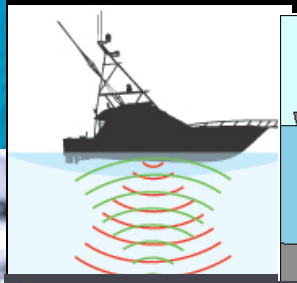


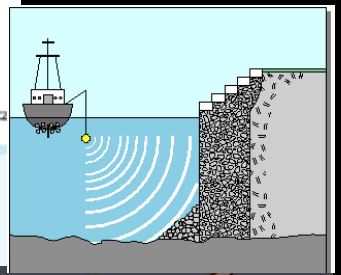
https://en.wikipedia.org/wiki/Digesting_Duck

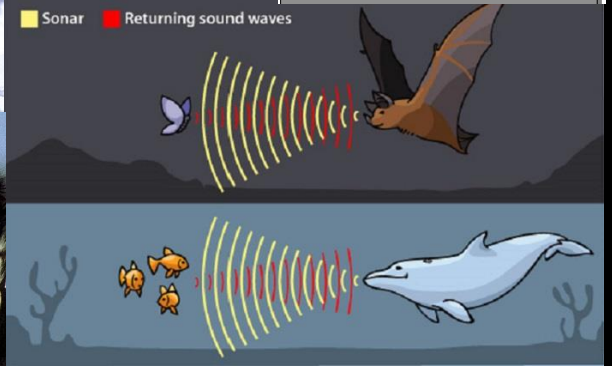
Living things are remarkably competent

- They are self-sustaining, reproducing, autonomous, deal with hostile, changing environments, …
- Designing a machine to do any of these things is currently beyond us

Design in life







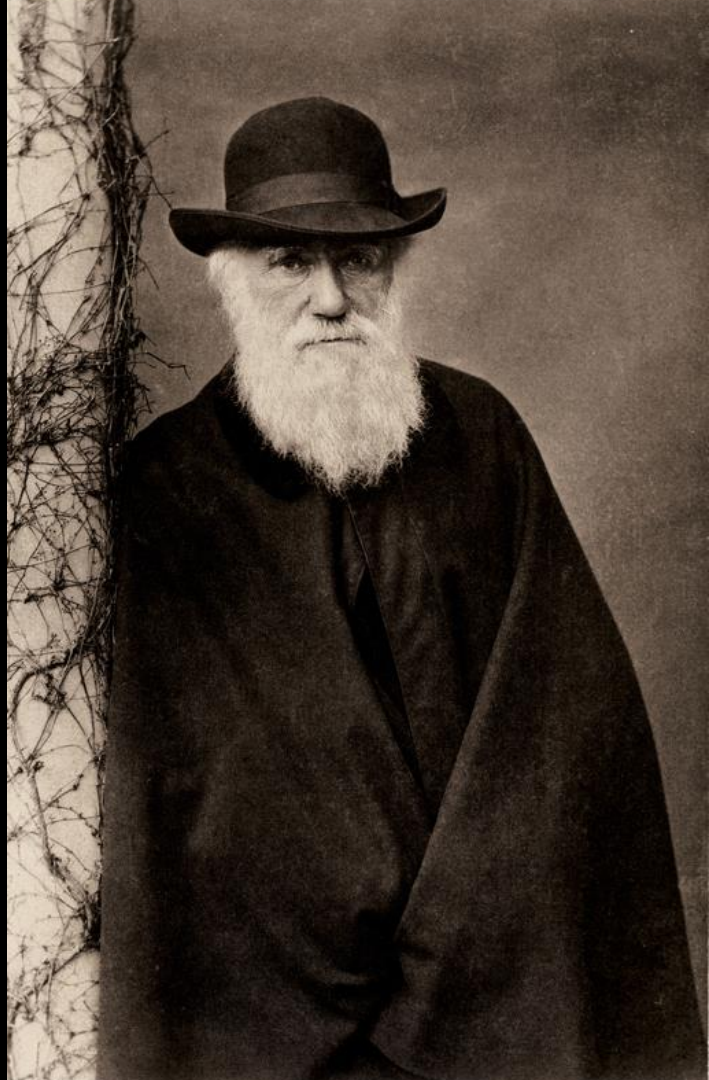
Adaptations

- "'design' in life – those properties of living things that enable them to survive and reproduce in nature." (Ridley, 1996, *Evolution*, p. 5)
- "An adaptation is a characteristic that enhances the survival or reproduction of organisms that bear it" (Futuyama, 2009, *Evolution,* p. 279)
- "The process whereby the members of a population become better suited to some feature of their environment through change in a characteristic that affects their survival and reproduction" (Futuyama again, same page)
- "a characteristic that has evolved by natural selection" (Futuyama again, same page)

Evolution by natural selection

"Owing to this struggle for life, any variation, however slight and from whatever cause proceeding, if it be in any degree profitable to an individual of any species, in its infinitely complex relations to other organic beings and to external nature, will tend to the preservation of that individual, and will generally be inherited by its offspring. The offspring, also, will thus have a better chance of surviving, for, of the many individuals of any species which are periodically born, but a small number can survive. I have called this principle, by which each slight variation, if useful, is preserved, by the term of Natural Selection"

(Darwin, 1859/1965, *On the Origin of Species*, p. 61)



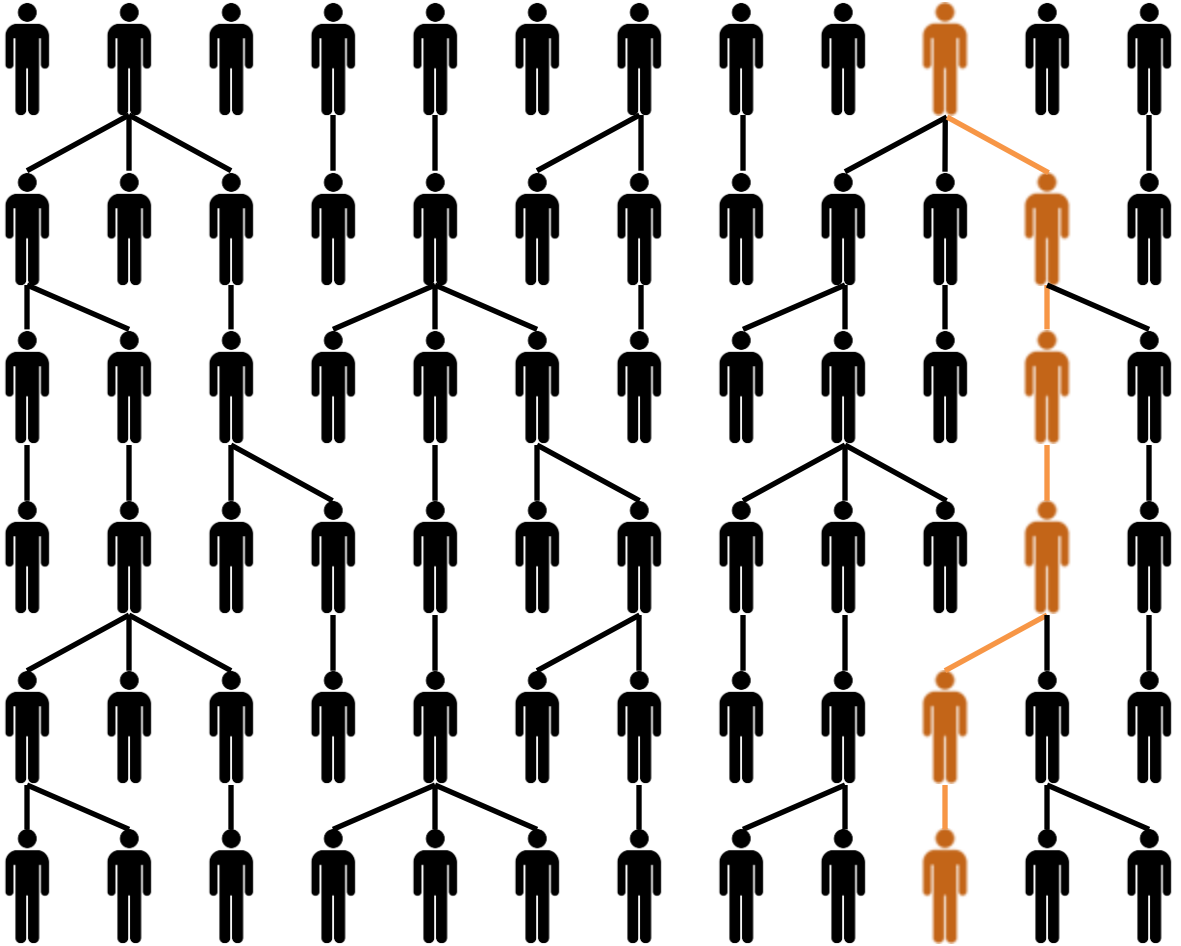
Evolution by natural selection

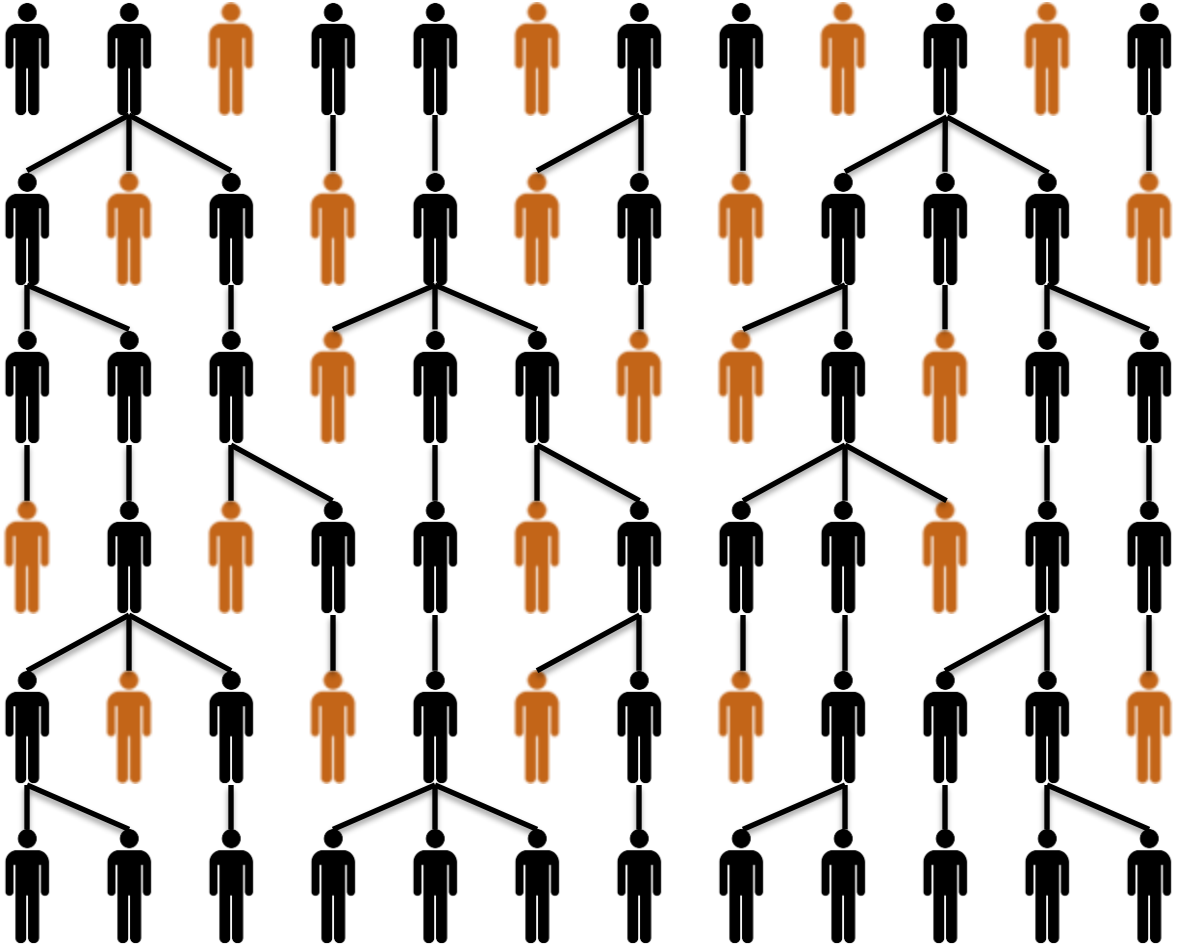
"Natural selection is easiest to understand, in the abstract, as a logical *argument*, leading from premises to conclusion…

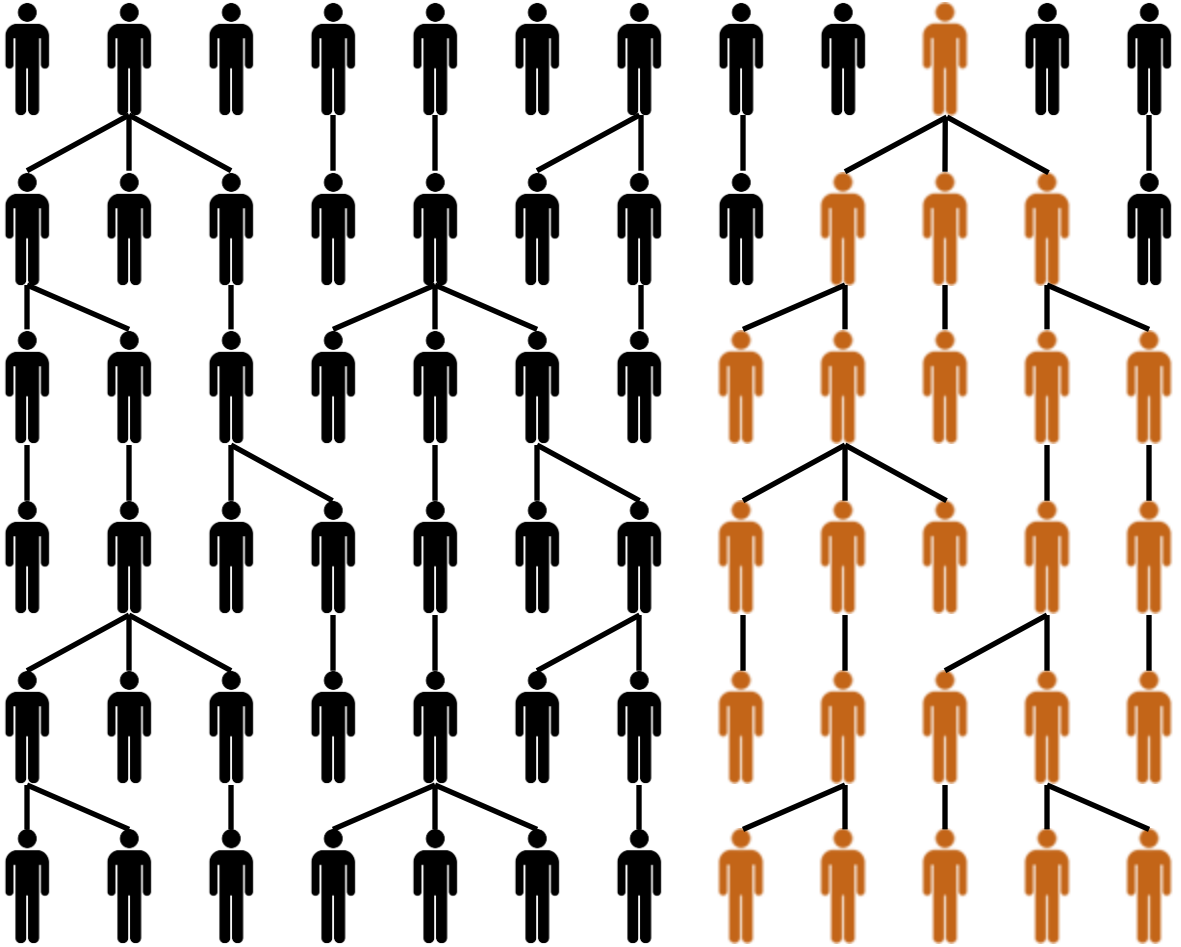
1. Reproduction. Entities must reproduce to form a new generation.
2. Heredity. Offspring must tend to resemble their parents: roughly speaking, "like must produce like."
3. Variation in individual characters among members of a population. …
4. Variation in the *fitness* of *organisms* according to the state they have for a heritable character. … individuals in the population with some characters must be more likely to reproduce (i.e. have higher fitness) than others

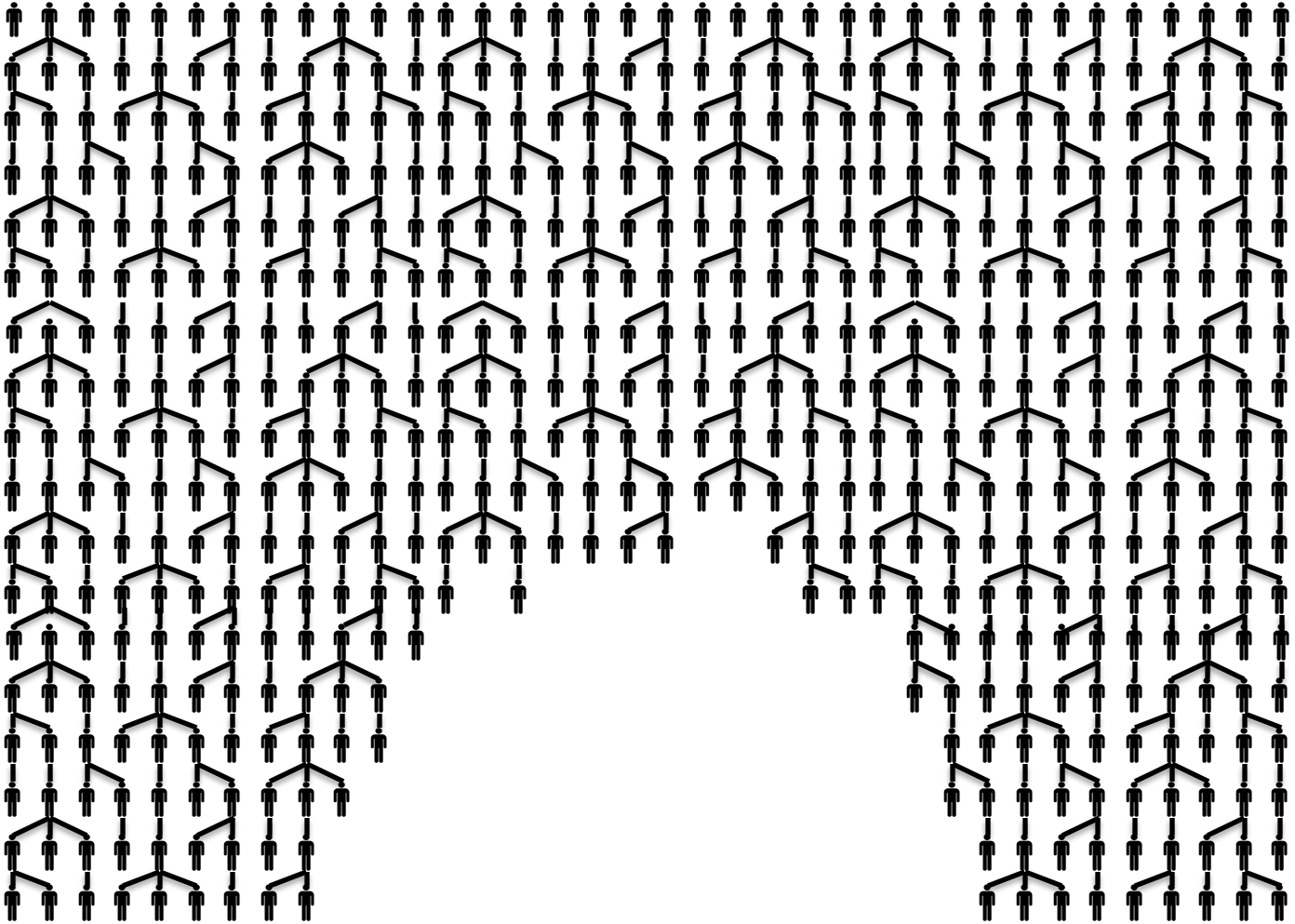
If these conditions are met, for any property or species, natural selection *automatically* results. If any conditions are not met, natural selection does not result. … When all four conditions apply, the entities with the property conferring higher fitness will leave more offspring, and the frequency of that type of entity will increase in the population" . (Ridley, *Evolution,* p. 71-72)

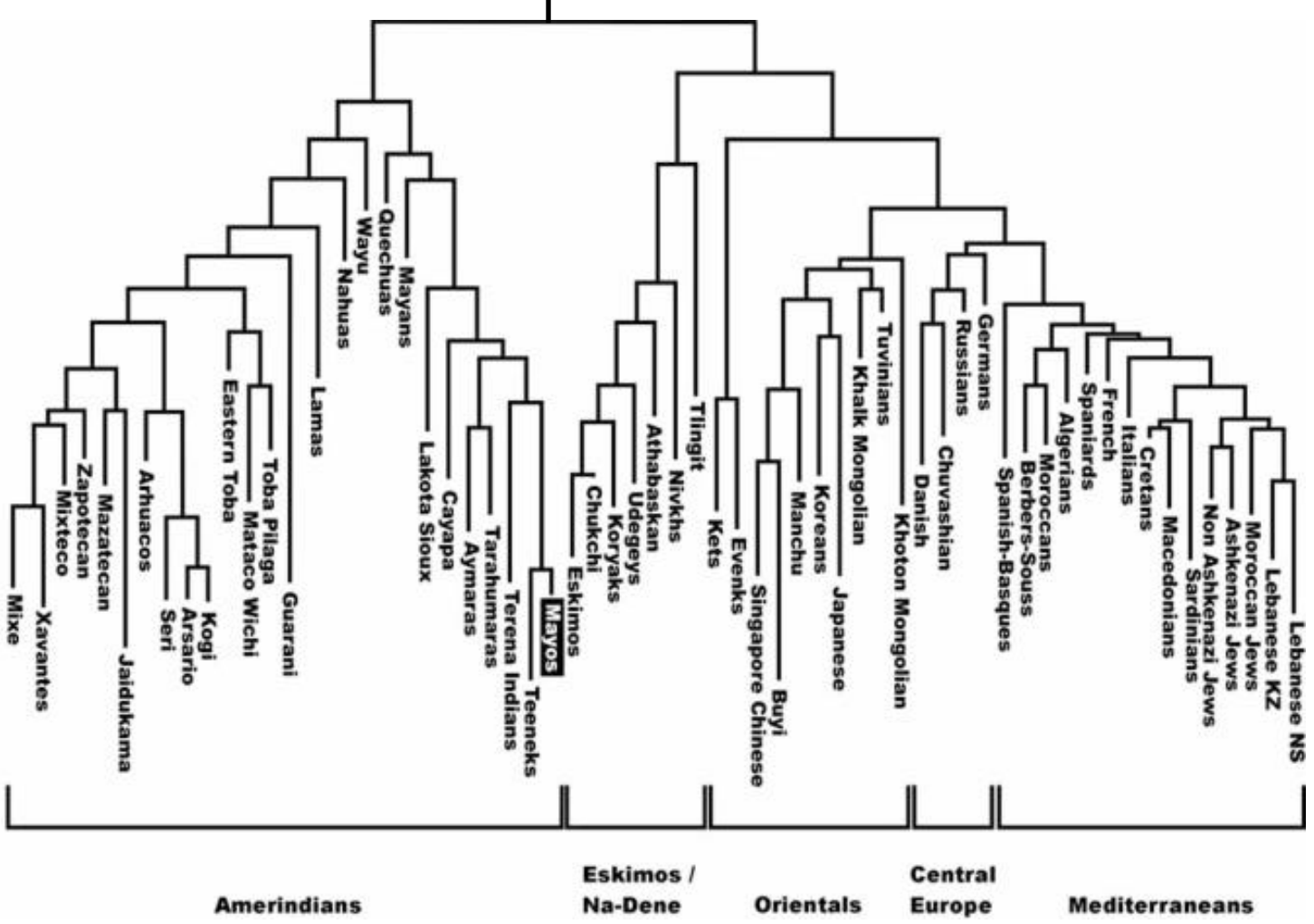
https://www.youtube.com/watch?v=plVk4NVIUh8



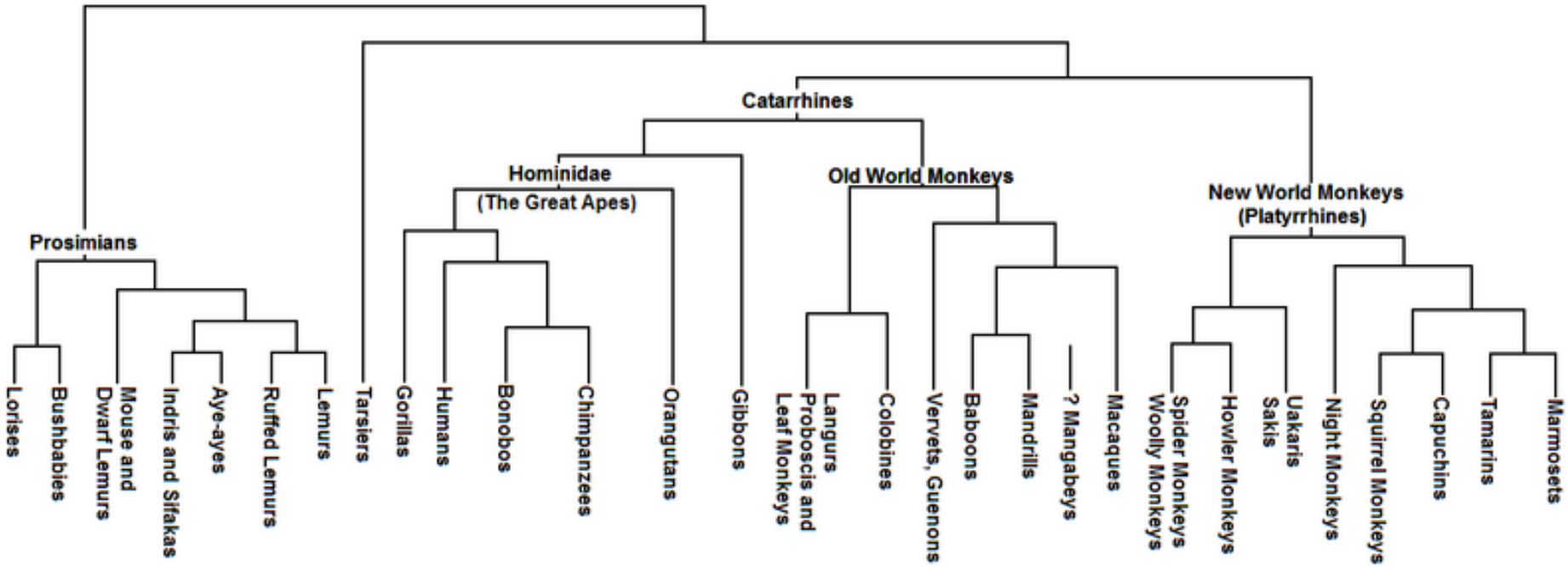


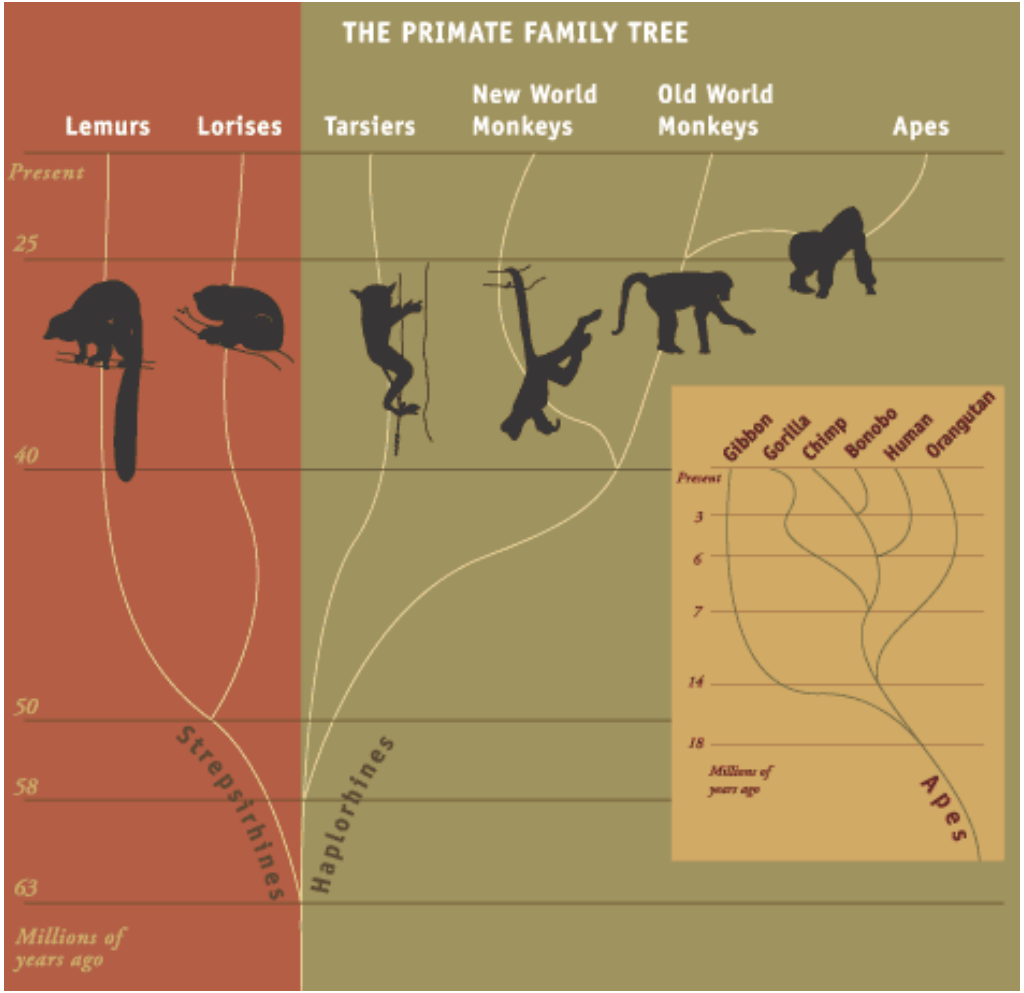




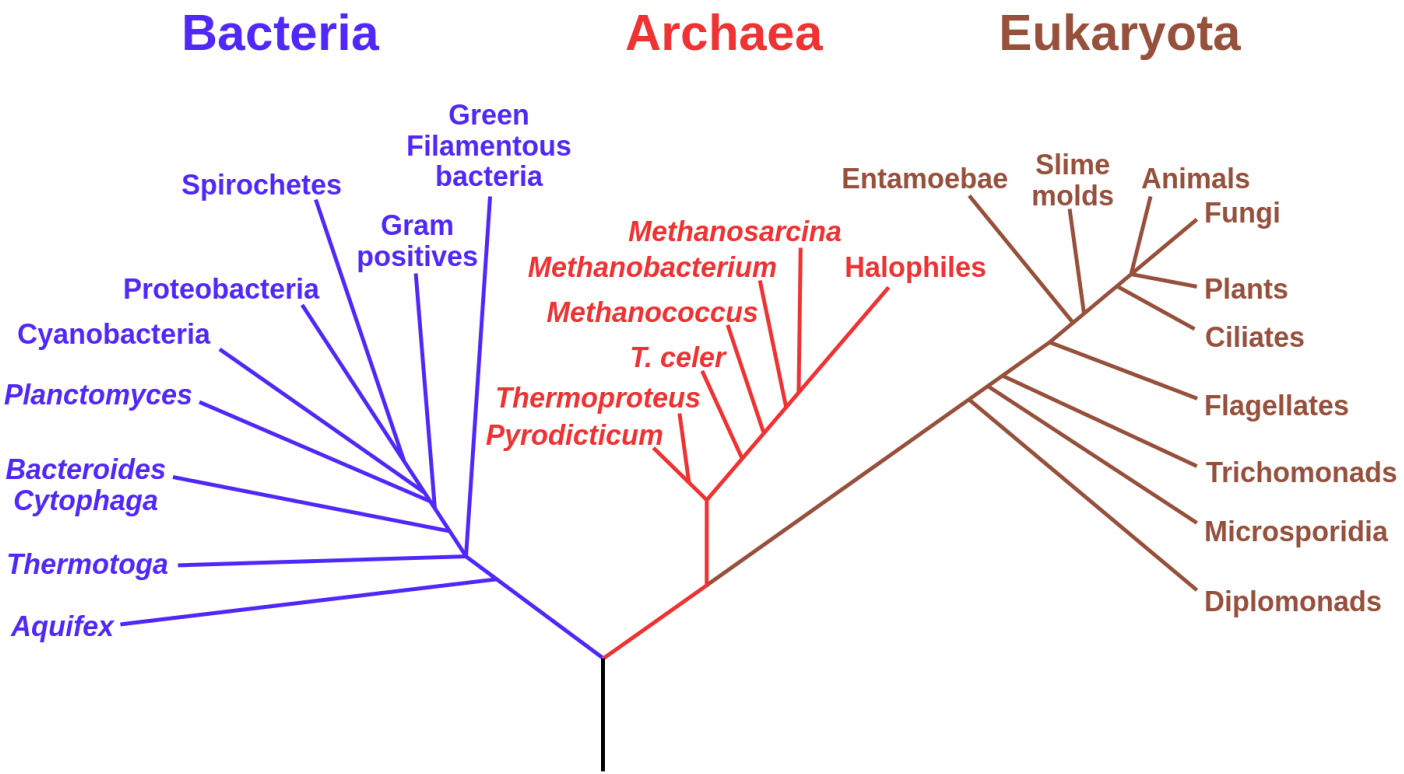


From Arnaiz-Villena et al. (2007). HLA Genes in Mayos Population from Northeast Mexico. *Current Genomics. 8.* 466-475.


Prosimians
Lorises
Bushbabies
Mouse and Dwarf Lemurs
Indris and Sifakas
Aye-ayes
Ruffed Lemurs
Lemurs
Tarsiers
Catarrhines
Hominidae (The Great Apes)
Gorillas
Humans
Bonobos
Chimpanzees
Orangutans
Gibbons
Old World Monkeys
Langurs Proboscis and Leaf Monkeys
Colobines
Vervets, Guenons
Baboons
Mandrills
? Mangabeys
Macaques
New World Monkeys (Platyrrhines)
Spider Monkeys Woolly Monkeys
Howler Monkeys
Uakaris Sakis
Night Monkeys
Squirrel Monkeys
Capuchins
Tamarins
Marmosets

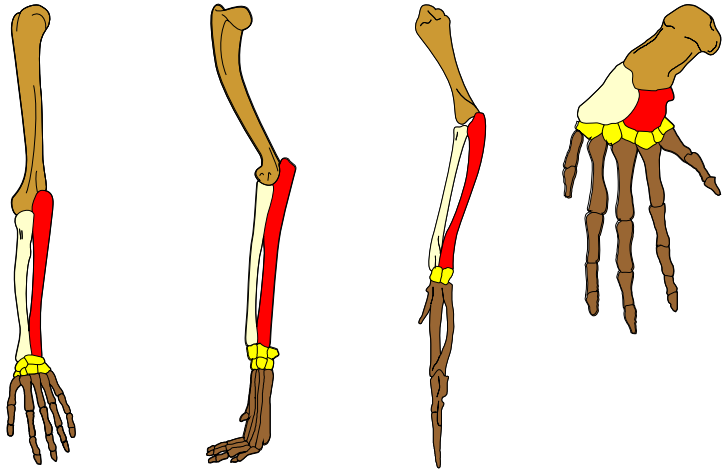


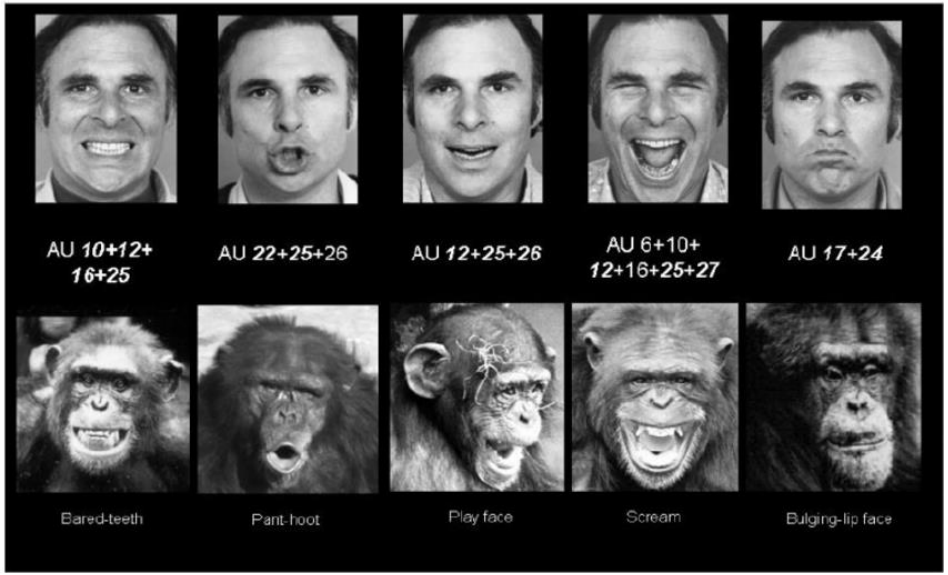
http://www.daviddarling.info/images/primate_family_tree.gif



https://commons.wikimedia.org/wiki/File:Phylogenetic_tree.svg

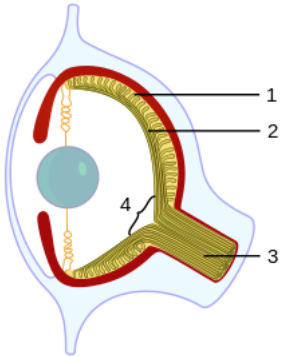
Homology

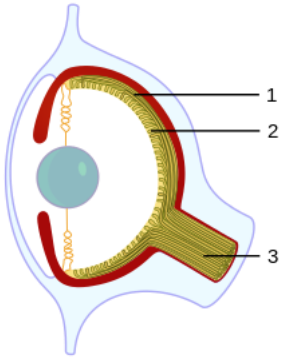


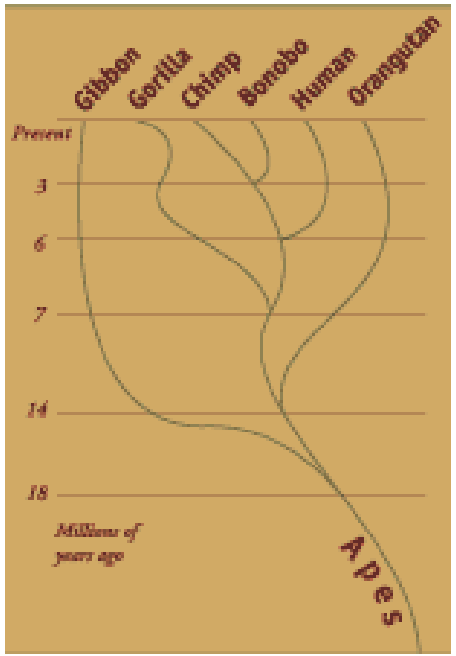


From Parr, L. A., &, Waller, B. M. (2006). Understanding chimpanzee facial expression: insights into the evolution of communication. *SCAN, 1,* 221-228.

Convergent evolution







Humans and white-handed gibbons produce complex vocalisations featuring rule-governed combinations of a limited set of discrete sound types. Is this likely to be a homologous trait?

Go to wooclap.com

Use code INMRBS

1: Yes

2: No

3: I need more information

Language as an adaptation?

- Language is just like any other adaptive feature of an organism's biology
- It's an **innate** feature of the human mind
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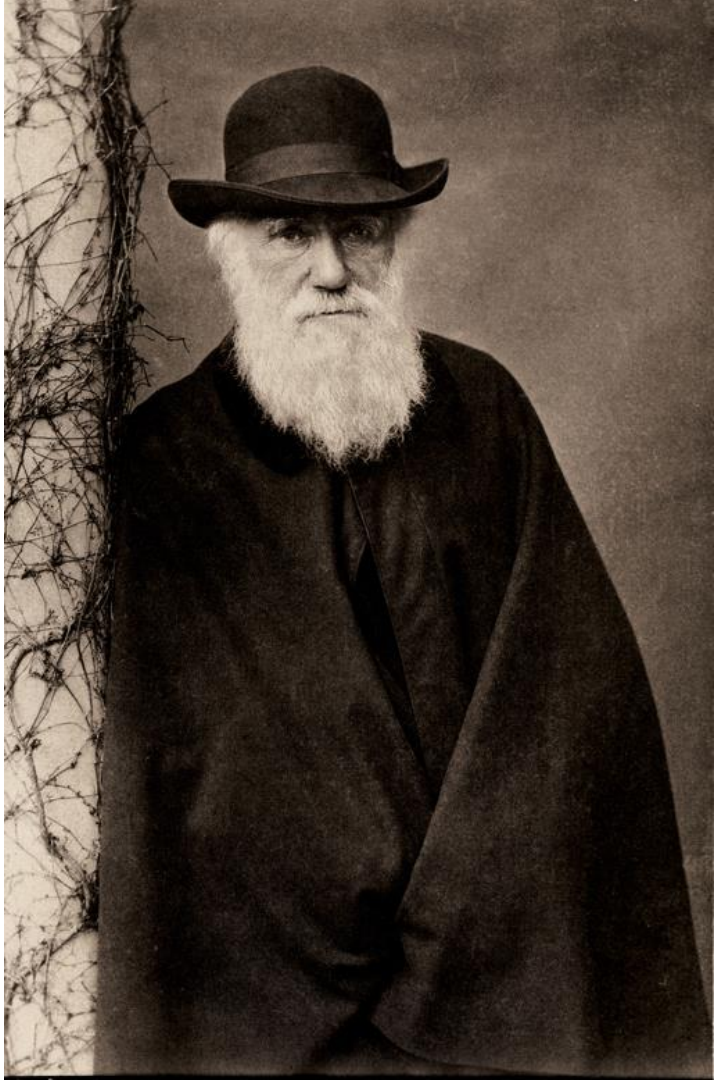
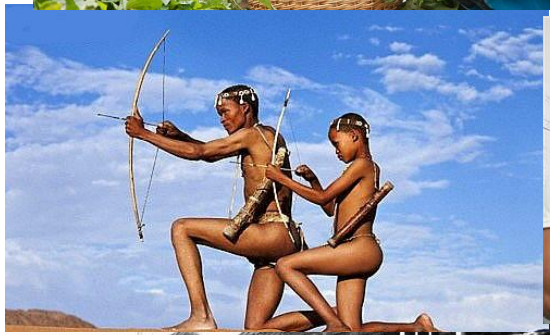


A tool for the communication of knowledge and internal states



The core of the argument (from Pinker & Bloom, 1990)

"We will suggest that language shows signs of design for the communication of propositional structures over a serial channel.

The propositions in [human thought] are relational structures whose symbols pertain to people, objects, and events, the categories they belong to, their distribution in space and time, and their causal relations to one another … The causal relations governing the behavior of other people are understood as involving their beliefs and desires, which can be reconsidered as relations between an individual and the proposition that represents the content of that belief or desire"

Pinker, S., & Bloom, P. (1990). Natural language and natural selection. *Behavioural and Brain Sciences, 13,* 707-784.
Lengthy quote is from p. 712-713

The core of the argument (from Pinker & Bloom, 1990)

"We would want to be able to

- *refer to individuals and classes,*
- *to distinguish among basic ontological categories (things, events, places, times, manners, and so on),*
- *to talk about events and states, distinguishing the participants in the event or state according to role (agents, patients, goals),*
- *to talk about the intentional states of ourselves and others*
- *to express distinctions of truth value, modality (necessity, possibility, probability, factivity)*

Pinker, S., & Bloom, P. (1990). Natural language and natural selection. *Behavioural and Brain Sciences, 13*, 707-784.
Lengthy quote is from p. 712-713

The core of the argument (from Pinker & Bloom, 1990)

- *to comment on the time of an event or state, including both its distribution over time (continuous, iterative, punctate) and its overall time of occurrence*
- *to encode an unlimited number of predicates, arguments, and propositions*
- *to be able to use the same propositional content within different speech acts; for instance, as a question, a statement, or a command.*
- *to focus or to put into the background different parts of a proposition, so as to tie the speech act into its context of previously conveyed information and patterns of knowledge of the listener. ”*

Pinker, S., & Bloom, P. (1990). Natural language and natural selection. *Behavioural and Brain Sciences*, *13*, 707-784.
Lengthy quote is from p. 712-713

The core of the argument (from Pinker & Bloom, 1990)

"All we have argued is that human language, like other specialized biological systems, evolved by natural selection. Our conclusion is based on two facts that we would think would be entirely uncontroversial: Language shows signs of complex design for the communication of propositional structures, and the only explanation for the origin of organs with complex design is the process of natural selection." (p. 726)

Are you persuaded? wooclap.com, code INMRBS

1: Yes

2: No

3: I need more information

Pinker, S., & Bloom, P. (1990). Natural language and natural selection. *Behavioural and Brain Sciences, 13,* 707-784.

Summary

- Adaptation & natural selection
  - A consequence of heritable variation in fitness
  - Similarity due to common ancestry (homology)
  - Convergent evolution and analogy
- Language as a biological adaptation

Next up

- Tutorials
  - Attendance compulsory
  - Know where you are going
  - Do the reading
- Next week's lecture: intention and structure in animal communication