

Origins and Evolution of Language

Week 2: Introduction to evolutionary theory

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Tutorial allocation for late sign-ups

If you have not been allocated a tutorial group:

- Contact timetabling@ed.ac.uk and ask them to allocate you to a group
- Until you are allocated, pick a group to attend yourself ([times and venues here](#))

**DEFEND THE FUTURE OF UK
HIGHER EDUCATION**

[ucu.org.uk/rising](https://www.ucu.org.uk/rising)



Strike action this semester

UCU, the main union for academics and support staff, is in dispute with the University employers

- Over pay, pensions, casualization, pay inequality

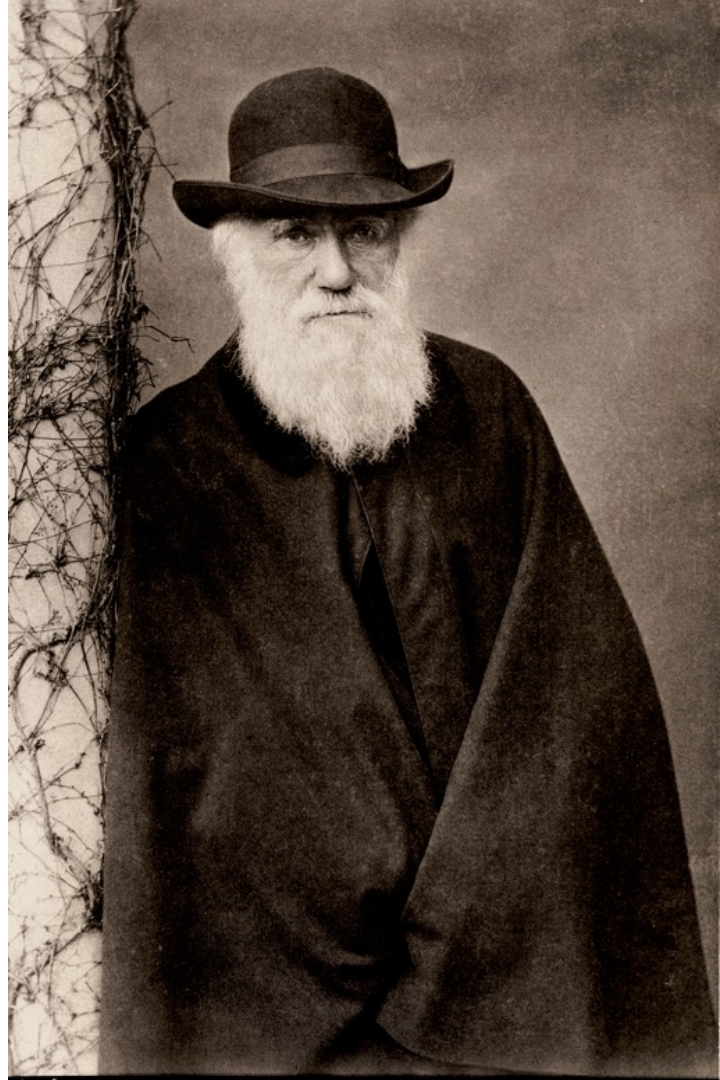
Definitely a strike on **1st February**, another **17** days to be announced in February/March, plus marking boycott from April

You can respectfully email your views to our Principal, Prof Peter Mathieson, principal@ed.ac.uk

We would much rather be teaching and getting paid!

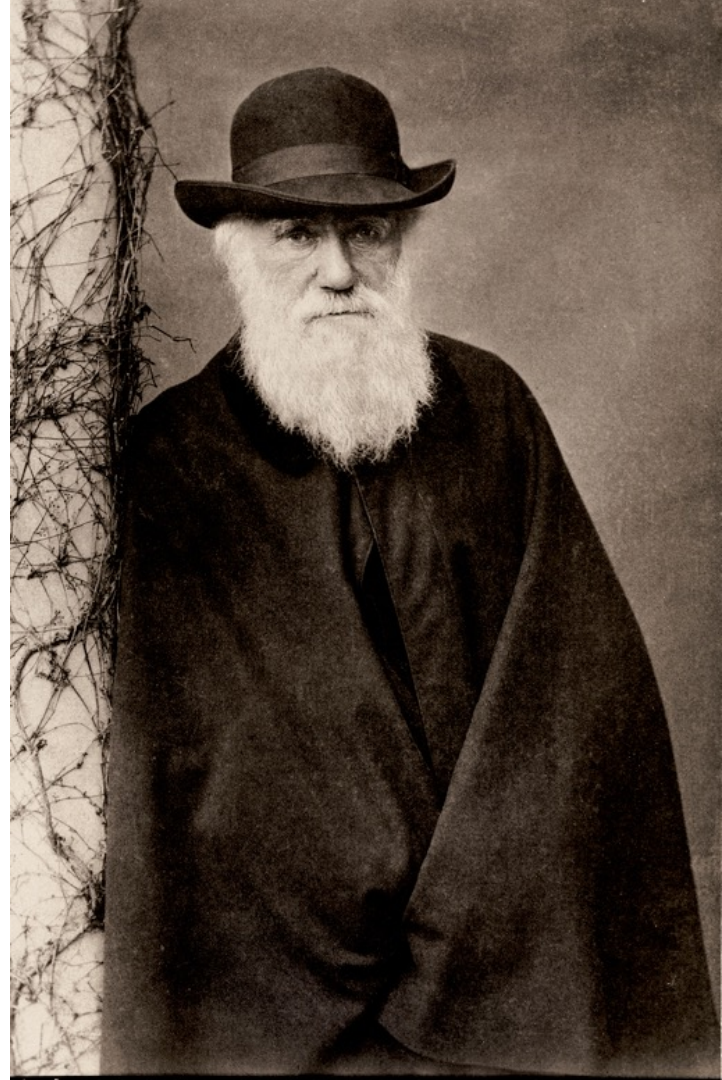
From last week

- 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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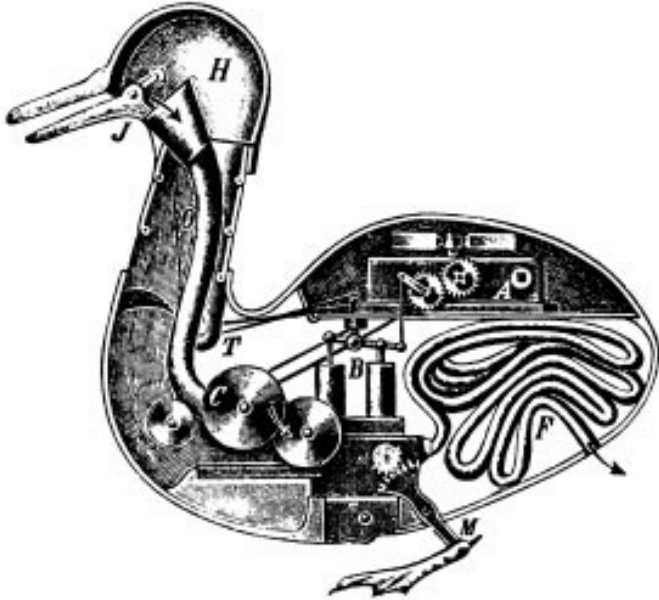
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Plan for today

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

Design in life



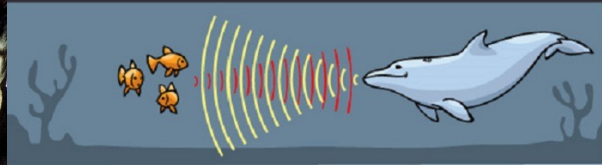
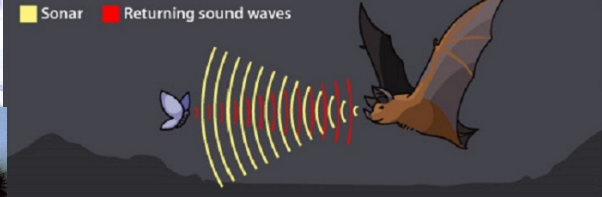
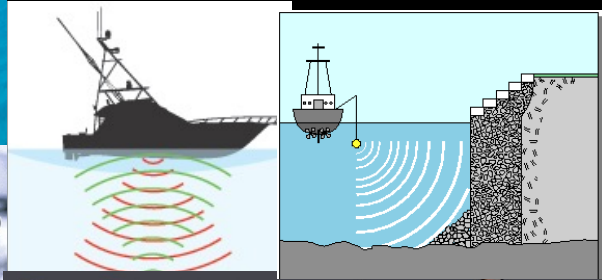
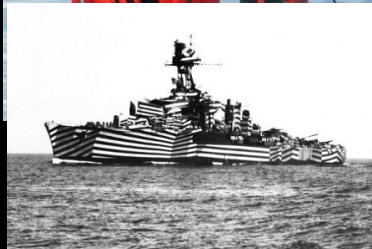
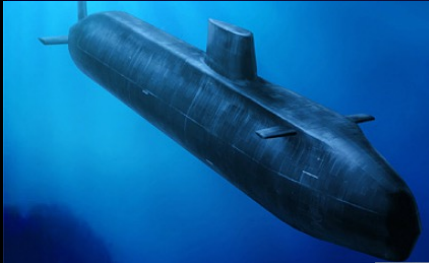
https://en.wikipedia.org/wiki/Digesting_Duck

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



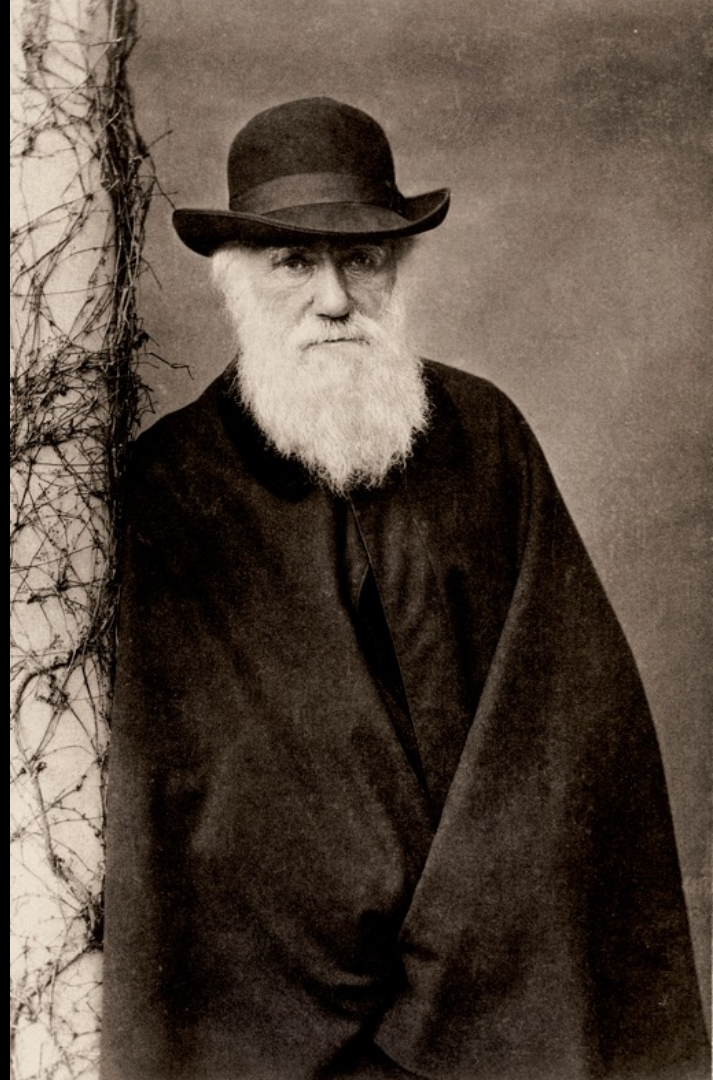
Adaptations

- “‘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)



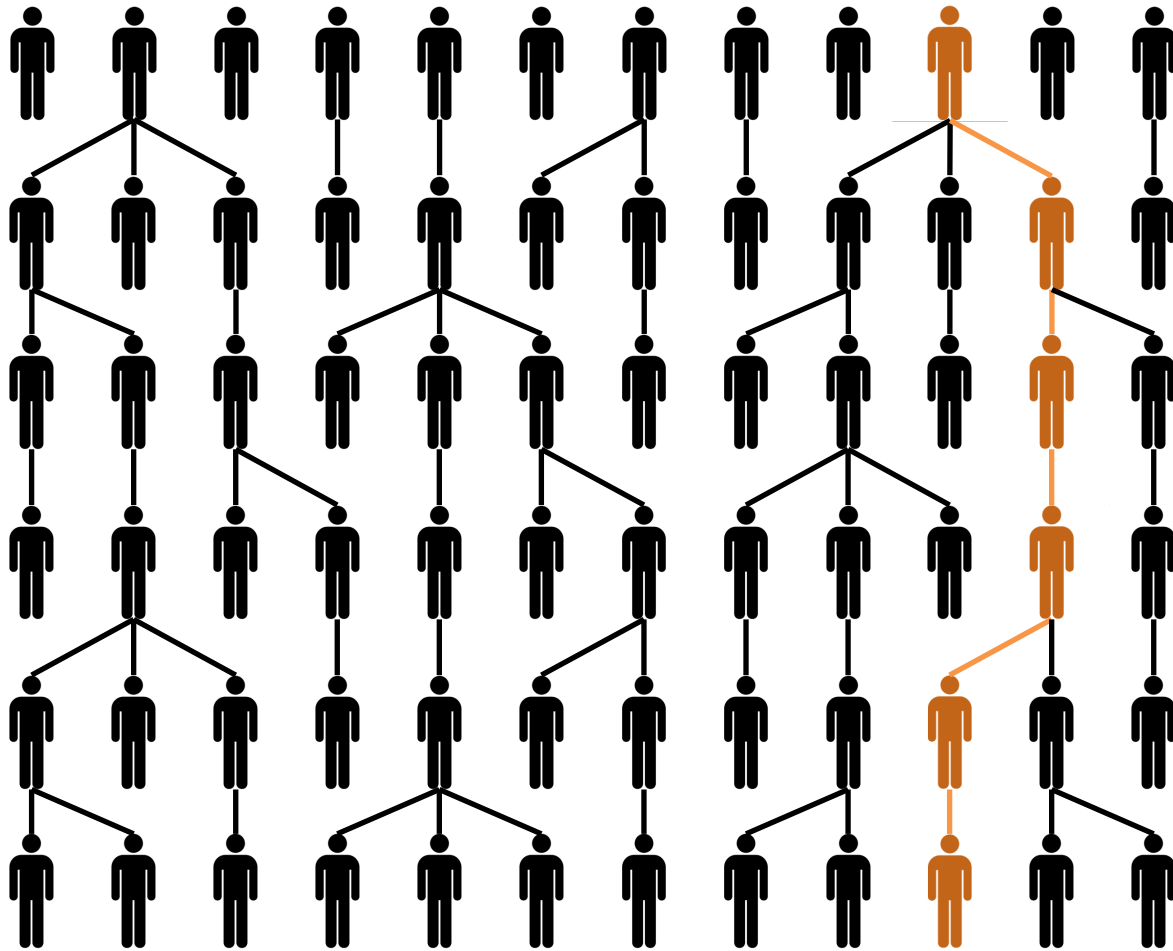
Evolution by natural selection

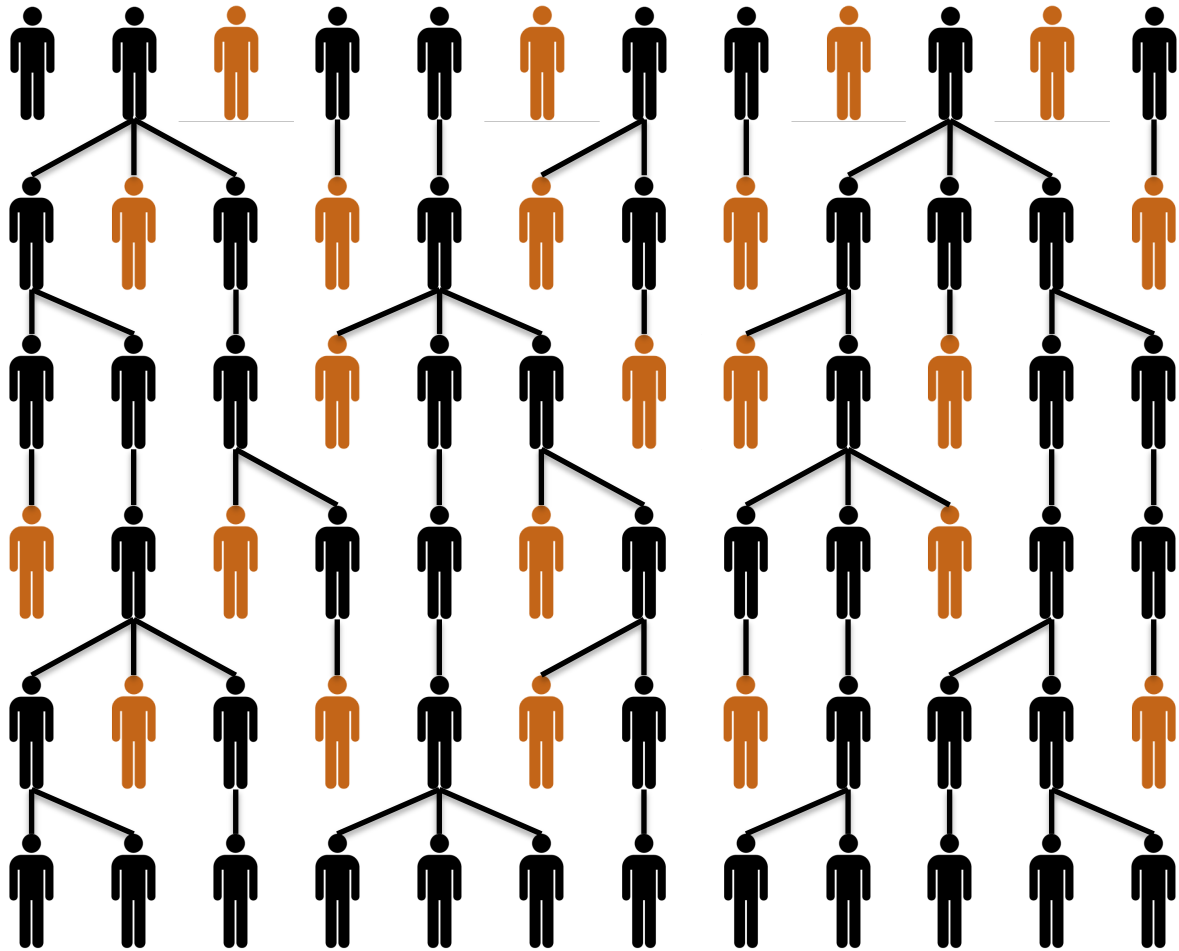
“Natural selection is easiest to understand, in the abstract, as a logical *argument*, leading from premises to conclusion...

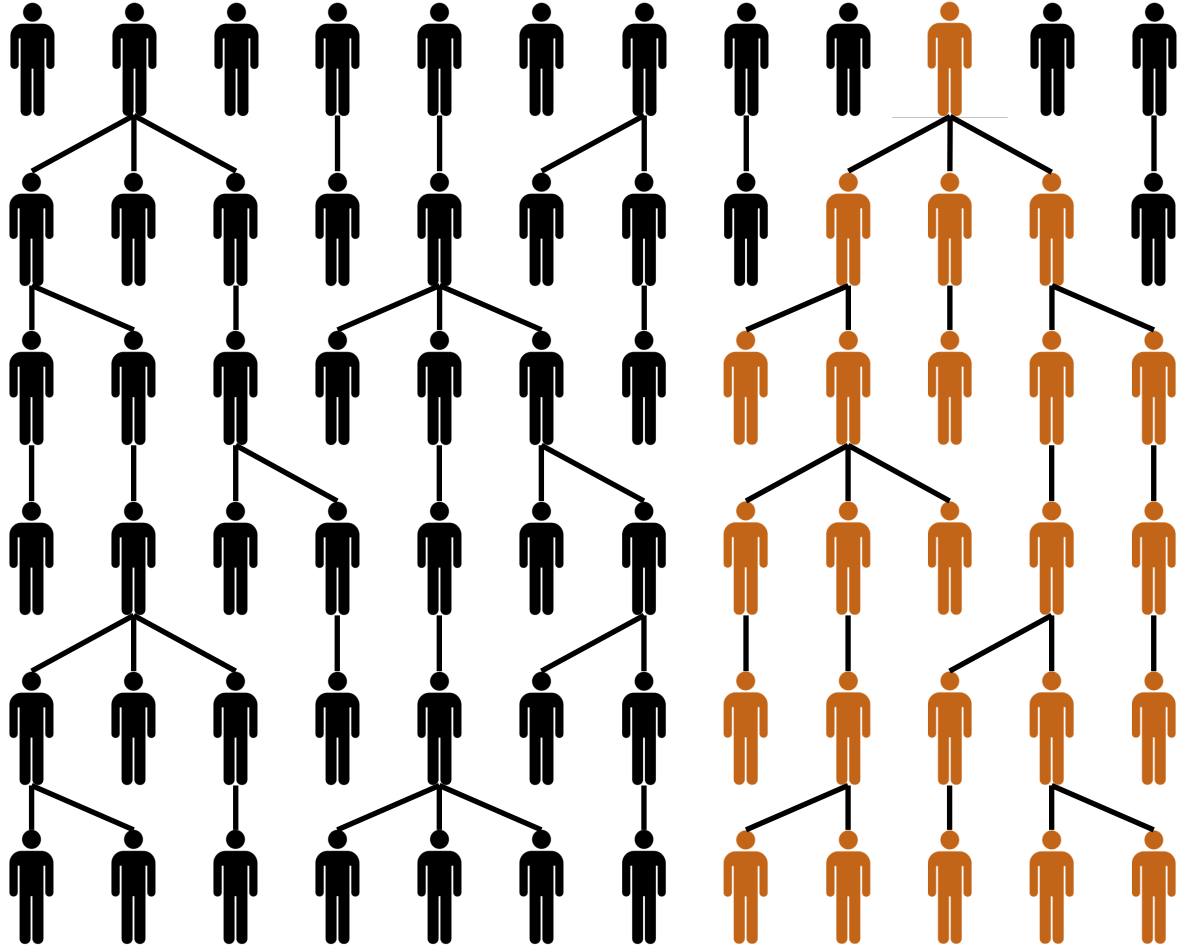
1. Reproduction. Entities must reproduce to form a new generation.
2. Heredity. Offspring must tend to resemble their parents: roughly speaking, “like must produce like.”
3. Variation in individual characters among members of a population. ...
4. Variation in the *fitness* of *organisms* according to 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

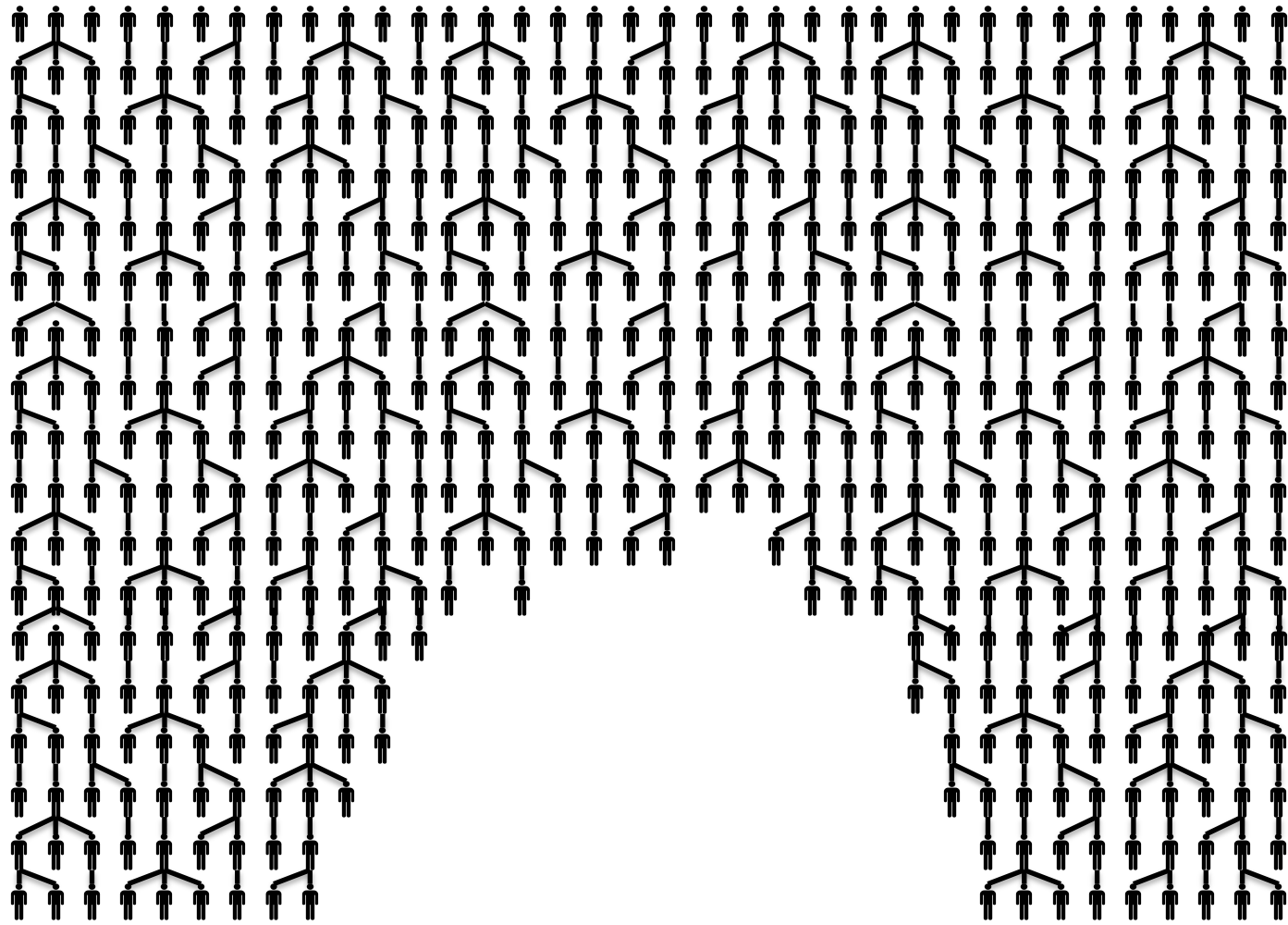
If these conditions are met, for any property or species, natural selection *automatically* results. If any conditions are not met, natural selection does not result. ... When all four conditions apply, the entities with the property conferring higher fitness will leave more offspring, and the frequency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

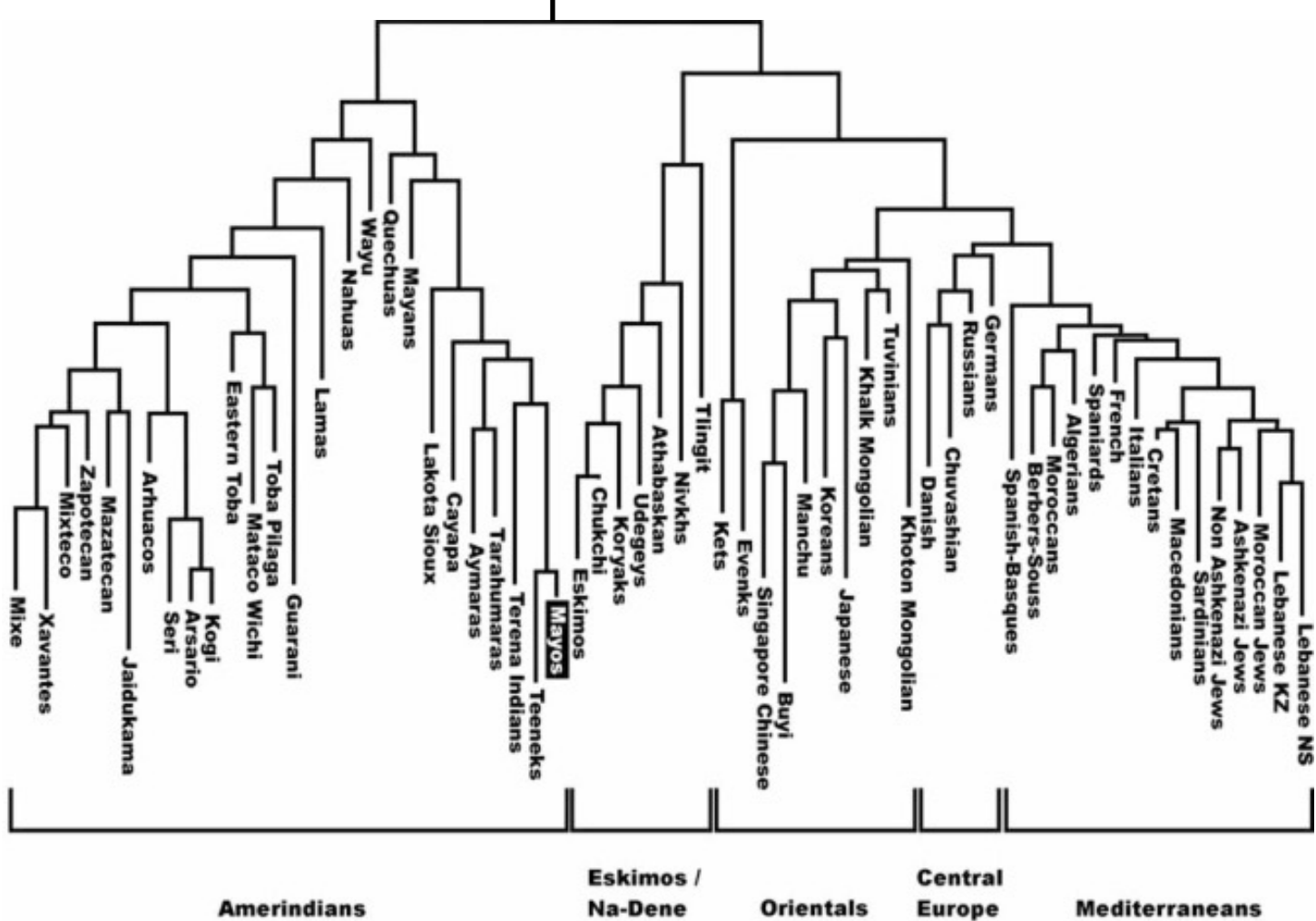
<https://www.youtube.com/watch?v=pIVk4NVIUh8>



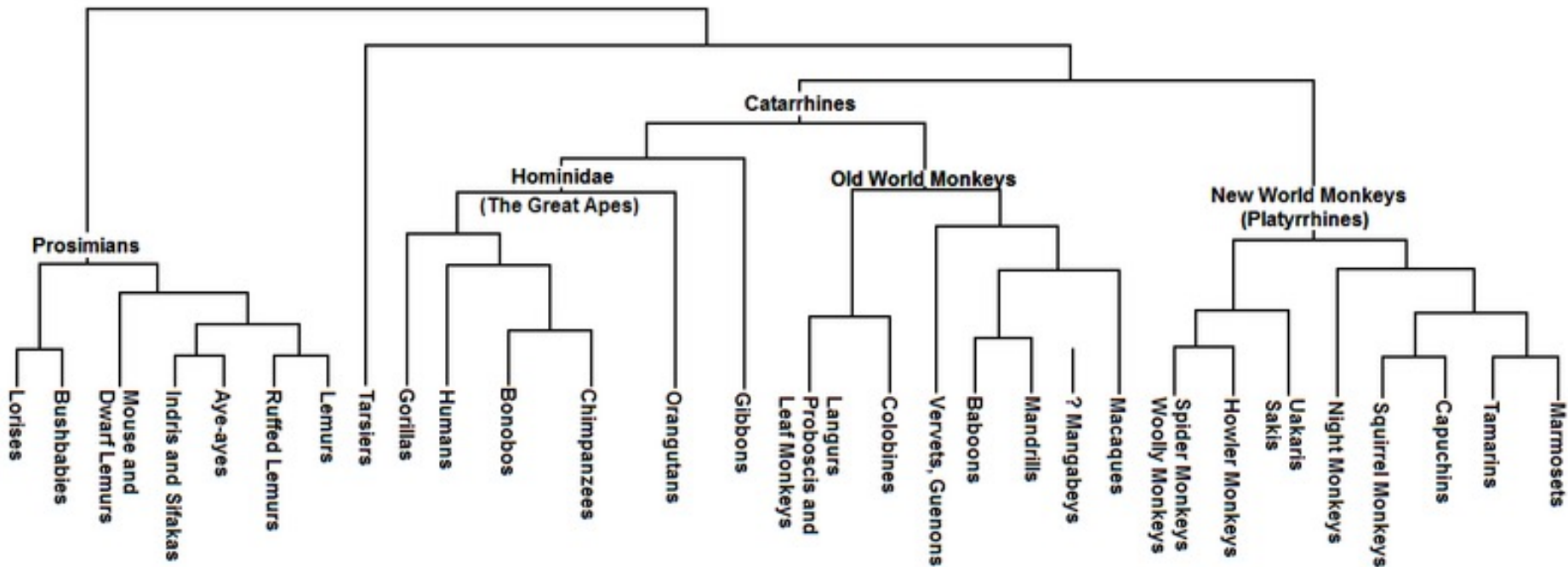


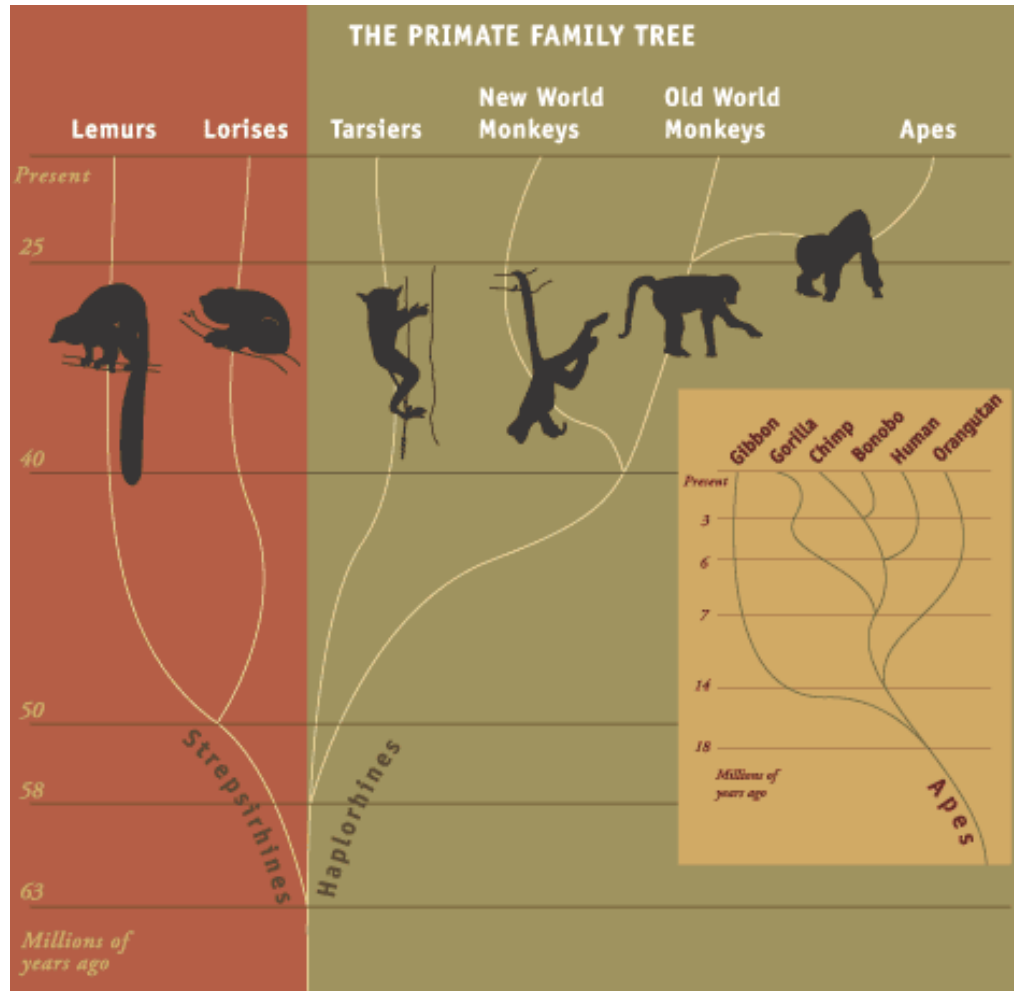


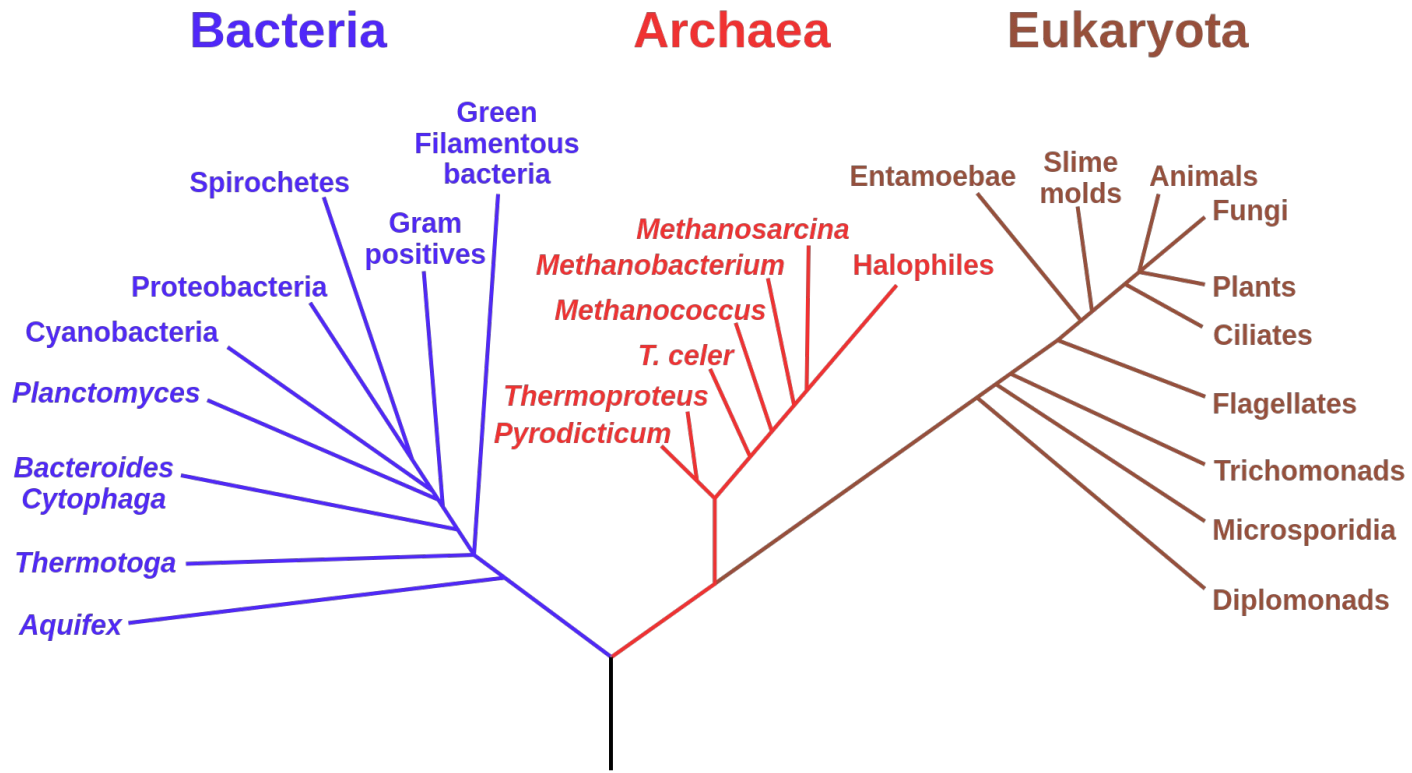




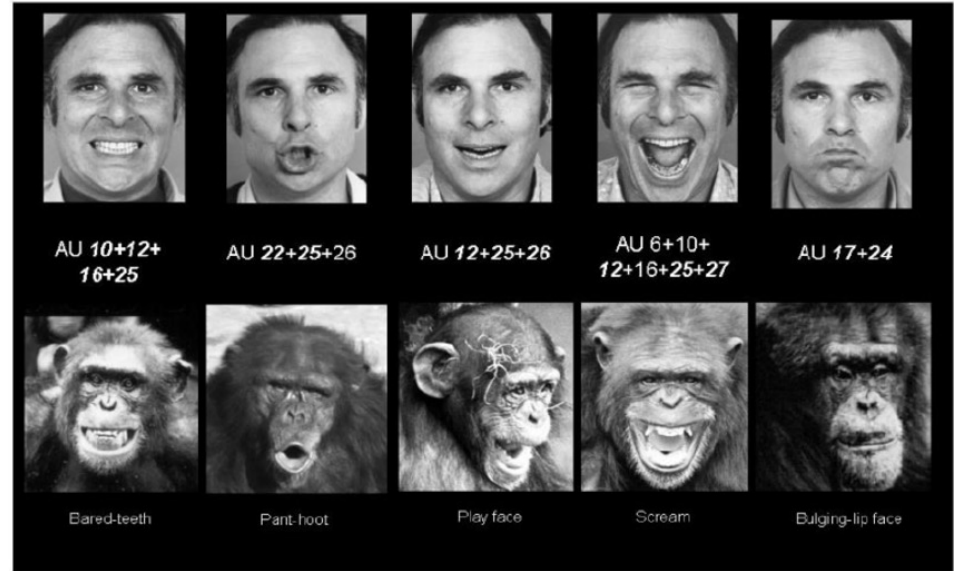
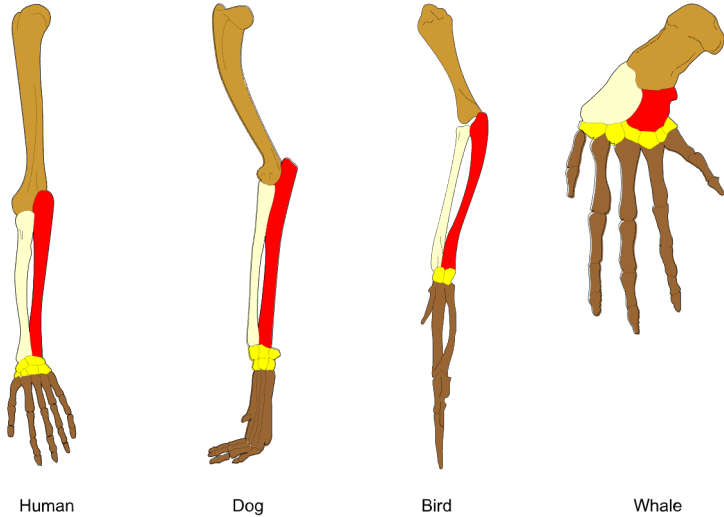
From Arnaiz-Villena et al. (2007). HLA Genes in Mayos Population from Northeast Mexico. *Current Genomics*, 8, 466-475.





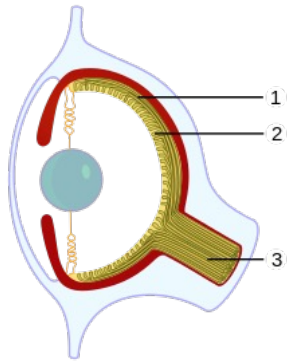
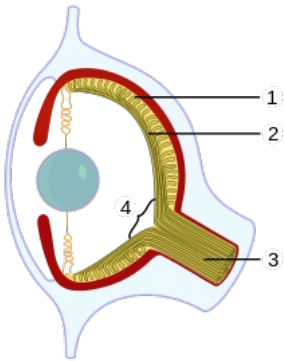


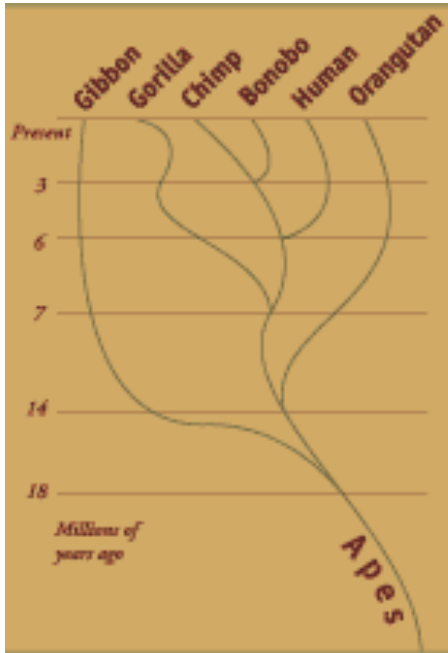
Homology



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?

A: Yes

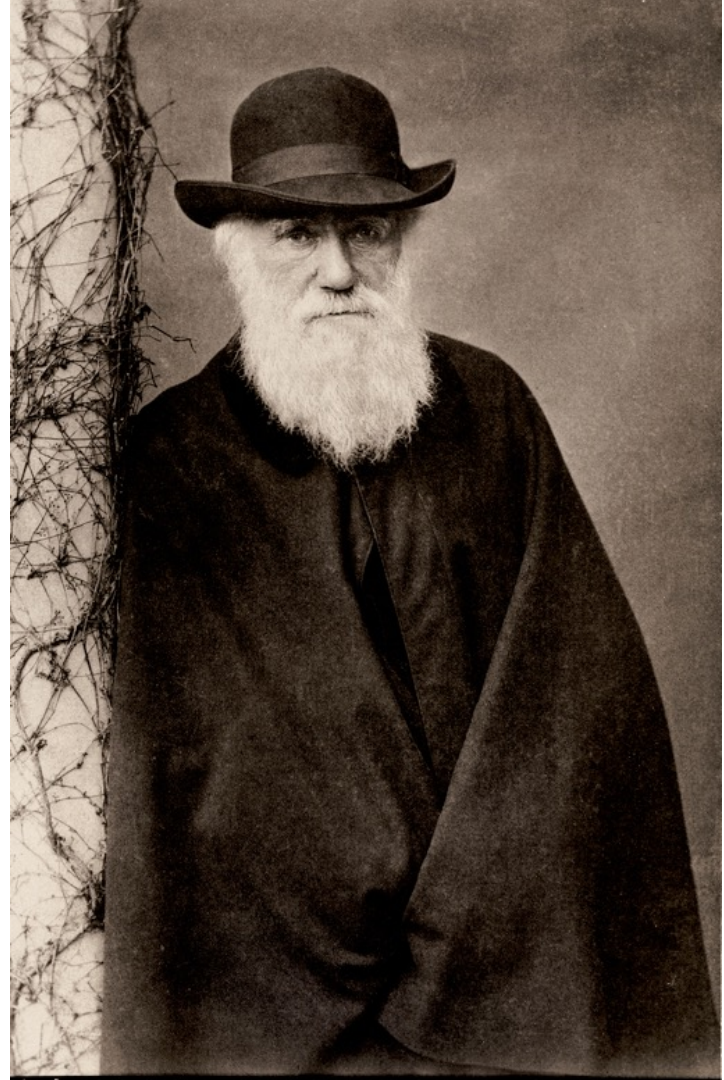
B: No

C: 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
- It **evolved by natural selection** under pressure for communication



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.
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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. ”*

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?

A: Yes

B: No

C: 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