Astronomy 230

This class (Lecture 20):
Origin of Intelligence
Alan Francis
Katelyn Swartz
Octavio Mendoza

Next Class:

Origin of Intelligence
Jeffery Ungrund
Ian Gentile
Chris Blim

Nov 9:

Jake O'Keefe
Brandon Eckardt
Kevin Quinn

Presentations

- **Alan Francis**:
- **Katelyn Swartz**:Possible Alien Physiolog
- **Octavio Mendoza**: Supernovae contributing to planet/life formation

Outline

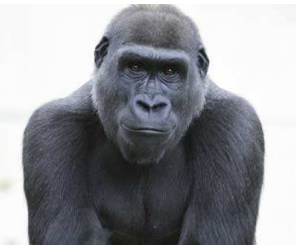
- The rise of the primates!
- From intelligence to communication
- Will a civilization develop that has the appropriate technology and worldview?
- Requires knowledge of quantum mechanics and astronomy.

Primates

- Main characteristics:
  - Flat fingernails
  - Eyes in front of face
  - No sharp teeth or claws
  - Some have large brain-to-body rations, but most do not.
  - Primarily adapted to life in trees
- Basically, with one large exception, primates have not been very successful.

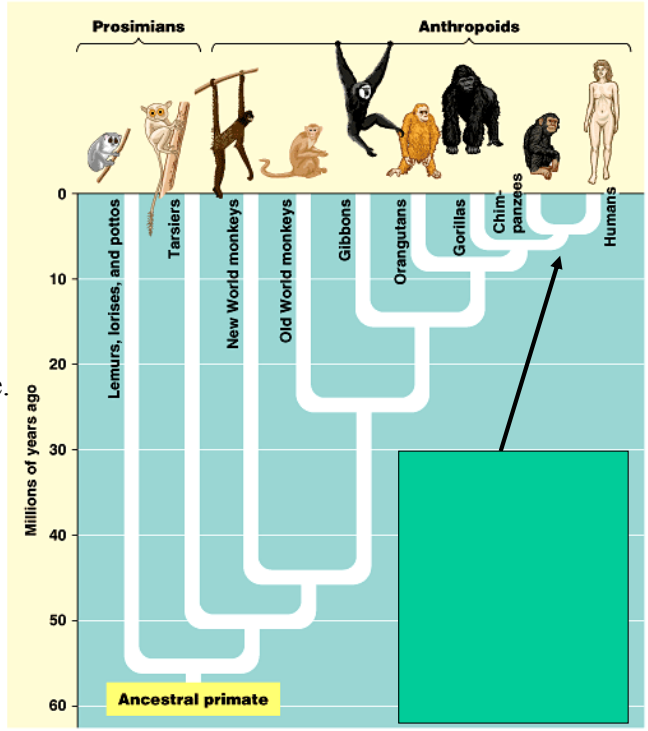
That one

Not that one



Family Tree?

- General trend of adaptation to tree life.
- From toe claws to gripping with large toes or fingers (thumbs).
- This allowed for tool use.
- From nocturnal to daylight.
- More vision– a rounded face with forward eyes and color vision.
- These mutations were random.

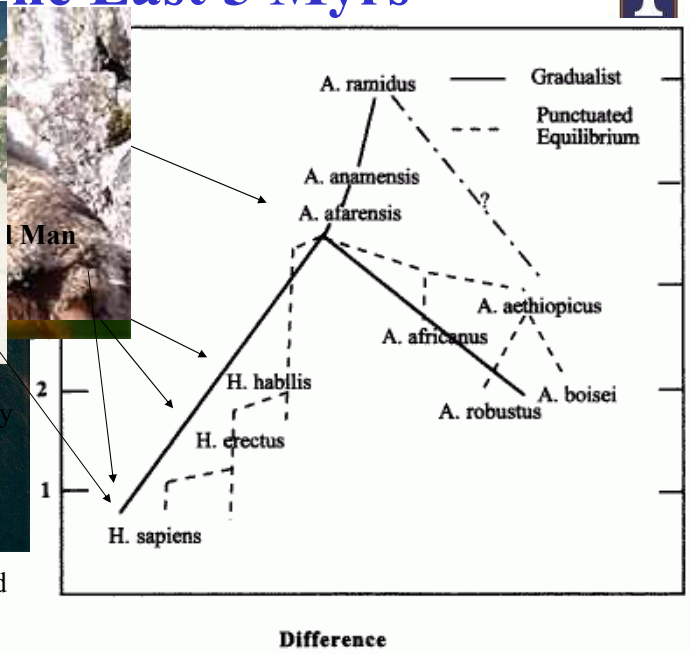


The Last 5 Myrs

Sapiens that had larger brain volume and probably language.

Went extinct 28000 yrs ago.

May or may not be related to us.



Ancestors

- Overall, the evolution leading to H. sapiens was not a smooth and steady path.
- At some points there were 4-6 distinct hominid species living.
- Modern humans emerged from a situation with many variant species adapting to fill different environmental niches.
- Only one path lead to much larger brains, and we do not truly understand what environmental factor favored it.

f_i Considerations

- Complexity leads to intelligence, but complexity seems to require a benign environment. Harsher environments have simpler organisms.
- Perhaps life may exist on harsh planets, but more intelligent life?
- Remember, human intelligence took 4.5 billion years.
- Systems too near the center of the galaxy are more likely to be hit with supernovae event in that time.
- 4.5 Byrs is about half the age of our galaxy. Were we fast or slow? Fast: severely limits ETs. Slow: there can be multiple ETs.

f_i Considerations

- Intelligent life is a very recent development on Earth with the emergence of the primates, hominids, and H. sapiens.
- Everyone agrees that this particular evolution will not occur on other planets.
- But, will the characteristics of H. sapiens be common to human-like intelligence?
  - Manipulative organs– hands
  - Walking upright?
  - Is tool use and larger brains associated with walking upright?
  - Pair bonding?
  - Human brains quadruple in size after birth compared to other primates which double.

f_i Considerations

- How unique is our intelligence?
- Teaching sign language to chimps and gorillas have shown they are more intelligent than we thought.
- Whales and dolphins are speculated to be of high intelligence.
- With all of this in hand, we are ready to make the next estimate in the Drake equation.
- This term is only intelligent life that can communicate abstract thought to each other, not technological able to communicate.

What is f_i

- What is the fraction of life that forms human or better intelligence in less than about 4.5 billion years?
- If you think that it always does, then $f_i = 100\%$
- If you think that it is a statistical fluke or required supernatural invention then you could use 1/billion or $10^{-7}\%$.
- Anywhere in between is fair game.

Backdrop of Civilization

- Origin of modern H. sapiens is disputed, but the genetic and linguistic evidence points toward a spread of humans across Eurasia then the Americas.
- We share a common gene pool, but genetic drifts and selection for local environments created genetic differences among groups.
- These differences have little to do with the concept of race, which has been showed by genetic studies to be a meaningless concept.
- The greatest genetic and linguistic variations are found in Africa, supporting the "out of Africa" idea.

http://www.popular-science.net/img/out-of-africa.jpg

Cultural Evolution

- Once humans spread across the globe, the primary method for evolutionary change shifted from biological to cultural evolution.
- Anatomically modern H. sapiens evolved 100,000 yrs ago, but the first modern behavior did not appear until 40,000 yrs ago– e.g. cave painting.
- Regardless, there has not been any significant biological evolution for the last 40,000 yrs– e.g. brain increase.

http://www.codcottage.freeserve.co.uk/images/hand_castillo_spain.jpg

Cultural Evolution

- The rest is cultural– from hunter-gathers to cell-phone-users.
- Cultural evolution was fast.
- Is cultural evolution needed for ET? Why would a ET culture try to communicate?
  - Capability (suitable technology) and interest (worldview?).

Hunting and Gathering

- Until 10,000 years ago, H. Sapiens functioned completely as hunter-gathers.
- Small nomadic tribes with few possessions.
- Except for shortages, a fair and easy life
  - No midterms
  - Only working about 4 hours a day
  - But, no way to create surpluses or free members for other roles.
  - When things go bad, they really go bad.

http://www.cnn.com/WORLD/9511/safrica_bushmen/