

Thursday, November 18
Intelligent Life in the Universe

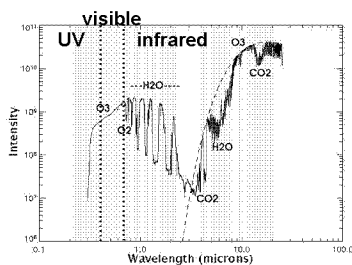


Quiz #4 will be tomorrow.

Intelligent Life in the Universe
Key Concepts

- 1) Discovering intelligent life would be even more interesting than discovering simple life.
- 2) On Earth, human intelligence took a long time to develop.
- 3) If beings develop advanced technology, they can make their existence known.

It would be interesting to find spectral biomarkers in the spectrum of an exoEarth.



However, finding **intelligent** extraterrestrial life would be even more interesting.

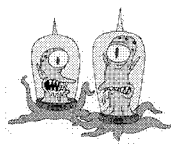
Historically, much of the speculation about extraterrestrial life has focused on **intelligent** life.



War of the Worlds
1898

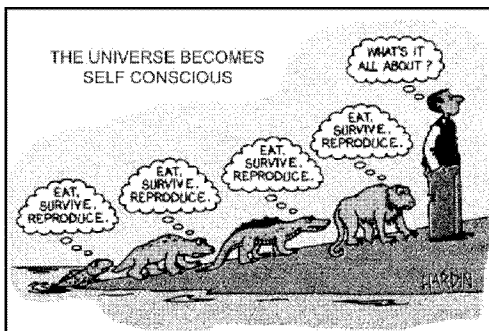


E.T. 1982



The Simpsons
1990 -

What does it mean to be “intelligent”?



I propose a definition.
A living being is intelligent if:

- It asks the question, “What’s it all about?”
- It uses tools to manipulate its surroundings.
- It uses language to communicate with other intelligent beings.

On Earth, different animals are intelligent to different extents and in different ways.

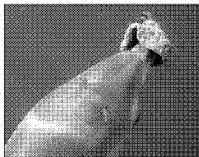


Dolphins communicate with contact calls and "signature whistles".

Chimpanzees & bonobos modify sticks and use them to fish for termites.



Intelligent beings develop a "culture" of behavior handed down from one generation to the next.

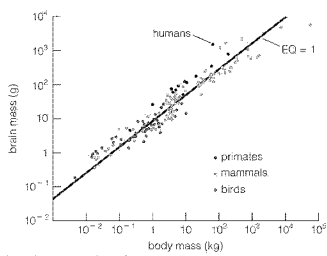


Dolphins teach their children how to use sponges to protect their snout.


Chimpanzees teach their children how to use stones to crack nuts.



On Earth, the encephalization quotient (EQ) can be used a proxy for intelligence.



EQ = an animal's brain mass divided by the average brain mass for other species with the same body mass.

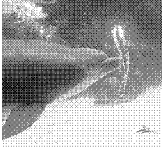
EQ of humans = 7 

EQ of dolphins = 4.5

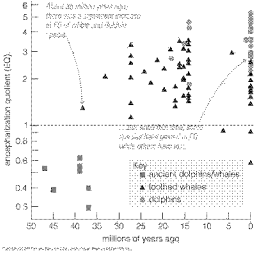
EQ of chimpanzees = 2.5

EQ of cats & dogs = 1

EQ seems to be well correlated with complex behavior, of the sort we might describe as “clever”.

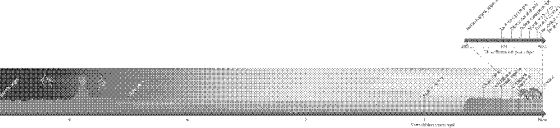


Some classes of animal show EQs that increase over many generations.



EQ is a partially heritable trait.
Intelligence is correlated with EQ.
Intelligence is sometimes useful in survival.

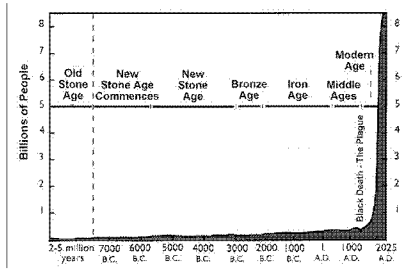
Intelligence as great as a human's (or a dolphin's) took a long time to develop on Earth.



Life arose within a few hundred million years of the end of heavy bombardment.

Human life took nearly four billion years to arise.

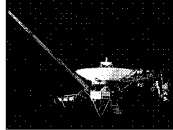
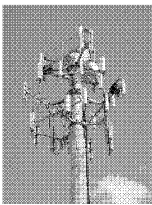
So far, the human species has been spectacularly successful, as far as growth in numbers is concerned.



Score one for human intelligence!

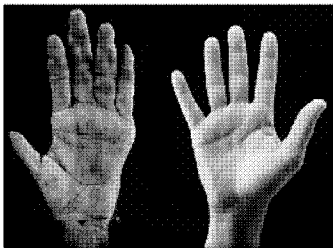
An intelligent species that has developed advanced technology can make itself known to intelligent species elsewhere.

“Advanced technology” = the ability to send out radio signals and the ability to build interstellar spacecraft.



By this criterion, human technology just barely qualifies as “advanced”.

Will high intelligence inevitably lead to advanced technology?



Appendages that can manipulate tools are useful if you want to develop technology.

A planet of Zen monks would not be interested
in broadcasting reality TV to the universe.



Quiz Tomorrow
Bring your pencil!
