

Astronomy 330



This class (Lecture 18):

Origin of Intelligence

Michael Murphy

David Mayer

Next Class:

Cultural Evolution

Joshua Seiter

Jonah Wolff

Music: *Aliens Exist* – Blink 182

Oct 25, 2007

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HW #3



- **Bryan White:**

<http://www.geocities.com/tasosmit2001/alien.htm>

- **Se Hee Jang:**

<http://www.mufon.com>

- **Nick Leners:**

http://www.dailymail.co.uk/pages/live/articles/news/news.html?in_article_id=470579&in_page_id=1770

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Presentations



- **Michael Murphy:** [Light the Universe and 42](#)
- **David Mayer:** [Self-Replicating Probes](#)

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Outline



- What is f_1 ?
- Cultural evolution

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Drake Equation



Frank Drake

That's 2.6 Life systems/year



$$N = R_* \times f_p \times n_e \times f_l \times f_i \times f_c \times L$$

# of advanced civilizations we can contact in our Galaxy today	Star formation rate	Fraction of stars with planets	# of Earthlike planets per system	Fraction on which life arises	Fraction that evolve intelligence	Fraction that communicate	Lifetime of advanced civilizations
	15 stars/yr	0.5 systems/star	$2.7 \times 0.134 = 0.36$ planets/system	0.95 life/planet	intel./life	comm./intel.	yrs/comm.

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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.

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f_l Considerations



- Complexity leads to intelligence, but complexity seems to require a benign environment. Harsher environments tend to have simpler organisms.
- Perhaps life may exist on harsh planets, but more intelligent life?
- Remember, human intelligence took 4.5 billion years.
- Systems very 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.

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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.

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f_i Considerations



- How unique is our intelligence?
- Teaching sign language to chimps and gorillas have shown they are more intelligent than we thought.
- Don't forget Alex the parrot!



Alex (1976 - September 6, 2007)

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Dr. Patterson persuades Koko not to smoke. "Kitten hates it, Koko!"

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f_i Considerations



- 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.



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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.

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Drake Equation

Frank Drake



That's ? Intelligent systems/year



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Star
formation
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Fraction
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Fraction
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nicate

Lifetime of
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15
stars/
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0.5
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star

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= 0.36
planets/
system

0.95
life/
planet

?
intel./
life

comm./
intel.

yrs/
comm.

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