Implications of the Search and Discovery of Life in the Universe

HNRS 228
Bennett & Shostak
Epilogue
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Issues Discussed in Chapter

• Is There Life Elsewhere
  – Is life likely
  – Prospects for finding life
    • In our Solar System
    • Elsewhere in the universe
• ET and Humans
  – What impact contact would have?
    • Examples from our own past
  – Is the search significant?
    • If life found or not?

Life Seems Likely

• What is needed for life?
  – Right chemical elements
  – Right environmental conditions
    • Especially for liquid water
  – Right amount of time
    • Without heavy meteor bombardment
    • With right elements and conditions
• Where are these conditions found?
  – Around individual stars throughout galaxy

Where to look in Solar System?

• Remember likely candidates
  – Mars
    • Perhaps life in past
  – Europa
    • Perhaps life in subsurface ocean
  – Titan
    • Perhaps life in oceans beneath cloudy atmosphere

Where to look in galaxy?

• Disk region of galaxy
  – Population I stars that have access to heavy elements during formation
    • Star like our Sun worked at least once
• Individual stars
  – F, G, K most likely for habitable zone over a long enough period

How will we view contact?

• General public
  – Many already believe that aliens are among us or have contacted us in past / present
    • “I told you so” attitude may arise
• Government
  – Make treaties with alien nations
• Scientists
  – Let’s study it
Types of Contact

• Communications
  – Radio waves
  – Other portions of EM spectrum

• Artifacts
  – Remains of spacecraft
  – Actual spacecraft

• Face to face
  – What language would they speak?

Response to Contact

• Nine principles
  – Seek to verify evidence
  – Alert other research organizations
  – Messages to IAU and UN under Article XI of the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space
  – Disseminate detection “promptly, openly, and widely” including the media

Response to Contact II

• Remaining (of the nine principles)
  – Release data for confirmation by others
  – Confirm and monitor more data recordings
  – Stop all noise at appropriate frequencies
  – Do not send a response signal
  – Advise and consult with other international organizations as to the procedure for further actions

Consider Your Reaction – iClicker Questions

• NEWSFLASH: Scientists Confirm They Have Received Message From Another Intelligent Civilization In The Galaxy
  – Would you change your religion?
    • A Yes
    • B No
    • C Not Sure

• NEWSFLASH: Scientists Confirm They Have Received Message From Another Intelligent Civilization In The Galaxy
  – Would you change your nationality?
    • A Yes
    • B No
    • C Not Sure

• NEWSFLASH: Scientists Confirm They Have Received Message From Another Intelligent Civilization In The Galaxy
  – Would you change your lifestyle?
    • A Yes
    • B No
    • C Not Sure
Consider Your Reaction – iClicker Questions

• NEWSFLASH: Scientists Confirm They Have Received Message From Another Intelligent Civilization In The Galaxy
  – Would you quit school?
    • A Yes
    • B No
    • C Not Sure

Consider Your Reaction – iClicker Questions

• NEWSFLASH: Scientists Confirm They Have Received Message From Another Intelligent Civilization In The Galaxy
  – Would you commit suicide?
    • A Yes
    • B No
    • C Not Sure

Explorations of the Universe: Another View

Encyclopedia Galactica

“Extraordinary Claims Require Extraordinary Evidence”
- Carl Sagan

Close Encounters

• First Kind: Sighting
• Second Kind: Physical Evidence
• Third Kind: Human-Alien Meeting

UFO - California, November 1896
Lessons From Early UFO’s

- Both are exactly what people around 1900 would have expected aircraft to look like
- If aliens are trying to conceal their presence by using terrestrial-style ships, why are they using searchlights?
- If we have effective night-vision devices, why would advanced aliens need searchlights?
- Clearly, people saw a light (Venus?) and subconsciously added details

Near Miss, August 10, 1972

- Object was about the size of a bus
- Entered Atmosphere over Utah, travelling north, exited over Canada
- Velocity 15 km/sec
- Missed by 58 km

Lessons From a Near Miss

- Completely unexpected
- Crossed sparsely-inhabited region
- Visible a total of 101 seconds
- Visible no more than 30 seconds at any one spot
- We have dozens of clear photographs of this event.
The Drake Equation

“A wonderful way to organize our ignorance”
- Jill Tarter

The Drake Equation: Another View

Number of Intelligent Civilizations =
Number of Stars in the Galaxy (400 billion)
× Fraction of Stars with Planets (1/4?)
× Number of suitable planets per star (2?)
× Fraction of planets where life appears (1/2??)
× Fraction of planets with intelligence (???)
× Fraction of planets with technology (???)
× Fraction of planet’s life with technology (???)

So Where Are They?

- Populations expand exponentially
- It would take an exponentially-growing civilization only a few million years to fill the Galaxy, even at sub-light speeds
- 2 to the 40th power is over a trillion
- If it takes 10,000 years for a colony to achieve interstellar travel, 40 doubling times is only 400,000 years.
- So why aren’t they all around us?

Is There A Problem?

- Alien psychology? We barely understand humans!
- Why did it take us so long to develop technology?
- Maybe we’re first?
- Maybe we’re unique?

Other Stuff For the Drake Equation

- Jupiter Stabilizes Solar System?
- Jupiter lessens impact bombardment
- Moon stabilizes Earth’s axial tilt
- Earth’s magnetic field deflects cosmic rays
- Liquid Water Zone is narrow and changes with time as stars brighten
- Center of the Galaxy Deadly?

Communicating With Our Aliens

- Rosetta Stone, 1799
- Champollion, 1828
- Three Parallel texts, one in Greek
- Can we decipher languages with no parallel texts?
### Cuneiform

Georg Friedrich Grotefend (1775-1853)

- Wedge-shaped markings in clay
- Simple, hence not pictographs
- Found literally by the millions
- Seem to be mundane records, official documents, etc.
- Probably Semitic language

#### Cuneiform

- Official documents probably had a standard format: “King ---, son of ----”, etc.
- Guess words for “king” and “son”
- Create genealogy
- Compare with genealogies in other documents and match format
- Assign sound values to letters
- Guess many other words from known Semitic languages

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### Maya Heiroglyphs

- Diego de Landa, 1566
- Responsible for destruction of much of Maya literature
- Left detailed account of Mayas at time of conquest
- Described 64 hieroglyphs, equated 30 with letters
- Later researchers identified 400-800
- Once regarded as a type example of a language lost beyond recovery
- Heinrich Berlin, 1958:
  - Locality signs
- Tatiana Proskouriakoff, 1960
  - Ascension and Reign signs

#### Maya Heiroglyphs

- Yuri Knozorov, 1960
- De Landa was too good an observer to be totally mistaken
- His “letters” were really syllables
- Positional statistics to analyze syntax
- Maya hieroglyphs are now over 85% decipherable
- Maya were not as one-dimensional as once thought

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### What if we succeed? Some Features of Culture Shock

- Loss of Faith in Beliefs and Institutions
- Xenophobia
- Over-Dependence, Copying
- Nihilism
Arthur C. Clarke’s Laws

• The only way to test the limits of the possible is by going beyond them into the impossible
• When an elderly but distinguished scientist says something is possible, he is probably right. When he says something is impossible, he is very likely wrong
• Any sufficiently advanced technology is indistinguishable from magic

No Point in Hiding

• At Radio Frequencies, Earth is brighter than the Sun
• Our Radio signals are now 70 light years out
• From our signals, aliens could determine:
  – Length of our day and year
  – Size of Earth, Distance from Sun
  – Draw a crude map of Developed World

Our Views of Aliens

• Post World-War II
  – “Savior Model”
  – “Hostile Aliens” - Eat or Enslave
• Science Source of Fascination and Fear
  – Winning World War II
  – Nuclear War
• Similarity with Westerns
  – We’re the Good Guys
  – Fighting off Hostile Threats

Our Views of Aliens Evolve

• 1960’s: “Hostile Alien” films and Westerns both decline
• We’re Not Always the Good Guys
  – Historical Revision of Frontier
  – “Spaghetti Westerns”-Dark and satirical
  – Civil Rights Movement
  – Vietnam
• Star Trek, 1967
  – Enlightened, Optimistic Future

Variations

• Humans as Helpers: E.T.
• Encounter as Wonder: Close Encounters of the Third Kind
• Encounter as Dreary: Contact
• Swashbuckling: Star Wars
• Satire: Men In Black
• Return to Hostile Aliens
  – Star Trek Spinoffs (The Borg, the Dominion)
  – Independence Day

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