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A New Meaning of "The Future"!

The Post-Biological Universe

synopsis of the February 19, 2004 WFS Washington DC Chapter dinner program presented by Steven Dick; summarized by Dave Stein

In an unusual program that extends the scale and concept of "the future" itself by several orders of magnitude, Dr. Steven Dick of the National Aeronautics and Space Administration (NASA) discussed the cultural evolution of advanced civilizations elsewhere in the known universe. Beginning with the Drake equation model for the number of advanced extraterrestrial civilizations possible, Dr. Dick extended its interpretation to include issues of culture in addition to those of astronomy and biology. In doing this, he brought together the physical and social sciences.

The Drake equation, well known among astronomers, predicts the number N of technologically advanced civilizations in our galaxy, based on the premise that they emit electromagnetic waves that we can detect. N is modeled as the product of several factors:

$$N = R^* \times fp \times ne \times fl \times fi \times fc \times L$$

where R^* = the birth rate of stars that are suitable for intelligent life to develop on their planets,

fp = the percentage of those stars that have planets,

ne = the percentage of those planets that have environmental conditions conducive to life,

fl = the percentage of those environmentally friendly planets on which life actually manifests,

fi = the percentage of those life bearing planets on which intelligent life develops,

fc = the fraction of civilizations that develop a technology that emits signals detectable (by humans),

and L = the length of time that the civilization emits these signals.

In Dr. Dick's interpretation, the parameters range from astronomical to biological to cultural as one goes from left to right. With the right-most parameters less well known as Dr. Dick observed, N might range from 1 (indicating that we are the only advanced civilization in the galaxy) to a very large number. For

the rightmost parameter, L , there is only one known data point – the one based on human civilization, which yields an estimate of 100 earth years.

As Dr. Dick noted, humans are not accustomed to thinking this far into the future, that is, on cosmic time scales, and since social scientists generally do not concern themselves with the possibility of intelligent extraterrestrial life, the “cultural” part of the Drake equation is not taken as seriously as are the astronomical and biological parts. Whereas 100 years might be an order-of-magnitude estimate for a human lifetime while 10,000 similarly characterizes human history, the anthropological time scale is approximately 10 million years. Next comes the geological scale of approximately 5 billion years, followed by the astronomical scale of 13.7 billion years. There is also the “staple domain” of biology and culture, as Dr. Dick pointed out.

According to Dr. Dick, a post-biological universe is one in which cultural evolution has replaced consciousness-based intelligence with artificial intelligence (AI). This is in contrast with a biological universe, in which cosmic evolution commonly ends with consciousness-based life. At the other end of the scale is a physical universe, which culminates only in galaxies, stars, and planets. In a post-biological civilization, Dr. Dick hypothesized, machines with greater resourcefulness than humans and with unlimited patience might dominate the airwaves.

Noting that L in the Drake equation might be much larger than 100 years, Dr. Dick argued that in the long term, cultural evolution might supersede biological evolution. Simultaneously recognizing the possibility that a mass extinction event such as a conflict or a supernova might reasonably limit L for various hypothetical extraterrestrial civilizations, he suggested that space travel to other worlds might mitigate this possibility. Thus, the upper limit on L might be measured in terms of millions or even billions of years.

At this point, Dr. Dick popped the questions, “At what value of L does a post-biological civilization occur? Furthermore, is there a unit of cultural evolution, similar to the gene in biology?” In examining the issues, he presented the intelligence principle, which recognizes the central role of the maintenance, improvement, and perpetuation of knowledge. He then noted that both an individual and a culture will do whatever they can to perpetuate and improve themselves, since otherwise they cease to exist. Continuing, he suggested that AI is a striking example of the intelligence principle at work. Both biotechnology and nanotechnology will help develop and improve AI, whereas space travel will spread it.

Providing further insights on AI and its role, Dr. Dick discussed the “strong AI” postulate, according to which intelligence equivalent or superior to human intelligence can be constructed. If the AI postulate is true, computers can be minds themselves as opposed to mere tools for studying the mind. Dr. Dick noted the positions of Hans Moravec and Raymond Kurzweil, who believe that an AI takeover of human civilization is possible within a few mere generations!

This led to the issue of possible ethical restraints, an issue that was discussed in the context of the present abortion controversy – which while emotionally charged, is a seemingly benign issue in comparison with the prospect of replacing the human species. Dr. Dick noted that objections based on ethical considerations might lose their impact as AI asserts itself.

Returning to the search for intelligent extraterrestrial life, Dr. Dick suggested that the likelihood of finding “life” would be greater in a post-biological universe, since L would then be substantially larger than for a biological universe. In addition, he discussed the signals that the “beings” in such a universe might send to one another, together with the possible implications of such signals. For example, if the beings were communicating among themselves, would we necessarily be able to intercept their signals?

Might they be more likely to receive than to send signals that would be intelligible to humans? What kinds of messages might they send – and would communication be as good as travel for them?

Even the nature of intelligence itself was pondered. Since it is natural to ask, “What next?” that begs Fred Hoyle’s question, “What is beyond AI?” Dr. Dick also commented on the possibility of distributed intelligence and on the nature of intelligence itself, particularly from the standpoint of data being the “what,” knowledge the “how,” and wisdom the “why.” Lively discussion ensued, and at approximately 9 pm, the program concluded

... but not really! (see related article in “The Program Goes On”)

The Program Goes On!

Dave Stein

posted Fri February 20 2004 05:59 PM

What kind of intelligence for a post-biological civilization?

This was one of our top presentations! Now I'd like to follow up on the role of intelligence and intelligent life as a prerequisite for a post-biological universe. Several types of intelligence have been identified, including linguistic intelligence, logical-mathematical intelligence, musical and artistic intelligence, spatial intelligence, and social intelligence. (Interestingly, IQ tests generally attempt to measure only some of these types of intelligence.) Another definition of intelligence is in terms of the ability of an individual – or a species – to adapt to its environment or to adapt its environment to it. In addition, there is the exciting possibility of new types of intelligence that we have not yet identified (or perhaps created)!

Continuing the thought – a member of the audience raised the question of whether a good chess-playing computer represents a type of intelligence. In *Shadows of the Mind*, physicist Roger Penrose notes that such computers have the advantage in processing speed that lets them examine more possibilities or “branches” quickly (in terms of “depth of moves”) than humans can. Conversely, he notes, humans have the advantage in judgment that eliminates the need to consider certain “branches.” This suggests that perhaps judgment is a type of intelligence, irrespective of whether it is reducible to another type of intelligence such as logical intelligence. Judgment, in turn, is often based on one's experience and sometimes even on intuition. Is there a role for intuition in the evolution of an extraterrestrial civilization to post-biological status?

All considered, what types of intelligence should be modeled in the Drake equation or deemed as necessary (or even sufficient) conditions for a post-biological universe?

Dave Stein

Posts: 1 | Registered: Fri February 20 2004

Limor S.

posted Sat February 21 2004 04:36 AM

Dave, you bring up several interesting points:

How does one measure intelligence in order to determine what contains “intelligent life”? We might not consider microorganisms to be intelligent life b/c we believe that definition requires a certain level of awareness of behavior? [In fact – is this how we define intelligent life?] Assuming it is, what if the criteria of the ETs out there is different and they do not believe we on Earth are intelligent life? We need to consider, and I think Steve touched on this, that we may simply not be considered “intelligent enough”/evolved enough by ETs out there to be of interest.

And let me build on your second point: intelligence, some believe, also comes from what we carry in our body – genetic memory. If postbios are nonbio, where does that memory go? Does it disappear? Does it get transferred and housed simply in the cognitive memory?

What happens to the concept of the subconscious mind in postbios? Does it continue to exist? In another form?

When looking at the spiritual realm, what effect if any does that have on postbios? Does karma still play a role? Could one claim they have souls? Are there souls like ours or different? (Is there such a thing as different types of souls – but not to digress?)

I welcome comments!

Limor S.

Posts: 1 | Registered: Thu February 19 2004

Steve Dick
posted Sun February 22 2004 06:16 PM

Thanks for your thought provoking comments. I think SETI astronomers have not thought a great deal about the nature of intelligence, other than the operational definition that it requires technology that makes them radio communicative – that is, after all, why they are interested in the first place. But recently some people have begun to think about message construction, and how we might best communicate if we send a message. This does require more thought about the nature of intelligence, and whether a message should incorporate music, spiritual or other non-technical elements. Doug Vakoch at the SETI Institute has done work on this, and references to his articles are probably found at the SETI Institute website.

Even this work, however, does not take into account the possibilities of the postbiological universe that I described. How might communication differ if we are talking to intelligent machines? I'm not sure, but if one believes in cultural evolution over millions of years, someone should think about this. We tend to have a "Terminator" view of machines, but it isn't necessarily so – it is possible they might have emotions and even spirituality, in which case they might be indistinguishable from biologicals, but, according to the intelligence principle I enunciated, much smarter.

The nature of intelligence is a fascinating subject about which many books have been written. Few of them, however, encompass the possible nature of ETs. I think both natural and social scientists can benefit from each other – the ETI debate is a great way to span the two cultures, and advance E. O. Wilson's concept of consilience.

Steve Dick

Dave Stein
posted Tue February 24 2004 05:01 PM

Another Question

I appreciate your insights on various types of intelligence in the search for extraterrestrial civilizations and especially your observation that ETI research may bring together the natural and social scientist cultures. Such synergies have been pivotal to many great discoveries.

Now, I have another question. Your presentation referred to radio frequency (RF) communication as a means of recognizing advanced civilizations elsewhere in the universe. This is in keeping with research by other scientists, who are also looking for RF signals to identify advanced extraterrestrial civilizations.

I'm interested in knowing the basis for assigning RF signals such a privileged role. Granted, of the four fundamental forces recognized by contemporary physics, electromagnetism seems most adaptable to communication systems as we know them, but let us consider:

1. What have we not yet learned about some of the known forces, some of which behave differently at different scales of spacetime? Contemporary research indicates the existence of electromagnetic fields beyond those described by our everyday "Maxwell equations," which are actually the Oliver Heaviside equations. In fact, one of the leading researchers of these fields was recently nominated for the Nobel Prize. If these "higher gauge symmetry" fields are confirmed as I anticipate, might these or other fields or energies be the preferred basis for communication by post-biological beings?

2. What are we assuming about the physical scales of intelligent life elsewhere, and about the types and ranges of sensory organs, when we presuppose their use of RF signals that we can receive?

3. In assessing the environmental conditions conducive to life, as modeled in the Drake equation, what are we assuming about possible life forms themselves, even before we turn to the issue of RF emissions?

Dave Stein

Posts: 2 | Registered: Fri February 20 2004