IAC-05-A4.2.03

"L" ON EARTH

Dr. Kathryn Denning
Department of Anthropology, York University,
Toronto, Canada, M3J 1P3
kdenning@yorku.ca

Abstract:

The Drake factor L (average lifetime of a communicative civilization) has such a strong effect on estimates of N (number of communicative civilizations in our galaxy) that frequent reassessment of our understanding of civilizations' lifespans is warranted.

Earth analogues have often been used as the basis for estimates of L, but what can we really hope to learn from the history of Earth's civilizations that might pertain to civilizations elsewhere? Are Earth analogues fit only to be used as rhetorical exemplars to shore up *a priori* beliefs about the probability of SETI's success or failure? Or can we actually use historical data to make meaningful generalizations about the paths that civilizations take, and how long they last? Recent archaeological work around the world is increasingly pointing to some recurring patterns of emergence and collapse, which may have some value here.

However, we can conceive of communicating civilizations so different from any on Earth that terrestrial analogues could be irrelevant. In particular, as our own computing achievements mount, there is increasing speculation that any extraterrestrial intelligence we might encounter will reside in machines, rather than organisms; this has tended to increase estimates of L. But there are assumptions embedded there too, which may derive partly from our understandings of why exactly it is that human civilizations fail. These understandings also warrant close examination, and checking against historical data.

Introduction

This paper proposes a renewed look at the Drake factor *L*, the average lifetime of a communicative civilization, from an anthropological perspective.

As an anthropologist and archaeologist with a particular interest in methods of reasoning about the past, I offer here not a new estimate of *L*, but some thoughts about how we might investigate this factor anthropologically.

There has been a great deal of provocative and useful thinking on *L*, much of it from those involved in these sessions. It is a controversial term: some contend that we have no useful data on the subject, while others contend we do; some argue that L is very short, while others think it is enormously long. It is also a factor in which we are exceptionally emotionally invested, for our estimates of L are intertwined with our forecasts for our own civilization's end. It is, in short, a problem. I do not think it impossible to investigate, however. For this, we need to turn to the social sciences.

Contributions to SETI from social science have been infrequent compared to those from the physical and biological sciences[1], but they have been consistently present. For example, social scientists have contributed to SETI-related endeavours through assessment of the possible evolutionary paths to intelligence[2], review of historical precedents for contact between civilizations, simulations of contact[3], consideration of the challenges of interstellar message decipherment and composition[4], the projected lifetime of advanced civilizations[5], and the characterization of long-lived societies[6]. It has been argued that there is much more to be contributed by social scientists[7], and I concur.

Here, I will explore the potential use of anthropology. SETI scientists have often drawn from archaeological and anthropological analogues in thinking about what ETI might be like, what contact would involve, and whether or how meaningful communication might be possible. But an anthropological perspective can be used more extensively in SETI with helpful results.

In this paper, I first explain why I am not attempting a new estimate of *L*, and then consider why it is worthwhile to examine Earth's civilizations, and what kinds of knowledge about them should count. I then consider what an anthropological perspective could bring to the study of *L*, specifically in revising the theoretical models we use for the evolution of civilizations, and in understanding why civilizations end.

Putting away the calculator

I decided to propose this paper after reading an essay from 2002 in *Scientific American*, in which the author computed *L* by averaging the lifespans of 60 Earth civilizations, including the ancient societies of Mesopotamia, Egypt, Greece, Rome, China, Africa, India, Japan, Central and South America, and several modern states. The paper concluded, apparently in earnest, that L = 420.6 years, or considering only the rather more technological societies, L = 304.5 years. [8]

Unquestionably, it can be entertaining to trawl through an encyclopedia with a calculator at one's side. But I must confess to a negative bias here, because to an archaeologist, this is one of the most trivial uses imaginable of historical knowledge. If all we learn from hard-won evidence concerning the collective human experience of 60 Earth civilizations on four continents over many thousands of years is that their average duration is 420.6 years, then it is a sad situation indeed. (I am further discomfited by that number's unnerving similarity to Douglas Adams' "42".)

In this paper, I will not attempt to arrive at a new value for *L*, for two reasons. First, I am not certain another estimate would help, because to my mind, whether *L* is small or large, and N is thus estimated to be two or 2 billion, the search should continue. Second, focusing too narrowly on the numbers misses the larger use of the

Drake equation, as a framework for inquiry into subjects pertinent to SETI. Scientists don't study the earliest microbes on Earth, or the processes of planet formation, solely to obtain values for Drake factors; they study to learn everything they can about these phenomena, because it is all relevant to the task of understanding life in the universe. This should also be the case for *L*, and for the closely related factor f_c, the fraction of civilizations which develop technology that SETI searches could detect.

Therefore, this paper is devoted instead to considering the sorts of information that we might usefully retrieve from the historical record, and considering the assumptions we may need to revise in order to do it. What can we know about lifetimes of civilizations, based on Earth experience? Are there patterns which might be helpful in anticipating extraterrestrial civilizations? Or, conversely, have we been making assumptions about extraterrestrial civilizations based on considerations which are likely to be unique to Earth, or even to our own current society?

Why bother with Earth's civilizations?

We might well ask – do Earth-based examples really matter? In thinking about extraterrestrial civilizations, should we not be more concerned with machine-based intelligence, or with projections derived from physics, like Kardashev's typology based on energy consumption, than with the history of our own humble world?

Perhaps. If one is seeking an estimate of *L*, then yes, one should probably pay the most attention to the possibilities of extremely long-lived civilizations, because they significantly skew the average.[9] It may also be that these 'supercivilizations'[10] are the ones that we are most likely to encounter. And clearly, one needs to consider the spectrum of possibilities for communicative intelligences, in order to keep developing new search strategies.

Obviously, those conjectures are important. However, I would argue that we should *also* make the most of the *data* we are fortunate to have at our disposal. This is, I think, one of the most laudable aspects of SETI-related science – the creative use of specific Earth cases to address more universal questions. For example – *Star Trek IV* notwithstanding – I doubt anyone imagines that we'll find cetaceans swimming through interstellar space, but studies of dolphin vocalizations are certainly useful in learning about structured communications in sentient species. Similarly, although we don't expect to encounter extraterrestrial civilizations just like our own, we should be able to learn something of value from these Earth-bound examples.

But what?

What kinds of knowledge should count?

Even before considering what we might learn from Earth civilizations, we need to ask: what kinds of knowledge will count? There is a bias in many scientific fields towards quantification and experimentally verifiable propositions. But we cannot meaningfully quantify or test all that we know about human thought, technology, or behaviour, or about the development of civilizations. This disjunction routinely leads to interminable discussions, particularly in undergraduate classes, about whether archaeology and anthropology are scientific. Of course, the debate is partly semantic in nature, for the outcome depends on one's precise definition of 'science', and those vary. But the debate also reflects the genuine discomfort that some people, students and scientists alike, have with interpretations concerning irreducible human realities. To this I can only say that in recent years, philosophers of science have convincingly argued that reasoning in historical disciplines like archaeology and evolutionary biology, for example, is not necessarily inferior to reasoning in experimental and mathematical sciences. The reasoning is different, but the resulting knowledge is not necessarily less secure.[11]

In what follows, then, I take it as given that an anthropological description of the social influences of radio technology is a form of knowledge as valid and useful as a graph describing the increasing power of receivers or transmitters over time. I also take it as given that the difficulty and importance of understanding subjects subsumed under *L* means that we should use everything in our analytical arsenal.

This then, brings us to the next question:

What is human history really good for?

We have considerable information about the history of humanity at our disposal. It is useful to step back for a moment to ask: how are these data being used in SETI discussions? And how might they be most useful?

Information about human civilizations has been used in SETI thinking primarily in these ways:

- as a source of specific numerical values to be used in predictive models concerning civilizations' longevity and development
- to generally project aspects of our own future
- to illustrate different potential outcomes of contact between civilizations, with a view to human-ET contact
- to characterize the general evolution of ET civilizations up to and beyond a level of technology that is SETI-detectable and/or spacefaring
- to consider potential patterns of ET colonization

These are certainly reasonable uses of the historical record, but are there deeper or more rigorous ways for SETI research to exploit the vast database of human history? Perhaps so. In particular, I propose that we may achieve useful understandings for SETI by adopting an anthropological approach, specifically:

- reconsidering the theoretical frameworks through which we explain the evolution of civilizations
- formulating hypotheses concerning the evolution of civilizations which we can evaluate by examining anthropological, historical, and archaeological data

The anthropological perspective

It is clear that the disciplinary backgrounds which people bring to SETI questions can affect their perspective. For example, physicists and biologists tend to have diverging opinions about the probability of intelligent life emerging on other worlds, because of their frames of reference and understanding of evolutionary processes.[12] But as Chyba pointed out, this comes down to differing perceptions of the "comparative importance of contingency versus convergence in evolution" – and *that* can actually be studied.[13]

Similarly, there are SETI debates concerning civilizations which could be, if not resolved, then at least informed by further research. In this, the anthropological perspective could be invaluable. One of anthropology's strengths is its focus on cross-cultural comparisons, and on the diversity of human experience. In addition to allowing us to see commonalities and differences across cultures, past and present, it also helps us to identify our own ethnocentric assumptions, which we surely need to minimize if we are seeking theories which may apply not only to other civilizations, but also to those on other worlds. It also provides a variety of theoretical models for understanding the development of civilizations, and this could be very useful to SETI questions.

Next, I will illustrate this through two examples, pertaining to *L*: first, concerning the theoretical frameworks we use to explain evolutionary change, and second, concerning our explanations for why civilizations end.

An implicit bias in SETI towards unilinear social evolution?

Anthropology has been largely responsible for two "great ideas" of the nineteenth and twentieth centuries: first, in the 1800s, the notion that given enough time, all societies progress through the same stages of development from savagery to barbarism to civilization; and second, in the 1900s, the realization that this model of unilinear social evolution is inaccurate and overly simplistic.

The former idea has taken root in popular Western thinking, while the latter remains specialist knowledge. Many anthropologists and archaeologists now consider that ranking societies according to their level of political and technological complexity is problematic, and that it is more useful to understand each society in its own context before comparing them. For example, Western history books have often portrayed native New World cultures as technologically inferior to Old World cultures because they didn't use the wheel in transportation; however, given that in the Americas before the European invasions, there were no draft animals suitable for pulling wheeled carts, this omission is entirely logical. Thus, using the absence of the wheel as a cross-cultural measure of technological sophistication is nonsensical. Similarly, a culture may have an elaborate and effective system of keeping records and transmitting knowledge that does not involve writing – which means that the standard practice of using writing as a criterion for evaluating a society's degree of intellectual advancement is problematic. A contemporary anthropological or archaeological perspective demands that we understand this before attempting comparisons. Moreover, it favours an approach which *fairly represents the diversity*, rather than slotting every society into a simple framework.

This connects to "L" in a potentially significant way, so it is worthwhile to elaborate. The easiest example comes from human biological evolution. We probably all recall the famous 1970s "March of Progress" illustration of human evolution, with different species of hominid in a line. One species simply turns into the next. We can compare this to a phylogenetic tree, a later convention of illustrating hominid evolution – which shows not only the species on the direct line to Homo sapiens, but others too. It represents each species in its own right, not only for what it became.[14] It may be even more fair to use an illustration which subtracts the firm lines between species, since these are inferences which change.

These represent different ways of describing and understanding an evolutionary process. We can look at the March of Progress and say X inevitably led to Y which led to Z – but this isn't, of course, how it really happens. This is a rhetorical trope. This is one way of writing history after the fact, rather than how it really happened. The reality is not linear, but filled with bifurcation points, and better described not as a simple progression, but as realms of adjacent possibilities.[15] The same is true for cultural evolution. There is an important connection here to SETI theorizing about *L*, in terms of the way that social evolution is understood.

In 1980, Sagan, greatly concerned about nuclear war on Earth, commented about the threat of civilizations self-immolating, observing that other communicative civilizations, like our own, could "take billions of years of tortuous evolution to arise, and then snuff themselves out in an instant of unforgivable neglect".[16] He urged us, however, to consider the hopeful possibility that at least some civilizations would survive this "technological adolescence" – and concluded that if even 1% lived to maturity, then those civilizations would surely have immensely long lifespans. This in turn would ensure that we have many as-yet-undiscovered neighbours. More recently, Shostak argued that rather than being on the road to self-destruction, we may merely be passing through a bottleneck – that is, a period during which we have the technological capacity to destroy ourselves, but haven't yet bought our species the anti-extinction insurance policy of colonizing other worlds. Further, he proposed that this is necessarily a short phase through which many technological civilizations will pass.[17]

Scenarios like these are both interesting and plausible. But underlying them are some assumptions which are intriguing both in content and in form. Arguments like these assume, variously,

- that most societies which become sufficiently technological for a SETI detection will also have weapons of mass destruction
- that most societies which become sufficiently technological will also colonize planets beyond their home world
- that the threat of self-destruction, if not fulfilled, will pass either through conscious evolution (enlightenment), or through the colonization of other worlds

There is a sense of entailment here, of a necessary movement from one stage to the next – the framework seems to be an essentially unilinear model of social evolution. And certainly, it *could* be so. But we may reasonably ask whether it is *necessarily* so, or *likely* to be so? And we might investigate those questions anthropologically, through cross-cultural research. For example, we might ask:

- It is clearly the case on our world that communications technology and space science are linked to military activity. But is this inherent to the technology, or a result of the particular cultural milieu in which it was developed?
- It is certainly true that some human societies have been active colonizers, and it is certainly likely that some members of our species will take up residence off-world soon; however, would this propensity for colonizing necessarily be universal or even frequent in all technological societies?

In other words, using an anthropological approach, we might explore the range of possibilities, rather than assuming similarities.

On the subject of technology in particular: Technology is frequently construed as existing because it provides a competitive advantage in endeavours of aggression and expansion – machines for conquest, or defense. But can we not imagine a world in which radar was developed to track weather systems instead of enemy aircraft? And can we not imagine a world in which technology was developed solely for its social merit, instead of its power or the 'sweetness' of the experiment? We may not need to imagine: an examination of the role of technology in different Earth societies may provide useful insights.

This brings me to the next example of the potential contribution of an anthropological perspective on *L*.

Why do civilizations end?

Most of us, living in our technologically advanced civilization, are culturally biased; although we may have some misgivings about technology, we tend to think that our way of living is good, and that it would be only natural to continue becoming ever more technologically sophisticated, unless we collectively experience a catastrophe. And those of us interested in SETI are necessarily biased towards technological civilizations, since they are the only ones we can hope to contact.

That isn't a problem in itself. What is interesting, however, is a related assumption. We tend to assume that if a technological civilization ceases to be visible for SETI detection, that could only be the result of a shift to more advanced technology, or a disaster – a rupture in the natural course of social evolution, caused by a very destructive war, a terrible disease, or an asteroid impact. In turn, embedded within this is the notion that the only rational process for a society, once it has achieved technological status, is to keep going.

We conceive of civilizations ending because of catastrophe. But there may be times when the most intelligent, rational option is to downscale – to become less technological. This is one crucial understanding from archaeological studies of ancient societies that collapsed – that

downshifting to a less energy-intensive form of social organization can be a successful, rational adaptation, rather than a failure.[18]

What this means for SETI is a subject for further exploration, as are all the factors limiting *L* on Earth.

In conclusion…

It has often been said of "L" that it is both the most influential variable in the Drake equation, and the hardest to know anything about.

The former is clearly true, but as for the latter – I am not convinced. I think we can learn a great deal of relevance to L, if we uncover our own assumptions about the evolution of civilizations, and check those by looking across cultures and through time, exploring the full depth and breadth of human societies. This would of course be a big project – but that hasn't stopped SETI before.

References

[1] Kukla, A. 2001. SETI: On the Prospects and Pursuitworthiness of the Search for Extraterrestrial Intelligence. *Studies in History and Philosophy of Science* 32(1):31-67.

[2] e.g. Raybeck, D. 2004. Predator-Prey Models and the Development of Intelligence. Paper presented at SETI Institute, Mountain View, California, Nov 20, 2004.

[3] e.g. Jim Funaro's longrunning annual conference, Contact: www.contact-conference.com

[4] Vakoch, D.A. 2004. The Art and Science of Interstellar Message Composition. *Leonardo* 37(1):33-34

Vakoch, D.A. 2000. The Conventionality of Pictorial Representation in Interstellar Messages. *Acta Astronautica* 46(10-12):733-736.

Vakoch, D.A. 1998a. Constructing Messages to Extraterrestrials: An Exosemiotic Perspective. *Acta Astronautica* 42(10-12):697-704.

Vakoch, D.A. 1998b. The Dialogic Model: Representing Human Diversity in Messages to Extraterrestrials. *Acta Astronautica* 42(10-12):705-710.

[5] Kent Flannery and Richard Lee participated in an early CETI symposium (Sagan ed. 1973). Other anthropological contributions to the discussion from the 1970s are outlined by Urbanowicz (1977). Discussions of human evolution which derive from work in physical anthropology appear frequently in the SETI literature.

Sagan, C., ed. 1973. *Communication with Extraterrestrial Intelligence (CETI).* Proceedings of a Conference held in Yerevan, USSR, 1971. Cambridge, Mass.: MIT Press.

Urbanowicz, C. 1977. Evolution of Technological Civilizations: What is Evolution, Technology, and Civilization? Paper presented at NASA. Unpublished, but available online: www.csuchico.edu/~curban/Unpub_Papers/1977SETIPaper.html Last accessed: 7 December 2004.

[6] Harrison, A. 2000. The Relative Stability of Belligerent and Peaceful Societies: Implications for SETI. *Acta Astronautica* 46(10-12):707-712.

[7] Finney, B. 2000. SETI, Consilience and the Unity of Knowledge. *Bioastronomy 99: A New Era in the Search for Life, ASP Conference Series*, vol. 213, G. Lemarchand and K. Meech, eds. San Francisco: Astronomical Society of the Pacific.

[8] Shermer, M. 2002. "Why ET Hasn't Called." *Scientific American* July 15, 2002.

[9] Drake, F. 2003. "The Drake Equation, Revisited, Part I." *Astrobiology* magazine. Online: www.astrobio.net/news/article610.html

[10] Kardashev, N.S. 1985. "On the Inevitability and Possible Structures of Supercivilizations" in *The Search for Extraterrestrial Life: Recent Developments*, M. Papagiannis, ed. p 497-504. International Astronomical Union.

[11] Wylie, A. 2002. *Thinking From Things: Essays in the Philosophy of Archaeology*. Berkeley, CA: University of California Press.

[12] McRobert, A. and G. Schilling. 2005. "The Chance of Finding Aliens". *Sky and Telescope*. Online: http://skyandtelescope.com/resources/seti/article_244_3.asp (Updated from 1998.)

[13] Christopher Chyba, quoted in McRobert, A. and G. Schilling. 2005. "The Chance of Finding Aliens". *Sky and Telescope*. Online: http://skyandtelescope.com/resources/seti/article_244_3.asp (Updated from 1998.)

[14] See S. J. Gould, 1991. *Wonderful Life*. New York: Penguin.

[15] Kauffman, S. 2000. *Investigations*. Oxford: Oxford University Press.

[16] Sagan, C. 1980. *Cosmos*. New York: Random House. p 301.

[17] Shostak, S. 2001. "The Lifetime of Technological Civilizations". International Astronautical Congress (IAA-01-IAA.9.1.06).

[18] Tainter, J. 1988. *The Collapse of Complex Societies*. Cambridge: Cambridge University Press.