http://www.sentientdevelopments.com/2007/05/drake-equation-is-obsolete.html

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The Drake Equation is obsolete

I'm surprised how often the Drake Equation is still mentioned when people discuss such things as the search for extra terrestrial intelligence (SETI), astrobiology and problems like the Fermi Paradox.

Fairly recent insights in such fields as cosmology, astrobiology and various future studies have changed our perception of the cosmos and the ways in which advanced life might develop.

Frank Drake's equation, which he developed back in 1961, leaves much to be desired in terms of what it's supposed to tell us about both the nature and predominance of extraterrestrial life in our Galaxy.

The Drake Equation

The Drake equation states that: $N = R^* \times f_p \times n_e \times f_l \times f_i \times f_c \times L$

where:

N is the number of civilizations in our galaxy with which we might hope to be able to communicate and:

R^* is the average rate of star formation in our galaxy
f_p is the fraction of those stars that have planets
n_e is the average number of planets that can potentially support life per star that has planets
f_l is the fraction of the above that actually go on to develop life at some point
f_i is the fraction of the above that actually go on to develop intelligent life
f_c is the fraction of civilizations that develop a technology that releases detectable signs of their existence into space
L is the length of time such civilizations release detectable signals into space.

Arbitrary at best

The integers that are plugged into this equation are often subject to wide interpretation and can differ significantly from scientist to scientist. Even the slightest change can result in vastly different answers. Part of the problem is that our understanding of cosmology and astrobiology is rapidly changing and there is often very little consensus among specialists as to what the variables might be.

Consequently, the Drake formula relies on 'stabs in the dark.' This makes it highly imprecise and unscientific. The margin of error is far beyond what should be considered acceptable or meaningful.

No accounting for cosmological development or time

Another major problem of the Drake Equation is that it does not account for two rather important variables: cosmological developmental phases and time (see Cirkovic, "The Temporal Aspect of the Drake Equation and SETI").

More specifically, it does not take into consideration such factors as the age of the Galaxy, the time at which intelligence first emerged, or the presence of physiochemical variables necessary for the presence of life (such as metallicity required to form planets). The equation assumes a sort of cosmological uniformity rather than a dynamic and ever changing universe.

For example, the equation asks us to guess the number of Earth-like planets, but it does not ask us when there were Earth-like planets. And intelligence itself may have been present as long as 2 to 4.5 billion years ago.

The Galaxy's extreme age and the potential for intelligence to have emerged at disparate points in time leaves an absurdly narrow window for detecting radio signals. The distances and time-scales in question are mind-boggingly vast. SETI, under its current model, is conducting an incredibly futile search.

Detecting ETI's

Which leads to the next problem, that of quantifying the number of radio emitting civilizations. I'm sure that back in the 1960's it made a lot of sense to think of radio capability as a fairly advanced and ubiquitous means of communication, and by consequence, an excellent way to detect the presence and frequency of extraterrestrial civilizations.

But time has proven this assumption wrong. Our radio window is quickly closing and it will only be a matter of time before Earth stops transmitting these types of signals -- at least unintentionally (active SETI is a proactive attempt to contact ETI's with radio signals).

Due to this revelation, the entire equation as a means to both classify and quantify certain types of civilizations becomes quite meaningless and arbitrary. At best, it's a way of searching for a very narrow class of civilizations under very specific and constrained conditions.

Rather, SETI should continue to redefine the ways in which ETI's could be detected. They should try to predict future means of communication (like quantum communication schemes) and ways to identify these signals. They should also look for artificial objects such as megascale engineering and artificial calling cards (see Arnold, "Transit Lightcurve Signatures of Artificial Objects").

The future of advanced intelligence

Although possibly outside the auspices of this discussion, the Drake Equation does not account for the presence of post-radio capable civilizations, particularly post-Singularity machine intelligences. This is a problem because of what these types of civilizations might be capable of.

The equation is used to determine the number of radio capable civilizations as they conduct their business on their home planet. Again, this is a vary narrow view of ETI's and the space of all possible advanced civilizational types. Moreover, it does not account for any migratory tendency that advanced civs may have.

The Drake Equation does not tell us about exponential civilizational growth on account of Von Neumann probe disbursement. It does not tell us where advanced ETI's may be dwelling or what they're up to (e.g. Are they outside the Galaxy? Do they live inside Jupiter Brains? Do they phase shift outside of what we regard as habitable space? etc.). This is a serious shortcoming because the answers to these questions should help us determine not just where we should be looking, but they can also provide us with insight as to the makeup of advanced intelligence life and our own potential trajectory.

In other words, post-Singularity ETI's may represent the most common mode of existence for late-stage civilizations. And that's who we should be looking for rather than radio transmitting civs.

Are we alone?

Michael Crichton once put out a very weak argument against the Drake Equation. He claimed that SETI was a religious endeavor because it was a search for imaginary entities. He is wrong, of course; we should most certainly search for data where we think we might find it. I believe, despite the low odds, that it is reasonable to assume that our search for life on other planets is warranted. Even a negative result can be meaningful.

Consequently, SETI should keep listening, but expect to hear nothing. If we should suddenly hear something from the depths of space, then we will have to seriously re-evaluate our assumptions.

At the same time we should find better ways to detect advanced life and tweak the Drake Equation in such a way as to account for the missing variables and factors I mentioned earlier.

Again, and more generally, we should probably adopt the contact pessimist's frame. Back in the 60's and 70's, when the contact optimists like Sagan, Shklovskii and Drake ruled the Earth, it was not uncommon to think that N in the equation fell somewhere between 10x6 to 10x9.

These days, in the post Tipler and Hart era of astrosociobiology, cosmologists and astrobiologists have to take such factors into consideration as Von Neumann probes, the Fermi Paradox, the Rare Earth Hypothesis, stronger variants of the anthropic principle and catastrophism.

Put another way, as we continue to search for advanced ETI's, and as we come to discover the absurdity of our isolation here on Earth, we may have no choice but to accept the hypothesis that advanced life does not venture out into space for whatever reason (the most likely being self-destruction).

Our other option is to cross our fingers and hope that something radical and completely unpredictable lies on the other side of the technological singularity.