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Approaching the SETI Strategically

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There are several competing hypotheses relating to the Search for Extraterrestrial Intelligence (SETI). These hypotheses mainly take the form of stated assumptions. Only a few are formulated allowing for any reasonable falsification. Propositions must be constructed so gathering the necessary empirical evidence can test their predictions. Most SETI hypotheses do not contain theoretical *predictions* based upon *any* existing observational evidence. Presently, in the face of no solid evidence, none of the competing hypotheses can be summarily dismissed. Nonetheless, certain SETI approaches have dominated even though their assumptions are no better than others are. The fundamental objective of the SETI is to collect factual observational data that can be used to verify that ETI exist. To this end, searching for ETI must be approached with a well-formulated strategic plan. Clearly there exist strategic alternatives, and some rank higher than others. In the drive to discover ETI, there is too much at stake to squander resources on ineffective strategies. The strategic alternatives must be ranked so that our finite resources for the SETI can be allocated properly. This paper examines how the microwave strategy came to dominate the SETI, and why this strategy must be challenged. It also examines our strategic response to finding ETI, and proposes a method to objectively compare the alternatives in order to make the right choice.

A Tale of Dominance

The modern SETI is dominated by the search for microwave signals from artificial sources far beyond our solar system and light years away. The foundation for this approach was initially based upon the existence of a relatively quiet region in the microwave frequency spectrum [1]. In 1959, this region was proposed as a good place to search for two reasons. First, weak artificial signals could be detected in the region because of the naturally lower background noise content, and second, a new parametric amplifier design of reasonable quality (NO = 350 Kelvin) for use in a narrow-band radiometer allowed an observational experiment to be carried out. With these two perfectly valid conditions, the assumption was posed that advanced ETI may be signaling Earth in this narrow frequency band.

The assumption was tested in 1960 [2] and, given the very narrow experimental parameters, proved to be false. At that point the microwave SETI approach should have been challenged.

However, not enough was known at that time about the conditions or requirements for extraterrestrial life, let alone intelligent extraterrestrial life, to make it possible to judge the validity of the experiment. Furthermore, the radio gear was limited and rudimentary by today's standards. These two conditions made it difficult to formulate rational challenges to the assumptions or methods.

Following the first experiment there were two paths that might have been taken. Delaying the microwave SETI experiment until there was a much better understanding of the permissible existence and likely motives of ETI was one. The other path would have meant continuing the search with the understanding that the assumptions might have been invalid and a study of other search possibilities would be needed. Instead, the same search effort continued to move forward. There was an underlying intuition that the rationale was basically correct, but the experiment was not technologically advanced enough to produce the sensitivity or bandwidth needed to extract the signals.

Even in 1960, one would believe that if advanced ETI were technically competent enough to carry out a long-term program of actively signaling to emerging civilizations, they could marshal the energy and timing required to send signals we could detect. The blame for not detecting any signals was passed to us, not to ET.

Perhaps there was a shared sense of impotency among the early SETI experimentalists, not about the rationale, but about the experimental methods they used. Did a focus on refining the methods take precedence over reconsidering the assumptions? It seems so, because soon after came a flurry of activity to mathematically refine the radio-science parameters and to further rationalize the assumptions and garner funding to build better instruments.

In many disciplines (e.g., astrophysics) improving upon experiments is justified, but usually improvements are built upon lessons learned from partial successes. When a reasonably constructed experiment that should produce some initial observations doesn't, it is common to either change the experiment or revise and possibly throw out the assumptions. If the assumptions remain constant while the experimental approach is continually refined, at some point the lack of observations should signal a strategic flaw.

Of the microwave SETI assumptions Drake himself wrote in 1965: "…the above approaches have been based on the assumption that another communicative civilization is overtly attempting to contact us. Surely this assumption is somewhat presumptuous – after all, *we* do nothing to contact other civilizations and are very unlikely to make such attempts until another civilization is detected. If, in fact, everyone listens and no one sends, then, for success, we must utilize a technique that will detect the signals a civilization uses for its own purposes. It is possible that such signals will not be strong enough to be detected individually." [3]

In the case of microwave SETI, the mentality of the 1960's persists today and is defended as if it were holy gospel. The methods continue to be polished despite the lack of any observational evidence to build upon. SETI now includes sociological refinements focusing on questions like: Do ETI enjoy music? Do they vote? What happens *when* we find a signal? Serious questions such as: 'What if we fail to find a signal?' are trivialized or avoided as if the failure to find a microwave signal is not even possible.

When doubts are raised, you will usually hear someone involved with SETI cry: "But we've just barely scratched the surface of the frequency spectrum!" I believe SETI has adequately scratched the right frequencies, but today we can see that it is a phantom itch that is being scratched—not unlike the itch on a dog's belly.

This makes a thoughtful person wonder why the microwave strategy persists; it remains the dominant strategy although it is has produced nothing observationally. There are a few reasons for microwave SETI's dominance, but they are not particularly rational or fair. Using analogies to marketing concepts will help get the explanation across.

The microwave strategies were the first to emerge, get attention and funding. In business markets, usually the first company on the scene has the best prospect of dominating the market, especially if it produces a valued product and the competition has trouble producing a product desired by consumers. Advertising plays a vital role in the growth of a company. Advertising can follow a tactic of conveying the worth and value of a product, it can fairly compare a product to others, or it can advertise the inferior value of other products. If the true value of one's product cannot be advertised, and it cannot be fairly compared to the alternatives, then the remaining choices are to do nothing or use negative advertising.

In the SETI, microwave strategies were the first on the scene—this was fine, but the primary marketing tactic that developed was the use of negative advertising to torpedo the alternative approaches. For years, the optical SETI (OSETI) alternative was smeared (technically and mathematically) as were searches for ET spacecraft or physical artifacts (technically and emotionally). The active SETI (ASETI) alternative was also attacked on emotional and security grounds. When alternatives weren't trampled, they were ignored. This was the main advertising approach for the dominant strategy, and even today it remains the main approach. For a contemporary example read this article by Shostak: [http://www.space.com/searchforlife/seti_shostak_visit_020627.html].

The history of the SETI shows that the microwave strategy remained dominant because it managed to crush competing strategies before they became established and were able to attract more talent and financial sponsors. Another factor seems to have been the steering influence the sponsors had on the microwave effort. If the SETI sponsors did not believe it was their in best interest to fund observational projects that sought to refine and broaden their working assumptions, then they could have threatened a withholding or decline of funds to keep them in line. Naturally then, the threat of losing sponsors would have a narrowing

influence on the assumptions and methods. The prominence of the sponsors involved could also be interpreted as a validation of the research, with opinions following the aroma of money.

This scheme has worked remarkably well for microwave SETI. The customers (i.e., curious scientific community) have been bombarded with one-sided arguments and information, resulting in their belief that there is only one good SETI product to choose from. The sponsors also got what they wanted—the perpetuation of outdated assumptions and methods.

Dominance Challenged

While negative advertising and smear tactics may work in competitive markets and muckraker politics, they have no place in scientific discovery. As one astrophysicist admonished his cynical peers: "Ridicule is not part of the scientific method." In science, new ways of seeing old problems continually surface. Scientists who are interested in pursuing knowledge should appreciate those who are seeking to improve upon existing research. Sometimes the improvement means that a theory must be completely revised, or temporarily set aside when a divergent, more promising path is recognized.

It is human nature to cherish things, including theories that have taken years to cultivate. Very few scientists can just walk away from decades of research. For some, the emotional bonds to their theories are particularly strong. If a strategy has held authority for a long time the researchers working on it form bonds to it like a mother to a child. This observation holds true for the SETI. The groups working on the microwave SETI have a strong attachment to their assumptions, both technically and emotionally; there is clearly resistance to change. In a conceitful way they may feel justified scoffing at those who would threaten their institutions. But again, as our wise astrophysicist observed, ridicule, especially when it is used to sabotage the research of others, has absolutely no place in science.

The time is long overdue to seriously study the SETI alternatives and assess their research value. Back in 1965 Drake recognized this and wrote, "…there are many other ways in which manifestations of intelligent life might be found…"[3] There are now good reasons to challenge the dominance of microwave SETI—not to shatter the cherished assumptions, or beat back the ridicule—but because the viable alternatives can now be investigated fairly and rationally.

One good reason is that the technological capabilities of the alternatives are more mature allowing practical implementations to proceed. Indeed, while the assumptions of the OSETI strategy appear similar to microwave SETI's, OSETI research is being conducted in a scientifically acceptable way. Another reason is that resources for the SETI are limited. Before more resources are invested in a strategy that may never be fruitful, we should understand the best way to allocate them. Throwing big money at the problem just because money is available seems equally wasteful.

Most importantly, there has already been enough time and money put into the microwave strategy, such that if an intentional signal were detectable on Earth it would have been found. In discussing a new approach to SETI Robert Freitas wrote: "Of course, the cheapest searches should always be attempted first and the more expensive ones later (after the cheaper ones have failed). Most [of] the easy beacon strategy searches have already been carried out experimentally…"[4]

No doubt, there will surface challenges to these statements, but continuing to blame ourselves, lackluster funding and temporal misfortune (bad timing) for the failure to find a microwave signal doesn't cut it. The greatest challenge, or perhaps greatest obstacle, to microwave SETI is ETI. If ETI won't cooperate by transmitting a signal our way, continuing to search for distant microwave signals is not the best strategic response.

ETI and Our Strategic Response

If the galaxy is as populated with ETI civilizations as we believe it should be, then there exist probability distributions for the cumulative objectives, interests intentions, actions and preferences of these civilizations. Such distributions will have a range of stochastic variance. Such variance implies a probability $\Pr(x) > 0$ of stochastic intersection between ETI's manifestations with our actions to discover ETI. The probability distributions, however difficult to estimate, can not be ignored; they must not be casually substituted with *hope factors* or wishful thinking that ETI will generate the desired manifestations.

Too often we hear: "We have lines of logic which will lead us, *hopefully*, to the frequencies most probably used…"[3] Even though hope can be a powerful motivator, the SETI must not depend on hope factors for success. By estimating the most likely cumulative incentives, motives and actions of ETI, a matching strategic response can be devised and followed thereby leading to favorable results. Hence, a rationally based decision analysis process must be followed to determine our preferred strategic response.

What comes first, is to determine, by looking inward and outward, the most probable actions and technological manifestations of ETI. An underlying assumption is that ETI sees value in communicating across vast interstellar space with EM energy and will act upon that recognition by sending signals to lesser or peer civilizations.

If you know another civilization exists because of astro-sensing observations, a targeted signal to that civilization seems reasonable and may result in a long-term dialog and the exchange of information. This is the anthropic microwave SETI view of the situation. But, if we project our views to the ETI side, the grass loses its color. If our world has been observed at a distance for a long time, the recent technological changes may have gone unnoticed. The atmospheric absorption spectra from our planet, when observed over hundreds of thousands of years, has probably varied, but not enough recently to signal a technological revolution is taking place. The buildup of greenhouse gasses in our atmosphere may have been observed before.

So changes we view as serious may really be statistically insignificant. Large forest fires produce a lot of air pollution, CO and CO2. An optical image of Earth and spectral measurements taken during periods of raging fires is notable, but could the relatively lower amount of man-made pollution be interpreted as anything other than the result of natural forest fires? While the amount of EM noise from our planet has increased, from an extraterrestrial perspective it is just noise. Even signals from powerful interplanetary radar systems are just stray transient pulse spectra and not a strong indicator of a growing civilization.

When viewed from beyond, none of the present conditions on Earth merits a directed signal from ET. When faced with the prospect that Earth is unremarkable in terms of interstellar communications (i.e. not bursting with strong signals), ETI could find little justification to fund a project to transmit signals to us. Because we know omni-directional signals are much more costly to produce because of the power levels and transmission durations required, ETI can't justify funding beacons either. Microwave SETI proponents admit that detecting targeted transmissions is their best *hope*, because the math shows that detecting communication leakage between advanced civilizations is vanishingly small. When ETI incentives are taken into account a microwave or optical SETI strategic response to the challenge of finding ETI warrants pessimism. Of ET's incentives Drake admits: "…our optimism must be tempered by the possibilities that our logic is not actually that most often used and that the majority of the civilizations do not attempt to make contact with other communicative civilizations."[3]

No matter how the argument that ETI are signaling with microwaves or lasers is presented, to survive, microwave SETI proponents must ignore or minimize the ETI perspective on signaling. Even though it is not possible to know the ETI perspective, role-playing such as that done in the annual Contact conference [http://www.cabrillo.cc.ca.us/contact/new.html] is very useful. If we mirrored ourselves as the ETI, what would the perspective be like? Well, one obvious characteristic is that we are averse to transmitting targeted signals, either microwave or optical. Yes, there have been a few token attempts, but nothing serious. There are two reasons for our aversion: we *don't want* to transmit and we realize that no one would fund such a high-risk gamble anyway.

While the technology to transmit clearly exists, SETI proponents are convinced that it is optimal to continue listening. By only attempting to receive, and not to broadcast, silence among the communicative civilizations is perpetuated. The mindset is: 'the job of transmitting is for someone else who can afford it, not us'. Now, if we are unremarkable and average in the galactic intelligence spectrum, and defer SETA to a distant generation or place the entire burden of it on ETI, then why wouldn't our ETI counterparts do the same? Deferral to others, an irresponsible attitude, in combination with ETI not being able to justify grand SETA projects, severely weakens the microwave SETI strategy.

Is there a preferred strategic response, and if so, how do we go about determining it? First, strategic responses must be rationally based. Certain initial assumptions are allowed, but when the experimental results are contradictory or elusive, the assumptions must be reconsidered. SETI strategies must take into account both the anthropic and ET perspective. Searches must be bounded spatially and temporally. Saying that we may need to search the universe forever to find ETI is reckless scientific talk. It is foolish to continue to investigate the same area until you've completely run out of options. Open-ended strategies are money pits to be avoided.

The estimated value and merit of the preferred strategy must be quantifiable and fairly compared to the alternatives. The preferred strategic response must be able to collect some kind of observational data that provides value to the researchers and sponsors. Decades spent observing nothing have no value to anyone. If observations made using a preferred strategy are not exactly what is sought, but they provide real value to other scientific fields, then such a strategy would be acceptable. It can be argued that currently the value of microwave SETI is to the fields of radio astronomy or astrobiology rather than to SETI. In that respect, microwave SETI is not a total waste of resources – radio-science is well served.

The value of a strategic response lies in the amount of new knowledge it can produce. Clearly the value of two-way communication with ETI is greater than directly observing ETI technology at work, which in turn is greater than a simple detection of ETI. Detection only gets us over the initial barrier of proving ETI exists. After that, additional "low information" detections are just statistics to be cataloged. The real value is searching for manifestations of ETI that produce high information outcomes. If extrasolar communication with ETI is not feasible then more direct or local observational strategies must be sought. These are some features of the preferred strategic response.

To Diversify or Die?

There have been calls to "diversify and widen SETI strategies" in order to maximize the results[5]. In general, diversification is desirable, but the plain truth is that resources and investments for the SETI research are woefully insufficient. In time, with the potential formation of many new theories and strategies, clearly a resource-diluting or draining effect may occur. Growth in any scientific field is healthy if there are enough resources to sustain the system and keep it focused and productive. Collapse eventually occurs when resources are scarce, decline, or are allocated to ineffective strategies. Collapse is merely delayed if abundant resources are allocated to the wrong approach or insufficient resources are allocated to the right approach.

In unpredictable markets one reason to diversify is to be in a position to change the direction of the company when market conditions shift. Within the SETI, institutions that diversify their talents probably do so because they expect to transition to substitute or complementary fields of research (e.g., astrobiology). Rather than make ideological refinements and then transition to a preferred strategy, the market plan is to focus on what's sellable now and

switch to a SETI substitute when the cosmic well runs dry. Given the present circumstances, diversifying the SETI by trying all kinds of different strategies concurrently is not sensible. If it isn't wise to diversify, a suitable alternative is to find the preferred strategy, allocate adequate resources to it, and make a strong case that the other strategies be put on hold. In today's modern SETI marketplace, if you diversify you die!

Making Fair Comparisons

SETI, like a business venture, must be sensitive to market demands. Continuing to peddle a product that people don't prefer is a bad business decision. Like the choices offered in those USSR shoe stores, one product choice is really no choice—not everyone wants to buy shoes of the identical color and style. So before a business can know what the customer wants, it needs to do a survey. Surveying the preferences of the SETI decision-makers and researchers is a valid way to holistically judge the research path they want to pursue. I have concluded that a private assessment of the preferences of SETI researchers will be necessary because nobody seems to care to admit publicly what they *really* prefer to study.

Conjoint Analysis is a valid tool to assess the attribute preferences and decision weights of the decision-makers [6]. Among the various types of conjoint approaches, Choice-Based Conjoint, Stated-Preference and Self-Explicative methods are practical ways to gather respondent data. In a SETI conjoint survey it is possible to gather the necessary survey data from the decision-makers without making them rate or rank specific brands of SETI. In this way the utility of the decision attribute levels can be learned without bias from the survey organizer or belief polarizations from the survey respondents. A sensitivity analysis can also be carried out to understand how much the attribute levels need to vary for the aggregate preferences to shift. From Conjoint Analysis we can learn the attributes of the preferred strategic response from the SETI decision-makers. Learning the preferences of the decision-makers is only half of the equation however.

As was noted, the ETI perspective must be taken into account. If we don't know anything about ETI's motives or behaviors, how do we proceed? First, on the whole, ETI is expected to produce some sort of manifestations that are observable. This implies a manifestation state space. The state space is an observable state of nature and, in our case, independent of the observer (us). The state space spans the technological manifestations of ETI that we can observe. To make the state space a closed set, it includes an element that ETI are not producing any presently observable manifestations. This allows far-out manifestations like nano-sized probes or gravity-wave telecommunications to exist even though we can't observe them. Establishing a set of manifestations also involves determining the probability distributions of the elements of the state space. Given the magnitude of the search space, there could be an enormous number of probability distribution functions (PDFs). It is not possible to examine them all, so it makes sense to consider a subset that are epistemically reliable [7]. The PDFs to be used are probability mixtures of microwave, optical and physical artifacts (e.g., robotic probes) manifestations. If we surrender to complete ignorance of the PDFs, then a uniform PDF is used in the calculations. If we have some tentative knowledge

of the probability intervals involved for the manifestation elements, this can be used to formulate a set of satisfactory PDFs. It turns out that there are not an excessive number of PDFs that must be examined. For example, we wouldn't expect a distribution having $\Pr(x) > 0.85$ for pulsed optical leakage to be very reliable. The satisfactory PDFs can be used in a rank-dependent expected utility (RDEU) analysis [http://ecocomm.anu.edu.au/quiggin/JournalArticles93/BKJ93.pdf]. RDEU[8] allows the researcher to estimate and rank the outcomes of a real or simulated observational experiment. The utility of the decision factors and outcomes produced can be calculated. The appropriate use of RDEU lies in the fact that SETI researchers prefer more knowledge to less knowledge. Certain permissible manifestations have the potential to produce more information than others do. One can surmise that advanced ETI will prefer certain activities and pursuits to others. In particular, advanced ETI will invest in ventures that produce the highest investment returns. They will not squander resources on risky or low rate-of-return projects even if these represent a tiny fraction of their economy (i.e. energy supply). *Truly* intelligent life would laugh at the idea of transmitting SETA beacons.

Even during our short time of exploring the solar system with robotic spacecraft, we know the return on this investment has been very handsome. The same holds true for astro-sensing efforts like IRAS, COBE, HST, the VLT and the upcoming family of TPF missions (e.g., Keppler). It doesn't take a visionary to see that advanced ETI must value astro-sensing and exploration projects to staying at home with a big ear to the cosmos. Hence, we expect advanced ETI to produce certain kinds of technological manifestations over others, and these can be ranked in terms of potential information content. An RDEU analysis of the manifestation state space should reveal what manifestations are most likely to produce the most information utility to us should we decide to attempt their observation. After determining which ETI manifestations are more likely to occur and produce the most information if observed, a fair and objective ranking of the SETI strategic alternatives can be made.

Among the SETI alternatives, the optimal strategy is a marriage between the collective preferences of the decision-makers, and the observational approach that applies resources to acquiring data on the ETI technological manifestations with the highest potential for producing valuable outcomes.

Making the Right Choice

While such a study as that outlined above can be carried out, what would it be expected to accomplish? First, it will produce results that may not be appealing to the SETI establishment. In fact, these conclusions may not be accepted by anyone actively engaged in microwave or optical SETI; they may be ridiculed or ignored. The private response may be positive while the official response is a negative one. No matter the response, the scientific community should know that alternate SETI choices exist, are scientifically based and rationally conceived. Scientists who are interested in practicing the SETI do not have to run with the herd. They can feel empowered to lobby organizations like the National Science

Foundation (NSF) to fund alternatives. NSF funding is peer controlled to the extent that the more people doing research in a field, the higher the odds the researchers will be university professors and their graduate students. Chris Chyba of the SETI Institute urged the NSF [http://www.house.gov/science/space/jul12/chyba.htm] to be more open to SETI funding in general. He said: "We are concerned that the search for extraterrestrial intelligence, despite having passed scientific peer-review and being technologically cutting-edge, may not be competing on a level playing field within the federal government." Once a group of professors have a unified opinion regarding a preferred SETI strategy, perhaps the NSF will consider grant proposals that reflect objective, though somewhat unconventional, scientific inquiry and experimentation. Even if funding from professional associations or governmental science agencies cannot be secured to carry out the preferred SETI strategy, there are other sources of funding. Regardless of the funding source, it's high time to identify the preferred strategy and start moving in the right direction! Similarly, it is high time for curious scientists to demand a better SETI product—one they both want and one that makes good business sense.

References

1. Cocconi, G. and Morrison, P., "Searching for Interstellar Communications", *Nature*, 184, No. 4690, pp. 844-846, 1959.

2. Drake, Frank, "Project Ozma", *The Search for Extraterrestrial Intelligence, Proceeding of the NRAO Workshop held at the National Radio*

Astronomy Observatory, Green Bank, West Virginia, Workshop No. 11, May 20-22, Kellermann, K.I., and Seielstad, G.A., Eds., p.23, 1985.

3. Drake, Frank, "The Radio Search for Intelligent Extraterrestrial Life", *Current Aspects of Exobiology*, (JPL Technical Report No. 32-428),

Jet Propulsion Laboratory, California Institute of Technology, pp. 323-345, 1965.

4. Freitas, Robert A. Jr., "Interstellar Probes: A new Approach to SETI", *Journal of the British Interplanetary Society*, 33, pp. 95-100, 1980.

5. Tough, Allen, "How to Achieve Contact: Five Promising Strategies", *A Humanity 3000 Knowledge Workshop, When SETI Succeeds: The Impact of High-Information Contact,* Foundation for the Future, pp. 115-125, 2000.

6. Louviere, Jordan J., *Analyzing Decision Making: Metric Conjoint Analysis*, Sage University Publications Inc., Newbury Park, CA, 1988.

7. Gärdenfors, P. and Sahlin, Nils-Eric, "Unreliable Probabilities, Risk Taking and Decision Making", *Decision, Probability and Utility, Selected Readings*, Cambridge University Press, pp. 313-334, 1988.

8. Quiggin, John, *Generalized Expected Utility Theory, The Rank-Dependant Model*, Kluwer Academic Publishers, Boston/Dordrecht/London, 1993.

9. Stride, Scot L., "An Instrument-Based Method to Search for Extraterrestrial Interstellar Robotic Probes", *Journal of the British Interplanetary Society*, 54, No. 1/2, pp. 2-13, 2001.

10. Stride, Scot L., "Instrument Technologies for the Detection of Extraterrestrial Interstellar Robotic Probes", SPIE Proceedings on Optical SETI-III, 4273, pp. 178-189, San Jose, California, 2001. [http://www.interstellar-probes.org/resources/OSETI3-4273-26a.pdf].

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