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ALIENS AMONG US:
LEARNING DISABILITY AS AN ANALOG FOR EXTRATERRESTRIAL INTELLIGENCE

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ABSTRACT

SETI scientists can learn a great deal about possible ET communications styles and motivations by studying social outcasts and mental misfits within the human population. Citing two examples: Attention Deficit and Hyperactivity Disorder (ADHD), which involves a seemingly chaotic learning style at odds with linear information processing, is considered a pathology which our society treats with medication. Asperger's Syndrome, a form of autism found among the highly intelligent, manifests itself as an apparent lack of social skills and inability to communicate meaningfully with "normals." Perhaps such forms of cognitive and emotional dysfunction are the norm among highly intelligent extraterrestrials? If so, then persons with ADHD, Asperger's, or other supposed disabilities may prove useful surrogates in the study of ET intelligence.

KEYWORDS

SETI, Communications, Learning Disability, ADHD, Autism Spectrum Disorder, Asperger

INTRODUCTION

It all begins (as should most SETI articles) with the Drake Equation [Morton, 2002]. Ostensibly, this equation allows us to compute N , the number of potential communications partners in the Milky Way Galaxy. Not really a formula intended for mathematical solution, this agenda for the world's first formal meeting of SETI scientists helps us to focus our research, by identifying the unknowns. It is, in short, an elegant tool for quantifying our ignorance.

Even as early as the Order of the Dolphin meeting, it was argued that the first six factors of Drake's famous equation don't really matter. When we multiply together our best estimated values for the rate of

stellar formation, fraction of stars with planets, number of good Earths per solar system, fraction of such planets with life, fraction of lifeforms evolving intelligence, and fraction of intelligent species choosing to communicate, we generally come up with a value of one (within plus or minus a couple of orders of magnitude).

N EQUALS L

So, what really matters is L , the lifetime of communicative societies. It stands to reason that the longer the duration of L , the greater the number (N) of civilizations out there with whom we can potentially make contact.

We hope that L is great, for our own sake as well as theirs. For nearly half a century,

we've conducted ever more sensitive searches, employing a multitude of search modalities, across an ever increasing search space. Yet, we continue to come up empty-handed. After fifty years of solitude, we might come reluctantly to the conclusion that L is very low indeed.

There is, however, an alternative explanation for our present lack of SETI success. For Drake's model is a multiplicative one. Thus, as *any* single factor in the Drake Equation approaches zero, the product N also approaches zero. So, a low enough value for *any* Drake factor could explain the null results of all SETI observations to date.

An interesting corollary to the above insight is that, conversely, if we can somehow *raise* the value of any single factor in the Drake equation, we achieve a corresponding increase in N , the number of extraterrestrial neighbors with whom we can expect to communicate. Thus, to improve SETI success, we need only pick one Drake factor, and proceed to increase its value.

INCREASING THE VALUE OF N

Which, if any, of the Drake factors can we hope to influence? Clearly, there's not much we can do about the astronomical ones. Stellar formation, planetary abundance, and Earthlike environments are beyond our direct control, so we leave those factors in the hands of Arthur Clarke and God. Similarly, there's little we can do about the biological factors – life and intelligence either emerge or they don't, without our say.

We could, I suppose, impact L , the mean longevity of communicative societies, but only negatively – perhaps by waging war on them, or spreading disease. Since (one

would hope) we humans are not so inclined, and given that there's little we can do to increase the longevity of societies we presume are more advanced than ours, let's rule out L .

That leaves us with one remaining factor: f_c , the fraction of intelligent species that choose to communicate. We can potentially increase the value of f_c in one of two ways: by inviting communication, or by redefining its parameters.

INVITING COMMUNICATION

We invite ETI to communicate with us through the science of interstellar messaging, lately becoming known as METI (Messaging to ExtraTerrestrial Intelligence). The landmark Arecibo Message of 1974 [David, 1980] is a prime example of METI. So are the more recent transmissions beamed to various stars from the powerful Evpatoria radar facility in Crimea, Ukraine [Zaitsev, 2003]. Such transmissions are not without their critics. Controversy arises around the fact that nobody can say with certainty that such transmissions do not subject humankind to some level of risk.

Risk-benefit analysis notwithstanding, there is a very good reason why METI activities have not contributed to SETI success, and will not, at least for the foreseeable future. Even the most powerful and elegantly crafted invitation to communicate must still travel through the interstellar medium at c , the cosmic speed limit. Thus, propagation time to the specific target stars can extend from the tens to the tens of thousands of years.

Why hasn't ETI answered our call? They haven't received it yet, and may not for a very long time – a period perhaps exceeding the longevity of human civilization.

REDEFINING COMMUNICATION

Some say SETI success eludes us because we're listening in the wrong part of the spectrum. Aliens, their reasoning goes, are so technologically advanced as to have abandoned microwave radio or laser optics aeons ago, in favor of – of what? Graviton communications, perhaps, or modulated gamma rays, or some other technology not in evidence to we primitives here on Earth.

The late SETI pioneer Prof. Philip Morrison used to talk about zeta waves, some hypothetical communications medium of which ETI has knowledge, and we do not. When we learn how to harness zeta waves, he whimsically predicted (without saying exactly what they are), we will finally achieve SETI success. Zeta waves may indeed be one way to redefine communication, but only after we have succeeded in harnessing zeta waves (which, by their very definition, we never will).

Might there be what I will call an eta wave, something not quite as elusive as a zeta wave, which exists, about which we are currently aware, but which we have not yet thought to exploit for SETI science? If there is, we may already have detected ETI, and just not recognized our positive result.

Eta waves might manifest not in some previously unexplored segment of the electromagnetic spectrum, but rather as previously unrecognized hallmarks of artificiality, already collected, but buried somewhere in the SETI data set.

For example, early in SETI science, when it was assumed that advanced civilizations would broadcast easily detected beacons, the primary tool of digital signal processing was the fast Fourier transform. The FFT is very adept at ferreting out monotonic carriers

submerged in broadband noise. Since such filtering renders undetectable those intelligent signals that masquerade as noise, the FFT would not be particularly adept at detecting, for example, some forms of spread spectrum communication. For such signals, an adaptive algorithm such as the Karhunen-Loeve Transform (KLT) [Maccone, 1994] might prove more applicable. So, part of redefining communication could well be re-examining archival data sets in new ways.

HUMAN LEARNING DISABILITIES; ALIEN COMMUNICATIONS DIFFERENCES

Which brings us to the focus of this paper. Factor's Corollary to Clarke's Third Law states: "any sufficiently advanced modulation scheme is indistinguishable from noise." [Shuch, 1996] If some modulation schemes render intelligent information content undetectable, might some alien communications modalities render unintelligible their attempts to communicate?

Within our own population, we encounter a variety of seemingly intelligent individuals whose particular communications styles (we tend to stigmatize these as 'disabilities') render them incomprehensible to the human mainstream. From them, we can seek to learn new communications modalities, which might be more applicable to the SETI enterprise than the linear learning modes for which our scientific training has prepared us.

ASPERGER'S SYNDROME

Fans of the weekly US television drama "Boston Legal" have already met an Aspie. His name is Jerry Espenson, and he is a highly intelligent (some would say brilliant) attorney totally lacking in social skills. As

insightfully played by actor Christian Clemenson, Jerry is awkward around people, stammers, fails to make eye contact during conversations, squirms, has various nervous tics, and generally fails clearly to communicate his extraordinary insights. Although a caricature in some respects, Jerry's behaviors and abilities are typical of individuals diagnosed with Asperger's Syndrome (AS), a supposed disorder only recently added to the Diagnostic and Statistical Manual of Mental Disorders [DSM-IV, 2000] the mental health care profession's standard reference.

Many of us in the scientific community recognize one or more of these AS behaviors in ourselves. Perhaps some future edition of the DSM will redefine AS more appropriately, as a collection of abilities, rather than as a disability. They might even rename it "geekism." In the interim, if we SETI geeks assume ETI to be highly intelligent, might we perhaps consider our own lack of success to be, at least in part, a manifestation Asperger's (either own or ETI's)?

ATTENTION DEFICIT HYPERACTIVITY DISORDER

Another recent addition to the DSM-IV, ADHD is an alternative learning and communications style typical of gifted students who are being bored to tears by a lock-step educational system. Mainstream medical practice is to drug ADHD students with stimulant medication (an option far less costly than individualized instruction). Formerly disruptive students receiving such treatment become so cooperative and compliant that it is often said Ritalin (the most commonly prescribed ADHD drug) is addictive: parents and teachers get hooked on it.

Persons diagnosed with ADHD tend to be multi-taskers. If you have ever been known to talk on the telephone and read a book while answering email and drafting your next journal article, you might well fit the syndrome, whether diagnosed or not.

The ADHD student will fail to hang on my every word. He or she may well feel that what I have to say is not personally relevant. Might not ETI, who chooses to ignore my attempts to communicate, be similarly unmotivated? "I'm not inattentive," the ADHD student might say in the lecture hall, "you're boring." I'm not listening, ETI may well think. You humans have nothing to teach me.

METAPHORICAL SPEECH

First airing on 28 September 1991, season 5 episode 2 of the TV science fiction series "Star Trek: the Next Generation" tackled the challenges of interstellar communication. In his script "Darmok," screenwriter Joe Menoskey depicts a race of highly intelligent extraterrestrials whose communication style is incomprehensible to humans. Although the ubiquitous Universal Translator (to which, regrettably, Paramount Studios still holds the patent) is able to translate their individual words into standard English, those words come out in a jumbled torrent, from which the humans can extract no meaning. It turns out the Tamarian race speaks solely in metaphor. Lacking a common cultural context, humans are at a loss to comprehend their speech.

Captain Jean-Luc Picard's words give hope to those of us who would try to communicate with alien intelligences. "But are they truly incomprehensible? In my experience, communication is a matter of patience... imagination. I would like to believe that these are qualities we have in

sufficient measure.” Through a shared adventure, a metaphorical common language is created, enabling successful first contact.

It is conceivable that the inspiration behind this episode was the prevalence of metaphorical speech among persons diagnosed with autism. The autism spectrum includes a number of communications mannerisms which require a specific shared context to facilitate understanding. A personal example may help to elucidate how such individuals communicate.

My own 18 year old son, Curran, suffered brain damage shortly after birth, resulting in both physical and cognitive disabilities. His high intelligence, evidenced by a propensity for making obscure connections (sometimes several layers deep) between apparently disparate phenomena, results in his communicating through metaphor.

Like many humans with autistic tendencies, Curran tends to fixate on areas of personal interest, and to memorize huge quantities of seemingly meaningless data. One area of interest to him has long been the US presidents, whose names and terms of office he can recite to anyone, interested or not. At school one day, he was asked by a teacher to describe his emotional state. “I’m number 17,” he replied, as though that answered the question clearly.

The seventeenth president of the United States, as Curran well knows, was Andrew Johnson. In every painting, sketch, or photograph of President Johnson which has survived to the president day, his countenance exhibits what Curran interprets as anger. (It is significant here that, whereas those with Asperger’s Syndrome have difficulty interpreting facial expressions, this

seems not to be a problem for those with other forms of autism.)

Curran’s mother and I immediately understood that, to Curran, being #17 means being angry. His teachers clearly would have lacked the cultural context to interpret this remark, which was dismissed by them as off-topic. Similarly, lacking a cultural commonality, might not communications between humans and ETI be equally challenging?

TECHNOBABLE

“The active field discriminator circuit presented in this article operates on the principle of balanced product isolation. Signals from the electromagnetic vector multiplier and one parasitic signal coupler are combined with the output of an external harmonic amplitude detector. The resulting waveform is routed through an isotropic polarization generator for processing, before being applied at the output to drive an orthogonal distortion filter. (See block diagram, fig. 3.) Possible applications include circular wave oscillator adjustment, as well as optimized linear frequency amplification.”

Did you get all that? Neither did I – and I wrote it!

Well, not exactly. Actually, I wrote the *computer program* that generated the above text. This opening paragraph appeared in a respected technical journal [Shuch, 1985] – and, much like the famous Alpher, Bethe, Gamov article [Alpher et.al., 1948] graced its April 1st issue.

My point is, we all tend to invoke the jargon of our particular disciplines, when communicating with our peers. And, if we optimistically consider ETI to be our peers,

we run the risk of obfuscating that which we are trying to communicate. Should we be fortunate enough to receive a verifiable SETI signal, what assurance have we that we can recognize and interpret ETI's discipline-specific jargon?

MEN ARE FROM MARS

Even on our own planet, between individuals of (arguably) the same species, gender differences preclude full communications. Numerous best selling books [Tannen, 1990; Gray, 1992] underscore the cultural commonalities (or lack thereof) between men and women. "I know you think you understand what I said," goes the old joke, "but I'm not certain that what you believe you heard is necessarily what I meant." (I leave it to the reader to speculate as to which gender is the able, and which the learning disabled, one.)

TEMPORAL PERCEPTIONS: SUNDIALS AND HOURGLASSES

A half century of observational SETI science has taught us little about the existence of communicative extraterrestrial civilizations, but it has taught us that SETI science offers little to he or she who demands instant gratification. Our human reaction to the prolonged null result tends to be one of impatience. However, our extraterrestrial communications partners are likely to perceive time differently than do we. Consider those who reckon time by the sundial (a clock with the fewest possible moving parts). To them, the passage of time is marked by a shadow's slow but inexorable progress across the ground. By contrast, to those who measure time by the hourglass (the chronometer design with, arguably, the *most* moving parts), time's passage is more palpable, and evident with the transit of each individual grain of sand.

Science fiction gives us examples of races who live by the sundial, and by the hourglass. At both extremes, we contemplate extraterrestrial intelligence that perceives time very differently from ourselves.

CHEELA

The concept of life on the surface of a neutron star, first articulated by our own SETI patriarch, Frank Drake [1973], was eloquently explored by Robert Forward in his novels Dragon's Egg [1980] and Starquake [1985]. These books gave us the Cheela, small but macroscopic creatures who lived a million times faster than humans. Contact, when ultimately achieved, represented a brief scientific mission for humanity, but a multi-generational effort for the Cheela.

A human analog for the Cheela might be those diagnosed with ADHD. As previously noted, ADHD multi-taskers tend to cram an immense amount of activity into a given 24-hour day. As a consequence, they perceive the passage of time differently from the mainstream human population.

METHUSELAH'S CHILDREN

Robert Heinlein [1941] envisioned, in his novella of the above title, a genetic lineage of long-lived humans, the result of non-coercive eugenic manipulation. Young people of marriageable age who happened to have four living grandparents were encouraged (through financial incentives) to pair with others similarly blessed. Over generations, longevity genes were reinforced, and lifespans expanded. The patriarch of this lineage, Lazarus Long, became something of a social misfit as his life spanned the centuries. It's not hard to see why communications would take on less

urgency to a race of immortals, be they human or extraterrestrial.

There are those humans on the autism spectrum who live by Methuselah time, even though their life spans are no greater than the norm. To them, the passage of time is imperceptible; they live by the sundial, not the hour glass, and approach human interactions accordingly.

Frank Drake [1976, 1980] has speculated that a sufficiently advanced civilization would eventually achieve immortality. If this occurred, we could expect that their incentive for interstellar communications would be significantly altered.

CONCLUSIONS

Human learning differences serve as an effective analog for extraterrestrial intelligence, in that they show us how effective communication can be impeded, even between members of the same species. We have seen that, in addition to differences in communications styles, our potential extraterrestrial communications partners may well perceive time differently than we do. Depending upon whether our communications partners reckon time by the sundial or by the hourglass, whether they live on Cheela time or on Methuselah time, our fifty years of solitude can be regarded as either an eyeblink, or an eternity.

REFERENCES

- Alpher, R.A., et.al., "The Origin of Chemical Elements," *Phys. Rev.* 73(7): 803-804, 1 April 1948.
- American Psychiatric Association, Diagnostic and Statistical Manual of Mental Disorders, DSM-IV-TR Fourth Edition, 2000.
- David, Leonard, "Putting Our Best Signal Forward," *Cosmic Search* 2(3):2-7, Summer 1980.
- Drake, F.D., "Life on a Neutron Star." *Astronomy* 1(5):5, December 1973.
- Drake, F.D., "On Hands and Knees in Search of Elysium," *MIT Technology Review*, 78(7):22, June 1976.
- Drake, F.D., "A Speculation on the Influence of Biological Immortality on SETI," *Cosmic Search* 2(3):9-11, Summer 1980.
- Forward, Robert L., Dragon's Egg, Del Rey, 1980.
- Forward, Robert L., Starquake, Del Rey, 1985.
- Gray, John, Men Are from Mars, Women Are from Venus, Harper Collins, 1992.
- Heinlein, Robert, "Methuselah's Children," *Astounding Science Fiction*, Street & Smith, July 1941.
- Maccone, Claudio, Telecommunications, KLT and Relativity, Vol. 1, IPI Press, 1994.
- Morton, Oliver, "The Drake Equation," in Farmelo, Graham (editor), It Must Be Beautiful: Great Equations of Modern Science, Granta Publications, London, 2002.
- Shuch, H. Paul, "Electromagnetic Jargon Generator," *Ham Radio* 18(4): 75-76, April 1985.
- Shuch, H. Paul, "Indistinguishable from Magic," *SearchLites* 1(3):2, Autumn 1995.
- Tannen, Deborah, You Just Don't Understand: Men and Women in Conversation, William Morrow, 1990.
- Zaitsev, Alexander L., "A Teen-Age Message to the Stars," *SearchLites* 9(1):7, Winter 2003.