

INTERSTELLAR COMMUNICATION. IX. MESSAGE DECONTAMINATION IS IMPOSSIBLE

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ABSTRACT

A complex message from space may require the use of computers to display, analyze and understand. Such a message cannot be decontaminated with certainty, and technical risks remain which can pose an existential threat. Complex messages would need to be destroyed in the risk averse case.

1. INTRODUCTION

The search for extraterrestrial intelligence (SETI) has provoked many critical discussions on technical and philosophical levels (Ćirković 2013). It is much debated whether contact with ETI would benefit or harm humanity (Baum et al. 2011; Shostak 2014; Brin 2014; Billingham & Benford 2014), and whether mankind should (Benford 2014; Gertz 2016b) or should not (Zaitsev 2011; Vakoch 2016) keep quiet in order to protect Earth from threats, or even “cloak” our planet using lasers to compensate for Earth’s transit signatures (Kipping & Teachey 2016).

One of the scenarios considered in the literature is the reception of an ETI message through electromagnetic radiation, e.g. through a radio telescope (Cocconi & Morrison 1959). Alternatively, a message might be found in the form of, or through, an alien probe, as first suggested by Bracewell (1960). It was suggested to search the solar system for non-terrestrial artifacts (Papagiannis 1995; Tough & Lemarchand 2004; Haqq-Misra & Kopparapu 2012), particularly for starships (Martin & Bond 1980) in addition to classical SETI (Gertz 2016a). In our solar system, probes are speculated to be in geocentric, selenocentric, Earth-Moon libration, and Earth-Moon halo orbits (Freitas & Valdes 1980; Valdes & Freitas 1983; Freitas 1983), or buried on the moon (Clarke & Kubrick 1993). Alternative ideas include the Kuiper belt (Loeb & Turner 2012), general technosignatures (Wright 2017), or even “footprints of alien technology on Earth” (Davies 2012).

While it has been argued that sustainable ETI is unlikely to be harmful (Baum et al. 2011), we can not exclude this possibility. After all, it is cheaper for ETI to send a malicious message to eradicate humans compared to sending battleships.

If ETI exist, there will be a plurality of good and bad civilizations. Perhaps there are few bad ETI, but we cannot know for sure the intentions of the senders of a message. Consequently, there have been calls that SETI signals need to be “decontaminated” (Carrigan 2004, 2006).

In this paper, we show that it is impossible to decontaminate a message with certainty. Instead, complex messages would need to be destroyed after reception in the risk averse case.

2. MESSAGE TYPES

There are several possible threats from an ETI message. On the most basic level, a message might represent a statement like “We will make your sun go supernova tomorrow”. True or not, it could cause wide-spread panic. More realistically, a longer text could have a demoralizing cultural influence. For example, it is debated whether the Roman Empire was destroyed by the bible (McGiffert 1909).

We now follow along the (perhaps more likely) case that the hypothetical message is not very short, and non-trivial in content. As an example, the message from the “SETI Decrypt Challenge” (Heller 2017) was a stream of 1,902,341 bits, which is the product of prime numbers. Like the Arecibo message (Staff At The National Astronomy Ionosphere Center 1975) and Evpatoria’s “Cosmic Calls” (Shuch 2011), the bits represent the X/Y black/white pixel map of an image. When this is understood, further analysis could be done off-line by printing on paper. Any harm would then come from the meaning of the message, and not from embedded viruses or other technical issues.

If such a message is received only in one place, and only once, it might be possible to contain it and its harmful consequences, or even destroy it. If it is received repeatedly, perhaps even by amateurs, containment is impossible. As a further complication, the International Academy of Astronautics has adopted a “Declaration of Principles Concerning Activities Following the Detec-

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tion of Extraterrestrial Intelligence” which states¹ that “These recordings should be made available to the international institutions listed above and to members of the scientific community for further objective analysis and interpretation.” This view is shared by the majority of SETI scientists (Gertz 2017).

3. THE NEED FOR A PRISON

We continue with a hypothetical message which appears to be, at first sight, positive and interesting, and shall be analyzed in depth. Any message could, in principle, be examined on paper. For many plausible message types, however, it is much more convenient to use a computer. Even the simple L^AT_EX notation is difficult to read as code. Consider the proof of the Riemann hypothesis, which begins with the equation

$$\zeta(s) = \sum_{n=1}^{\infty} \frac{1}{n^s} = \prod_{p \text{ prim}} \frac{1}{1 - \frac{1}{p^s}} = \frac{1}{\left(1 - \frac{1}{2^s}\right) \left(1 - \frac{1}{3^s}\right) \left(1 - \frac{1}{5^s}\right) \dots}$$

which is much easier to read when interpreted and finely printed as

$$\zeta(s) = \sum_{n=1}^{\infty} \frac{1}{n^s} = \prod_{p \text{ prim}} \frac{1}{1 - \frac{1}{p^s}} = \frac{1}{\left(1 - \frac{1}{2^s}\right) \left(1 - \frac{1}{3^s}\right) \left(1 - \frac{1}{5^s}\right) \dots} \quad (1)$$

Even a typesetting system such as T_EX is a Turing-complete programming language (Greene 1990), so that the message is in fact code, and may contain a malicious virus. Messages may contain large technical diagrams, equations, algorithms etc. which can not reasonably be printed and examined manually. In addition, the message itself might be compressed to increase interstellar data rates, and the decompression algorithm would be code. Executing billions of decompression instructions cannot plausibly be performed manually and requires the use of a computer. But then, the computer would execute potentially harmful ETI code. For this case, it was suggested to use isolated, quarantined machines for analysis (Carrigan 2004, 2006).

In the following section, we explain why these measures are insufficient, and no safety procedure exists to contain all threats.

4. THERE IS NO PERFECT PRISON

Consider a large ETI message with a header that contains a statement such as “We are friends. The galactic library is attached. It is in the form of an artificial intelligence (AI) which quickly learns your language and

will answer your questions. You may execute the code following these instructions...”

We assume that the message is available only to a small group of people, part of a government body, who decide to keep it private, but follow their curiosity and examine it with utmost care. A computer in a box on the moon is built to execute the code. Safety devices are in place, their design by choice of the reader, such as remote-controlled fusion bombs to terminate the experiment at any time.

This scenario resembles the Oracle-AI, or AI box, of an isolated computer system where a possibly dangerous AI is “imprisoned” with only minimalist communication channels. Current research indicates that even well-designed boxes are useless, and a sufficiently intelligent AI will be able to persuade or trick its human keepers into releasing it (Armstrong et al. 2012; Dawson et al. 2016).

For the escape, we have to assume that researchers engage in a conversation with the AI (without, there would be no benefit in running the experiment in the first place). In such a text conversation, the AI might offer things of value, such as a cure for cancer, and make a small request in exchange, such as a 10% increase in its computer capacity. It appears rational to take the offer. When we do, we have begun business and trade with it, which has no clear limit. If the cure for cancer would consist of blueprints for nanobots: should we build these, and release them into the world, in the case that we don’t understand how they work? We could decline such offers, but shall not forget that humans are involved in this experiment. Consider a nightly conversation between the AI and a guard: “Your daughter is dying from cancer. I give you the cure for the small price of...” . We can never exclude human error and emotions. After all, is it ethical to keep a sentience in a prison when it expresses incredible pain due to small manufacturing errors from building the box?

Even in a military-style, adamant experiment, there will still be humans involved who go home after examination work with their own feelings. Even if everything is officially secret, whistle-blowers might get some news out to the public. Quickly, there could be a community on Earth in favor of letting it out for religious, philosophical etc. reasons. If the AI promises to cure cancer, or offers a message of salvation, a cult could form. Maybe (or maybe not) a majority of the population would be in favor of releasing the AI. Should, or even could, a democratic government work against the majority of its people? Dictatorships are unstable and eventually overthrown; the AI will be eventually released.

5. PRISON ESCAPE

With a non-zero prison escape probability in any single time period, the AI will be free at some point of time. Then, the worst possible result would be human

¹ <http://www.setileague.org/iaaseti/protdet.htm>

extinction or some other unrecoverable global catastrophe (Bostrom 2014). The main argument is that the human species currently dominates planet Earth because of our intelligence. If ETI-AI is superior, it might (or might not) become more powerful and consider us as irrelevant monkeys (or maybe not).

6. DISCUSSION AND CONCLUSION

As we realize that some message types are potentially dangerous, we can adapt our own peaceful transmissions accordingly. We should certainly not transmit any code. Instead, a plain text encyclopedia (Heidmann 1993), images, music etc. in a simple format are adequate. No advanced computer should be required to decrypt our message.

Our main argument is that a message from ETI cannot be decontaminated with certainty. For anything more complex than easily printable images or plain text, the technical risks are impossible to assess beforehand. We may only choose to destroy such a message, or take the risk. The risk for humanity may be small, but not zero. The probability of encountering malicious ETI first might be very low. Perhaps it is much more likely to receive a message from positive ETI. Also, the potential benefits from joining a galactic network might be considerable (Baum 2014).

It is always wise to understand the risks and chances beforehand, and make a conscious choice for, or against it, rather than blindly following a random path. Overall, we believe that the risk is very small (but not zero), and the potential benefit very large, so that we strongly encourage to read an incoming message.

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