

McGill University

Final Essay

*Language, Universe*

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## Introduction

From the very beginning of humanity, of the existence of our species, we have used language. In fact, we are the only species to have developed this ability. On a more fundamental level, we could even say that language is what defines us as human beings, and it is what separates us from the rest of the living world. We've certainly observed many instances of animals communicating. In fact, a species might only be able to thrive if there is communication between its members. However, the distinction between human language and animal communication, is in the humans' ability to transmit thought. We are able to speak and to make others think about what we have spoken about. We tend to say that the other thing that separates us from other living beings is our ability to think, our conscience. Language and thoughts have preceded and have led all the advancements and achievements of humans as a species. From societal structures to the invention of technologies, and domains of thought such as physics, we have always used language to communicate to others what we know, what we don't know, how we have come to know, and even, why we should know – the philosophical purpose of knowing. We have used language to explain all that “knowing” to others, but also to ourselves. It's difficult to imagine thinking about anything without using language. Astrolinguistics is the theoretical field that studies and proposes potential candidates for a language that could be spoken by intelligent beings out in the universe. It is a field of study that is itself part of a much larger, search for extraterrestrial life, or SETI. Both Astrolinguistics and SETI have, pretty much since their inception, been heavily criticized and regarded as pseudoscience, and if not, at least a waste of scientific effort and resources, given the little to no return researchers get from their investments. Given what we said earlier, where we elaborated on the importance of language, its connection to thought, and its defining nature to humans, it might come as a surprise that a study, a search for beings of equal or higher ability to use language and, more importantly, thought, is so often regarded as a joke. A conscious life is our most fundamental nature. For so long, we have lived on this planet as the only thinking and language-using beings, alone. Perhaps are we *afraid* of discovering other conscious beings, knowing the evil some of us have used our conscience (and our language) for? In this essay, we ask the question, “*If there is a universal language, what would it be?*”. We will look at how we have previously approached Astrolinguistics, some potential candidates of universal languages, their flaws, how we can link all of it to the study of physics, and some thoughts for the future.

## I. A Language for the Universe

For now, we know nothing of potential extraterrestrial life, therefore if we are to think about any of their potential properties, such as the language they could use, we must first rid ourselves of any human assumptions and biases. Since we know nothing, we cannot assume anything.

Thus, we will assume nothing. By this we mean that the only assumption that we do make is that extraterrestrial language is *nothing* like human language. Given the very strict environmental requirements for the development of life, let alone intelligent life, there is indeed the possibility that intelligent life will develop very similarly to us humans, and might therefore resemble us physically, and perhaps develop the same language as us. However, if extraterrestrial language resembled human language, communication between both our and their species would already be possible, so researching this question further becomes pointless. Put simply: For the sake of argument, we assume they don't speak "human".

We begin by looking at existing proposals of a cosmic language, a *lingua cosmica*. For a long time, a cosmic language was a topic of science fiction. Most science fiction universes that had an intelligent species, also gave that species their own language. It seems even authors found that language was an integral part of what made an intelligent species intelligent.

In 1960, Hans Freudenthal, published his book "*Lincos: Design of a Language for Cosmic Intercourse*" (Freudenthal, 1960). In it, he proposes a language based on mathematical concepts, like numbers. It attempts to teach intelligent life his symbolization of mathematics, operations, variables, constants, logic and set theory. He also introduces natural concepts like time and the measurement of duration. He then attempts to teach behaviour, which is perhaps the most complex part. He introduces communication, through the exchange of questions and answers. The final section describes concepts such as mass, space, and motion, and everything relating to it, from large structures in the universe to human physical characteristics. Even though nowadays Freudenthal's work is largely considered a complex experiment that exists within itself, it sets some basic ideas of Astrolinguistics, notably that we cannot think of creating a language that resembles any of our so called natural, human languages.

In 2012, Alexander Ollongren published a book titled "Astrolinguistics: Design of a Linguistic System for Interstellar Communication Based on Logic" (Ollongren, 2012). As the title says, this *lingua cosmica* is based on logical operations. It assumes that intelligent life that is capable of receiving radio transmissions from so far away would have developed technology advanced enough to do so and would already be capable of understanding logical operations. It is in fact the book that coins the term Astrolinguistics. However, it mostly describes human situations in human society, using formal logic. Whether extraterrestrial intelligent life will be able to understand it, is a whole other question. In fact, there are several problems that arise when trying to create a *lingua cosmica*.

## II. Issues with Universal Language

If we really wanted to assume nothing, this leads us to some very obvious roadblocks. These at first sight might seem easy to discard for the sake of argument – like we did for the possibility of intelligent life developing the same language as us – but are more plausible than not, and ultimately fundamental problems of Astrolinguistics.

*Life may not see.* This discards any possibility of a visual or written form of language. This problem isn't as critical since writing isn't considered a language on itself, at least not for humans. In human language, the written medium isn't language, it is *a parasite that feeds-off language*. Now, we could wonder why that is. Why haven't humans developed writing to be completely separate from spoken language, to be able to take full advantage of both mediums. To such questions, we often give an answer such as "*It's simply more efficient*". In fact, if some characteristics of language still exist today, it's because they have been efficient enough to actually be used, and therefore stay in the language. Other features used less because they were less efficient – maybe some sounds were too difficult to produce, or too lengthy, for example – have disappeared. The same answer can be used for the question of why didn't writing develop as its own language. Ted Chiang explores this in his book called *Story of Your Life*, which portrays an intelligent alien species that has such a writing system. "*For them, speech was a bottleneck because it required that one word follow another sequentially. With writing, on the other hand, every mark on a page was visible simultaneously. Why constrain writing with a glottographic straitjacket, demanding that it be just as sequential as speech? It would never occur to them. Semasiographic writing naturally took advantage of the page's two-dimensionality; instead of doling out morphemes one at a time, it offered an entire page full of them all at once*" (Chiang, 1998).

*Life may not hear.* This one is much trickier. Since language is most often transmitted through sounds, intelligent life that may not be able to use hearing becomes a roadblock to the development of the cosmic language. That said, they might just not hear *us*. By that we mean that their hearing might have a different range in perceived frequencies, like some animals on earth. In that case, if we are to develop a sound-transmitted language, we would need to accommodate it to be perceived on all frequencies, which is a difficult task, since there exists an infinite amount of sound frequencies.

*Life may not count.* Freudenthal's and Ollongren's proposals of a cosmic language were based on the idea of logical operations and mathematical concepts, however these might not be relevant to intelligent life. The Piraha people are a notable example of a civilization that has a language that doesn't have a developed numeric system. The Piraha people can only count up to 2, anything above is "much".

*Life may not be social.* We can assume that life can be capable of thought, but nothing forces thinking beings into developing societal structures. Hypothetically, they could be evolved enough to be

self-sufficient, and live without the need for others of their species. Additionally, since we can't assume anything about their means of reproduction, nothing forces the idea of needing two of a species to make a third. We cannot exclude the possibility for them to do something similar to mitosis, and make new copies of themselves, from themselves. If intelligent life does not exist within societal structures, social concepts that are common to us humans, may not be understood by non-social beings. They might consider our species as another source of food, which one could consider savage and very close to the behaviour of animals, but in reality, a society is not necessary for the development of thought. One can reflect on observations of the world surrounding oneself. One does not need to interact with others to develop thought. Indeed, a species might reach further knowledge by sharing the different thinking of the different members of the thinking species, just like humans have done throughout history. However, not sharing knowledge does mean a lack of intelligence. Therefore, intelligent life could consider feeding off us. It might question that thought, as an intelligent being would, but has no obligation in doing so.

From the beginning, we have been making one secret assumption. We have assumed that there is extraterrestrial life at all. We make this assumption simply from the infinite nature of the universe, which in itself is enough to infer that there is a non-zero probability of life outside Earth to exist, because simply speaking, if we were the only living and thinking beings in this infinite universe, it would be *an awful waste of space*. This is put as the Fermi Paradox, which states that there's a high possibility of encountering intelligent life, yet we still haven't. There are many proposed reasons for why we haven't encountered intelligent life yet, why we haven't detected it in space, and why it hasn't contacted us. One of the hypotheses is that intelligent life receives our signals, knows we exist, but are hiding, by fear of being exterminated by a potentially more advanced civilization. The more common version of this theory, the Dark Forest Hypothesis, considers the possibility of intelligent life being hostile. Therefore, many argue against the attempts to communicate with other intelligent life, because of the potential risks it would pose. Stephen Hawking argues that sending messages to outer space is just signaling our presence, which might not be met kindly, in the same way the Spanish met the North American Natives. In his science fiction novel, *The Forge of God*, Greg Bear explores this hypothesis. "*We've been sitting in our tree chirping like foolish birds for over a century now, wondering why no other birds answered. The galactic skies are full of hawks, that's why. Planetisms that don't know enough to keep quiet, get eaten.*" (Bear, 1987). Another proposal is the Berserker hypothesis, which states that we can't detect any signs of life in the universe because it is systematically destroyed by endlessly replicating structures. A broader equivalent of this is the Great Filter hypothesis, which states that there is something in the essence of life that doesn't allow it to evolve far enough to reach interstellar colonization, and discover or be discovered by other intelligent life. My personal favorite proposal comes from the science fiction novel *The Engines*

*Of God*, by Jack McDevitt, which suggests the idea of planet-sized clouds that annihilate any civilization that has reached a considerable point in its development (McDevitt, 1994). In the novel, an alien civilization builds monuments composed of geometric shapes to lure the clouds away from their planet, which would have structures that are also geometrical. This suggests that there is some force in the galaxy that is attracted to geometric, often cubic, shapes – shapes that would indicate the presence of intelligent life capable of modelling matter in such shapes that don't often occur on large scales. Another personal idea is that intelligent life, at some very high point in the development of its intelligence, realizes how unnatural the idea of having a conscience is, how damaging it can be to the natural random order – as we have seen with our own development, and its consequences on nature – and decides to abandon conscience altogether, for the sake of the natural universe. This leads to the humorous thought that animals might be such beings, that used to be conscious, but were wise enough to abandon it. Afterall, we've heard many stories about animals speaking and thinking, and stories are often derived from something true...

If we push our negation of assumptions a bit too far, we might reach the frightening thought of “*Life (of the intelligent type) may not exist (outside of Earth)*”, thus making the search for an extraterrestrial language, and extraterrestrial life for that matter, pointless. However, it might just be that we are not pushing our vision wide enough.

### **III. The Universe as a Language**

The main goal of Astrolinguistics research is to conceive a language to facilitate potential communication with an otherworldly species. Perhaps we have been limiting ourselves to the vision of language as a mean of communication, and not as a mean of understanding the universe. Afterall, we not only use language to communicate with others. We also use language to explain things to ourselves. Academic research is something that happens on an international scale. Researchers around the world communicate their results in their own language. It can be difficult to advance research if we haven't standardized some aspects of science. In fact, we don't need to look very far to find such standards. Algebra as we know it today, is composed of symbols and notations that facilitate the understanding of natural concepts and are understood by speakers of any language. “*A strong argument for [a mathematical language] may be found in what happens if a book be translated from one language into another, let us say from English into French. If this book is a mathematical textbook or treatise, there will be parts that need not be conveyed into, viz. the mathematical expressions and formulae. If we seek for other examples of texts that are exempt from translation, the result will be meagre.*” (Freudenthal, 1960).

Mathematical relations, and mathematics in general, exist. They are not invented. We are only responsible for inventing ways of communicating mathematical notions in a human way, most often

through writing. Relations exist, and our goal is to find new ones. We aren't discovering "new" concepts or ideas. The concepts exist in the universe, we simply find ways to explain them to ourselves, using language. To simplify relations between numbers, we assign values to constants, to make our equations cleaner and parsimonious. The very fact that we assign placeholder for recurring numbers implies that this number recurs so often and is used so often in so many different situations, that a placeholder was necessary for efficiency of expression. Edward Harrison's book *Cosmology, the science of the universe* has an entire appendix of fundamental quantities. (Harrison, 2000)

Now, let's look at *linguistic creativity*. Language being creative simply means that you can express anything using language. There is an infinite number of thoughts and scenarios that language can describe, even parallel or imaginary worlds, and realistic world scenarios. There is nothing language cannot describe. The kneejerk reaction to that is to say, "*Well, some emotions you cannot express in other languages*". However, as we said before, every thought can be expressed, we just need to use more words to express it in another language. One might say that we lose the *nuance* in the emotion, but since you can create infinitely long sentences, you will eventually be able to express an infinitely specific feeling. You can refine the meaning of what you're expressing, simply by using more words. Language is a tool for communicating with others, transmitting information through words that we have carefully placed in a certain order, forming certain sentences of a certain length. However, the words in each language are limited. The lexicon is indeed vast, but finite. Therefore, we must resort to using the same words, in a different order, or more times, to create new sentences with new meanings.

In physics, we have established some constants, that have fixed values, like Newton's gravitational constant, or the speed of light. We can for example relate the notion of speed of light to concepts completely separate from that of speed, such as mass, or energy, and relate them in parsimonious ways, and even find equivalences between these relations. We arrive at these beautiful, concise equations like  $Energy = mass * speed\ of\ light$ , a relationship between three things that at first glance do not seem related at all, but that when ordered in a certain way carry meaning and define the way the universe functions. The constants and the variables used in one equation are as easily used in many others, concerning many different phenomena, such as mass's relation to force, in  $Force = mass * acceleration$ . These might be the most famous examples, but these constants and variables appear truly everywhere in physics. Some more famous examples involve numbers like pi or phi, that we not only use in our equations in physics, but that we also find in nature on Earth, in the smallest shells, to the petals of flowers. It really doesn't take a long time to start seeing these numbers, these letters representing numbers, appear everywhere around us or within physics, from the gravitational fields of massive objects and how they affect light, to the simple movements of small objects on Earth.

With this, we can argue that finding special and unique relationships between words to make complex and understandable sentences carrying meaning is the same as using different constants, units, and expressions to create different and unique equations that carry the meaning of the universe. These "words" are being used in various "sentences" to express different meanings. Mathematics is not the language that speaks of the universe, it is the meaning spoken by the universe itself. Written mathematics are a way for humans to express and explain the meaning of the universe to themselves and others, using a standardized communication system. Furthermore, mathematics is riddled with equivalences of equations, where one way of writing an equation using division, can be equivalent to the other way of writing it, this time using multiplication. This might seem obvious, but we do the same thing in language, where we move words around, and still conserve the meaning of the sentence. Mathematics simply might be more parsimonious, in the sense that there is no implied meaning that changes with word order as it would in natural languages like English. Mathematically (or logically) "I want to go to the party" is equivalent to "I do not *not* want to go to the party". In English however, these two sentences have completely different meanings that are *implied*.

Another interesting thought is dark matter. We don't know what dark matter is. We know it's there, but we don't know what its essence is. Perhaps all that we need is to reshape our way of thinking, or our way of speaking of the universe. We once considered the electron as simply a particle. When we were suddenly faced with the strange behaviour of the electron, we had to rethink its definition, we had to find a new way of thinking of the electron. Perhaps uncovering the mystery that is dark matter requires a similar kind of redefining, a similar reshaping of our way of thinking matter, and perhaps the universe as a whole. Examples of this changing of our way of thinking about physics are many, and they have always been considered as revolutions in physics. Furthermore, the goal of physics, and research in general, is to develop theories as parsimonious as possible. This means finding the simplest way to explain something, and in physics' case, the universe. This can also be done by combining multiple concepts together, simplifying through union of existing theories. This has been the end goal of physics, discovering a Theory of Everything. A single theory to unite all of physics, and to explain the entire universe. And perhaps, to reach this one, ultimately parsimonious theory, we must not only unite physics, but unite all domains of research – including language.

*So, does the universe speak?* To say "yes" would be an awful simplification and personification. However, it might be interesting to think of what that entails. In some way, we could think of the universe speaking a single, infinitely expanding sentence that carries all meaning. We can think of the expansion of the universe as the sentence being continuously expanded upon, with more words being added to it, growing infinitely because there is an infinite combination of words that we can align to refine the



meaning. If we believe that the universe will eventually deflate and crunch back to a singularity, we can also think of that as the sentence ending, the universe completing its utterance, having said all.

*But why would it speak?* The question of the purpose of the universe carrying all of meaning, is questioning the purpose of everything existing. We aren't asking "why are things the way they are", we are asking "why *are* things". Perhaps it is fundamentally wrong to think of the universe as existing with a purpose, because that would relate it to the human concept of purpose, and it would be personifying the universe. Humans have done this before, most notably in religion. The existence of a Creator is the main theory against the scientific understanding of the cosmogenesis, the beginning of the universe. If we look at the various myths of creation, most of them involve a Creator being. In arguably the most popular myth of creation, the Bible, we still find a correlation between language and the universe. "*And God said, 'Let there be light,' and there was light. [...] And God said, 'Let there be an expanse in the midst of the waters, and let it separate the waters from the waters.'* *And God made the expanse and separated the waters that were under the expanse from the waters that were above the expanse. And it was so. And God called the expanse Heaven.*". We see a direct link between what God says, and what is created. Not only that, but God also *names* the Heavens. He attributes a distinct way of referencing the expanse. There is power in the word, and there is power in naming. "*In the beginning was the Word, and the Word was with God, and the Word was God. He was in the beginning with God. All things were made through him, and without him was not any thing made that was made*". Here, language is directly personified, perhaps even as a separate entity, existing with God during creation. Like an artist, God creates, but some of the biggest artists will tell you that they don't create with a specific purpose in mind. They create for the sake of creating, because if we were to consider the other option, not creating, then nothing would be created, and nothing would be. Perhaps the universe *is*, simply for the sake of *being*.

## **Conclusion**

Throughout this essay, we have discussed the importance of language, and how it defines us. This led us to look at examples of languages that have the potential of being used in the universe by hypothesized intelligent life. We then discussed the caveats of developing such a language, we challenged the need for one, and more fundamentally, explored why we haven't encountered other intelligent lifeforms. In the final part of this essay, we flipped the tables, and instead of thinking of a language to use in the universe, we hypothesized the idea that the universe is itself a language, that we are constantly finding ways to express in written form through mathematics. We made parallels with the portrayal of language in religious scriptures, and how it related to our theories of cosmogenesis. Finally, we discussed the purpose of such a language-universe existing.

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