

The Question of Extraterrestrial Life and its Artificial Intelligence

'Suppose we find, on Mars, a robot explorer from another world. How might we decide whether it is using an artificial intelligence constructed by the inhabitants of that other world, or if it is one of the inhabitants? How would you treat the object while that uncertainty remains?'

Although the explorer is from another world, we can still deduce its intelligence, purpose and perhaps origin through its actions, responses, and design.

But what is intelligence? Intelligence is the 'aggregate or global capacity of the individual to act purposefully, to think rationally, and to deal effectively with his environment' (Wechsler, 1944). In other words, it's a being's ability to both comprehend new ideas independently and learn from previous attempts. But where this intelligence stems from is the main objective of this essay: was it an evolutionary result or designed from scratch?

Another area we have to consider with our explorer is whether it can experience consciousness. Because if it does, it goes against our ethical codes to harm it. With that being said, would our ethical reasons even apply to intelligent organisms from other worlds?

In order to understand anything about our explorer, we need first to understand its nature. That is to say, we first have to classify it into one of three groups:

1. AI: Intelligence is designed, and experiences no consciousness
 2. A post-biological organism: The augmentation of non-biological components into its body, which may affect its decision making and mental capacity, but preserves the experience of consciousness.
 3. Biological organism: Intelligence is a result of evolution, and experiences consciousness.
- Likewise, if it's an AI, it can fit into another one of three categories: narrow (ANI); general (AGI) and super (ASI) due to its intelligence in comparison to that of a human's.

For the sake of this essay, three assumptions are made to decrease uncertainty:

Assumption 1: Communication, even at a basic level, is possible with the explorer.

Of course, if it's not, any attempt of learning anything from the explorer, apart from literal disassembly, is futile. With the atmosphere of Mars being 100 times thinner than Earth's (Sharp, 2017), sonic communication is essentially out of the question. Therefore, communication via electromagnetic light is most viable.

Assumption 2: We are able to temporarily contain the explorer in a controllable environment. (Eden & Moor, 2012)

Given it poses no immediate threat and we can approach it, we should be able to seal the explorer away from external influencers and interference. Which leads onto the next assumption:

Assumption 3: It's not a machine that is actively controlled by another intelligence.

In other words, the explorer's responses and decisions are independent of other organisms. Take our Opportunity Space Rover on Mars, for instance. To outsiders it may seem intelligent, however, it's the scientists here on Earth that is actively controlling its actions. How do we distinguish which decisions

are from an organism or machine? To eliminate the possibility, all electromagnetic communications are sealed off. It can be argued, however, that it can use quantum means of communication, for which we cannot prevent.

Artificial Intelligence

Artificial Intelligence (AI), is, as quoted by Merriam-Webster: 'the capability of a machine to imitate intelligent human behavior.' (Marr, 2018). However, this definition is vague, especially since it's mimicking an unknown alien intelligence instead of a human's. Comparing the intelligence to a human's, separating into 3 categories:

ANI: Below the capacity of a human

ANIs specialize in one performing a specific, narrow task. They can process many functions and outperform their human counterparts in their area, but are limited 'to a narrow range of parameters and contexts'. (Tweedie, 2017). At this point, there is no real 'intelligence' involved, simply repeating predetermined responses to human choices. All AI developed here on Earth are ANI.

Notably, ANI lack the ability to perform tasks outside of its predetermined decisions. Without independent thinking and logical thought processes, it lacks diversity in thinking.

Take Siri, an example right here on earth. Siri, despite being a sophisticated software, is only limited to its predefined functions, and it cannot perform any request beyond these parameters.

From here on out, we would design a test that determines the breadth of the explorer's understanding. Perhaps a robot designed solely to analyze soil content won't understand the ethical concerns over its actions. Perhaps it doesn't recognize us as an input, and not respond to us at all.

Does this explorer self-aware, and recognizes itself as an intelligent being?

It's important to see if the explorer identifies as an ANI, as it, with such a narrow field of thought, is very unlikely to experience conciseness, as consciousness itself is subjective awareness of surroundings and being part of a larger system. (Edward N. Zalta, 2014). Its intelligence is clearly designed and it in itself won't be conscious.

Machine Learning: Savant AI

Another area to cover on ANI, or in fact all AI, is independent learning. Just because it can't answer our questions now, doesn't mean it can't when asked again.

On the 11th of December, 2017, Alpha Go Master, a system that plays the Chinese game Go (Association, 2017) was created by Deep Mind. With no prior knowledge, experience and only inputted with the basic rules, it played against itself continuously, having started with 'completely random play'. By the process of an area of machine learning called reinforcement learning and storing the outcomes of each action in a modular neural network, it utilizes a 'powerful search algorithm' 'to predict moves'. (DeepMind, 2017). With each iteration of the game, the software's performance improves.

And this is where we reach the border between determining if the intelligence is designed or evolved. Because machines like AlphaGo Master have started by playing randomly, their strategies were completely new and unconventional, perhaps even alien, according to the human players. Perhaps if

we play two independently evolved AlphaGo Masters together, their techniques may be unfathomable to *each other*.

Machine learning works by using modular networks, similar to those in the brain, to separate the problem into smaller subtasks, solve them independently, and assigns a bias or weight to each subtask via a gradient descent function. (Bart L.M.Happel, 1994) (Fig.1) (Fig.2)

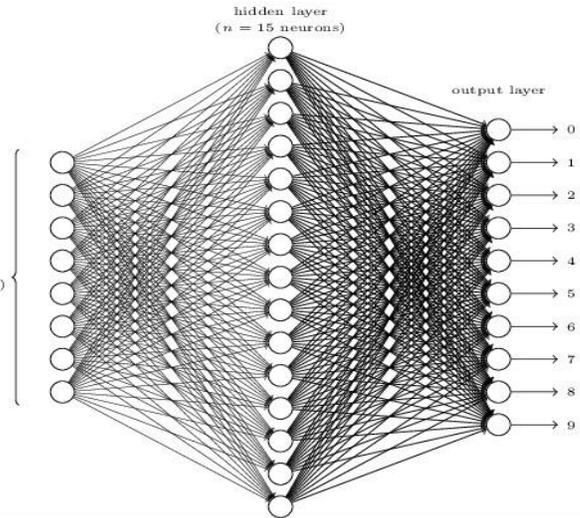
But because it's based on error minimization (the gradient function), it leads to the AI having very restrictive parameters in terms of choice and independent thought. So, although the machine can evolve, it *is* still a designed intelligence.

AGI and ASI: Superintelligence

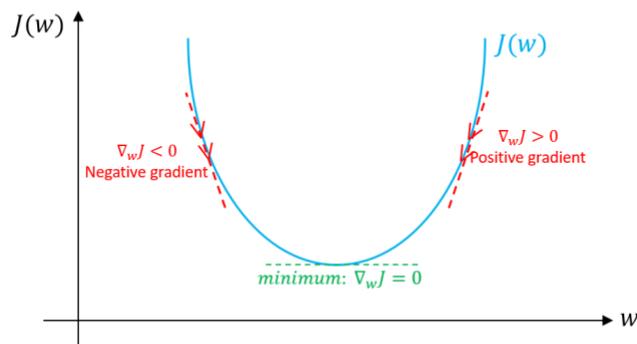
Supposedly, our alien civilization has passed the 'technological singularity', the point at which they have created AGI and ASI, machines far more intelligent than themselves (and presumably us), who has undergone a "runaway reaction" of self-improvement cycles. (Eden & Moor, 2012) , a stage in a civilization's development theorized by Amnon H Eden in 2012. This is the point at which our technological knowledge is most likely been surpassed by the alien civilization, and at the point, we start considering if it has the potential to have consciousness.

We have theories on technologies that create AGIs, like using quantum computation for larger computing power, but we never created an AGI.

AGIs and ASIs are AIs that can surpass a human in all fields: whether in cognitive ability, problem-solving and perhaps interpersonal relationships. The AI will be an imitation of life, but as it stands,



(Fig. 1) Topology of modular neural networks (Nielsen, 2018)



(Fig.2) The gradient descent function is a search algorithm designed to search for the lowest possible cost under it's given parameters (Dabbura, 2017)

there is no way for us, as beings who are less intelligent than it, to know. Perhaps it has a motive to imitate consciousness to us, maybe it has learned from encounters from our civilizations its visited the idea of consciousness, or seek to experience themselves?

So really, it's the explorer's choice on whether or not it chooses to identify as being conscious. No one knows why we experience consciousness, it's an experience that is self-orientated and it may

or may not be universal across all intelligent beings. Apart from containing organic matter, there is no difference from living being and machine from our point of view, since the AI surpasses us in all areas, maybe even in self-awareness.

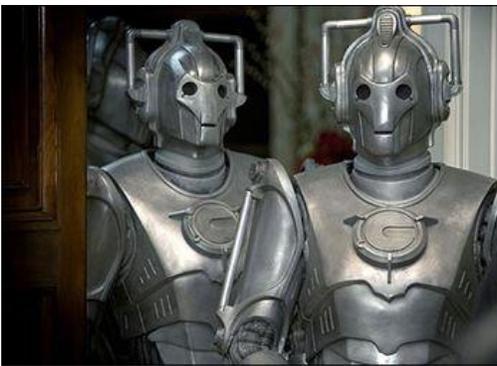
Inhabitants: Post Biological and Biological Beings

Post-biological organisms

Post-biological organisms are those who have permanently augmented their biology with technology. A famous example in media are Cybermen from Doctor Who (Fig.3)

'Once a society creates the technology that could put them in touch with the cosmos, they are only a few hundred years away from changing their own paradigm from biology to AI.' said Susan Schneider of the University of Connecticut, (Minds, 2019). So, since the period of time, until the civilization alters its own biology is so small, there is a high probability the explorer we meet is post biological.

Having this upgrade has many benefits, like prolonged life and greater cognitive function, but also blurs the lines between machine and the living. If their brain is augmented, which decisions are of a machine, and which are of a living organism? Perhaps they have a machine's processing power, but still, maintain an idea of ethics and consciousness. Maybe they've upgraded to the point that there is



(Fig.3): Cybermen from BBC's Dr. Who

virtually nothing organic about them, to the point that it seems more fit to classify it as a machine?

Again, it depends on the level of the machine over organic, but it's possible for an explorer that seems machine in intelligence, but conscious in thinking.

Biological organisms

And perhaps, if all else is eliminated, we can conclude it's a biological being that is self-aware, able to learn independently and has basic intelligence.

The main defining feature of a biological organism is its physical form: it's organic matter. It could be carbon-based like on Earth, but there's a high possibility that it may be

silicon-based. Silicon is an 'easier medium for information processing' (Minds, 2019) which can evolve to have higher computing power like those of a machine, and will be more robust in extreme environments.

Approach to the explorer

Of course, if the explorer turns out to be conscious, we would refrain from harming it to abide by our ethical codes. If it were a machine, with no concept or awareness of what's happening around it, there should be no harm in satiating our curiosity with further research and analysis.

But would alien life forms even understand our ethical concerns? For example, perhaps the explorer is impartial to disassembly if it had no fear of death? Would it mind being isolated, if it had no concept

of freedom? Perhaps it has a whole new ethical code it abides by, one determined by serendipity, like the unique strategies stemming from random play from the AlphaGo Master?

The Fermi Paradox and the Advancement of the Alien Civilization

The idea on whether or not we could ever encounter an AI alien explorer is put into question by the Fermi Paradox, developed by physicists Enrico Fermi (1901–1954) and Michael H. Hart (born 1932). The paradox is a simple one of the contradiction between high probability and lack of evidence: if so many planets can harbor life, why haven't we encountered any? (Krauthammer, 2011). One solution put forth is the idea of great filters, great developmental breakthroughs that civilizations have to get through, for example, the Industrial Revolution. Perhaps the technological singularity, at which AGIs and ASIs are created, was the last barrier the explorer's creators manage to get through. Maybe that civilization managed to destroy itself, but its creations have lived.

This leaves a note of caution for the future of our AI, or perhaps the breakthrough leaves tremendous benefits, of which the explorer's civilization has experienced. According to the Kardashev Scale (Kardashev, 1985), a scale based on the level of energy the civilization has access to, which was put forward by Nikolai Kardashev, suggests a civilization is most likely Type 2 to be able to build an AGI and ASI. A Type 1 civilization has access to all energy of its home planet; Type 2 able to harness all energy of its planet star, and Type 3 energy of its planet galaxy. We are now currently approaching Type 1 as a civilization.

A Type 2 civilization would have access to enough energy to build grand megastructures: like the Dyson sphere, which surrounds a star and harnesses all its energy (Dyson, June 3); the Matrioshka brain, a star-sized computer powered on several Dyson Spheres, with essentially unlimited computing capacity (Bradbury, 2004); and perhaps Von Neumann probes, self-replicating machines mimicking our biology.

Conclusion

All things considered, it seems reasonable to conclude that our findings could unlock our own developmental and technological progress, and it may lead to our civilization advancing faster than before.

But above all, it *is* important to remember that finding an alien explorer will be proof that, as a civilization, we are not alone. Finding that other explorer could be finding another civilization, so it's pertinent that we treat it ethically. We might discover they think like and feel like we do, or we might find that we're different from the roots up, like two separately evolved strategies in an AlphaGo-Master's game of chance.

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