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A PHILOSOPHY OF FIRST CONTACT: STANISŁAW LEM AND THE MYTH OF COGNITIVE UNIVERSALITY

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Abstract: Within science fiction the topic of ‘first contact’ is a popular theme. How will an encounter with aliens unfold? Will we succeed in communicating with them? Although such questions are present in the background of many science fiction novels, they are not always explicitly dealt with and even if so, often in a poor way. In this article, I will introduce a typology of five dominant types of solutions to the problem of first contact in science fiction works. The first four solutions are the more dominant, but also the least interesting ones. There is a fifth category that addresses the question of first contact in a more interesting way, exemplified by the work of Stanisław Lem. This fifth option defines itself as a critique of the four previous categories, or of their shared assumption of what Lem (1967) has called ‘the myth of cognitive universality’. Lem is sceptical of the common optimism that first contact will always be successful. In books such as *Solaris* (1961), *His Master’s Voice* (1967) and *Fiasco* (1986), humanity makes first contact with an alien phenomenon, but fails to comprehend the phenomenon. Fundamentally, it will be argued that Lem’s work shows that in such an encounter we will typically not only lack the right answers to our questions, but that we also often lack the correct questions: we simply do not have the right categories or instruments to even recognize, let alone meaningfully interrogate, the alien phenomenon. The article ends with an exploration of the implications of Lem’s pessimism and whether it is the most plausible option for first contact. Moreover, the article will draw some lessons for philosophy of science, by exploring the parallel with the confrontation of novel or deviant phenomena in science. Lem’s work is helpful here because it succeeds in articulating what has not always been appreciated in the philosophy of science, namely that the right questions by which to interrogate scientific phenomena are not given, but that their articulation always requires work.

Keywords: Stanisław Lem; first contact; scientific discovery

For if Aphrodite exists, and if she has the properties and idiosyncracies ascribed to her, then she certainly will not sit still for something as silly and demeaning as a test of reproducible effects (shy birds, people who are easily bored, and undercover agents behave in a similar way). (Feyerabend 1989, 389)

Introduction

In *The Hitchhiker’s Guide to the Galaxy*, Douglas Adams recounts the story of Deep Thought. Deep Thought is a computer, built over millions of years to answer the Question of Life, the Universe and Everything. When, after millions of years, Deep Thought is done calculating, with a certain pride he finally gives them the answer: Forty-two. After a long and

uncomfortable silence one of the scientists finally responds. “‘Forty-two!’ he yells, ‘Is that all you’ve got to show for seven and a half million years’ work?’ ‘I checked it very thoroughly,’ replies the computer, ‘and that quite definitely is the answer. I think the problem, to be quite honest with you, is that you’ve never actually known what the question is’” (Adams 2003, 152). As a result, the scientists went back to building an even bigger computer in order to find, this time, the right question to which forty-two seems to be the answer.

In addition to *answer machines* there exist *question machines*: machines that allow to grasp what questions to ask. The crucial role of question machines has been a central topic in many science fiction stories, especially those concerned with the topic of ‘first contact’: what will our first confrontation with an alien phenomenon look like? But the topic of ‘first contact’ is not just a concern for science fiction. Anthropology too faces the question of ‘first contact’ between different cultures; and science, on its turn, is faced with a ‘first contact’ with novel phenomena which no scientist has encountered before. The problem of ‘first contact’ is thus multi-layered.

A first cluster of questions concerns the *theme of dominance*: in what way does first contact lead to one group dominating or destroying the other? Think of H.G. Wells’ *War of the Worlds* (1898) or James Cameron’s *Avatar* (2009). First contact provokes questions about colonialism and racism (e.g., Langer 2011). Connected to this, there are questions concerning the ethics of first contact (e.g., Kupperman 1991): how should we behave in first contact situations? Though interesting questions, these are not the main concern here.

Secondly, there is the *theme of self-reflection*: first contact with an alien phenomenon often serves as a mirror for ourselves (e.g., Malmgren 1993). As the anthropologist Loren Eiseley expressed it:

In the modern literature on space travel I have read about cabbage men and bird men; I have investigated the loves of the lizard men and the tree men, but in each case I have labored under no illusion. I have been reading about a man, *Homo sapiens* (Eiseley 1957, 194)

A confrontation with an alien is a confrontation with ourselves, only situated in an unfamiliar setting. Either to make us more aware of what we take for granted or, more pessimistically, to delude ourselves into thinking that speculations about aliens will show us anything but ourselves. This is a theme we will find in the work of Stanisław Lem. Science fiction does not necessarily tell humans a lot about the world out there, but rather projects “their fears and self-generated delusions on the universe” (Lem 1984, 247). A variation of this theme is the literature on doppelgangers and shapeshifting. Either first contact has already happened, but we did not notice, as in Jack Finney’s *The Body Snatchers* (1955); or we ourselves are in fact not human, but are unaware of this, as in Philip K. Dick’s *Do Androids Dream of Electric Sheep?* (1969). Again, our focus will be different.

Central here is the *epistemological question* of what it would mean to be confronted with a radically alien entity: Will we succeed in communicating with such an entity? Although this question is at work in many science-fiction novels, it is often not explicitly dealt with or in a poor way. In the next section, I will therefore introduce a typology of solutions to the problem of first contact in science fiction. The first four solutions are dominant, but the least interesting ones. There is a fifth category that addresses the question in a more interesting way, exemplified by the work of Stanisław Lem.

As we will explore in the third section, this option defines itself as a critique of the four previous categories, or of their shared assumption of what Lem (1999) called ‘the myth of cognitive universality’. Lem is skeptical of the common optimism that first contact will be successful. It will be argued that Lem’s work shows that in such an encounter we will not only lack the right *answers* to our questions, but also the correct *questions*: we simply do not have the right

instruments to even recognize the alien phenomenon. We will explore the implications of Lem's pessimism and whether it is the most plausible option for first contact. In the final section, the article will draw some lessons for philosophy of science. Lem's work is helpful here because it succeeds in articulating what has not always been appreciated in the philosophy of science, namely that the right questions by which to interrogate scientific phenomena are often not given, but require the construction of question machines. This is what I will call the work of articulation.

A typology of first contact

The first two types of solution to the problem of first contact are in fact non-solutions. The first solution can be called the assumption of *direct understanding*. Within this first category of novels alien species are introduced, but there never is a real issue in understanding them. They miraculously speak our own languages (often English) or give us fast and unexplained technofixes of why such communication is possible. An example is Arthur C. Clarke's *Childhood's End* (1953), dealing with a benign alien invasion by the Overlords who impose a global peace regime on Earth. These aliens are immediately able to communicate in English. The problem of communication is never raised. Similarly, in *The Hitchhiker's Guide*, numerous alien species are introduced, but humans are able to communicate with them simply by putting a so-called 'babel fish' in their ear that feeds on the brainwave energy of those around them. Thereby "you can instantly understand anything said to you in any form of language" (Adams 2003, 51).

The second solution is a similar non-solution. It can be summarized under the banner of *kill it before it breeds*. This group skips the problem of communication by shooting before asking questions. Think of H. G. Wells' *War of the Worlds* (1898), where Martians attack Earth and are subsequently eradicated before the question of communication was even raised. Similar examples are *Starship Troopers* (1959) by Robert A. Heinlein, *The Forever War* (1974) by Joe Haldeman, and *Ender's Game* (1985) by Orson Scott Card. At best, the question of communication is raised at the end under the banner of guilt: perhaps we should have tried to understand the aliens before we blindly started shooting at them. In *Ender's Game* the last surviving Hive Queen confesses to Ender that their initial attack was a mistake, because they did not recognize humans as intelligent beings: "We did not mean to murder, and when we understood, we never came again" (Card 1985, 353). A similar conclusion is drawn in *The Forever War*: "The 1143-year-long war had been begun on false pretenses and only because the two races were unable to communicate. Once they could talk, the first question was 'Why did you start this thing?' and the answer was 'Me?'" (Haldeman 2006, 228). What such a communication would look like, however, is hardly ever explored.

The third and fourth categories are more promising, but remain equally unsatisfying. But they at least explicitly address the issue. The third solution relies on the assumption of *mathematical universality*. Good examples are Carl Sagan's *Contact* (1985) and Jack McDevitt's *The Hercules Text* (1986). Both novels center around SETI scientists receiving messages of extraterrestrial origin. But the subsequent problem of how to understand these messages is solved by means of mathematics. In the case of *Contact*, for example, the extraterrestrial message is sent in the form of prime numbers, recognized as such by humans and further decoded as an elaborate plan to build a specific machine. Through this machine they are able to communicate with these aliens, having no problem in understanding them (since they suddenly speak English) nor in grasping their intentions. Sagan has been very explicit about this optimism in other texts: "Science is the Greek of the interstellar Rosetta Stone" (Sagan 1975, 21).

An even more telling example is Camille Flammarion's *La fin du monde* (1894). In this book humanity receives a 'telephotogram' from Mars, telling them to 'Get out of Italy' since a comet

will crash at the Vatican. As Lorraine Daston and Peter Galison already note “little scepticism arises regarding the existence of Martians or their ability to communicate ideas intelligible to humans,” and rather tellingly the only “debate ensues as to whether they really know Italy by name” (Daston and Galison 2007, 298). General communication is not deemed problematic, since it is assumed that all species share the language of mathematics. Only a cultural particular such as ‘Italy’ is object of debate, since one cannot deduce the name Italy from any mathematical principle. This also shows the limit of such an approach: it assumes that mathematics is enough. But, as ethnographical studies on encounters with other cultures tell us, there is quite a gap between prime numbers and daily conversations.

The fourth solution is similar to the third, but the assumption is that of a *mystical-mental unity*. It solves the problem of first contact by assuming that some humans will have a mental, intuitive or even mystical connection with the alien species. Examples are Robert A. Heinlein’s *Stranger in a Strange Land* (1961) or Arthur C. Clarke’s *2001: A Space Odyssey* (1968). Or take *Nemesis* (1989) by Isaac Asimov, which tells the story of the encounter of humanity with a strange, living planet called Erythro. Although the beginning of an interesting story raising the question of how to communicate meaningfully with a radically alien being, it skips this question by somehow allowing the planet to communicate with and through the daughter of the protagonist by means of telepathy. Similarly, in Christopher Hinz’ *Anachronisms* (1988) humanity discovers a type of humans, called Psionics, who have enhanced psychic capabilities. One effect of these capabilities is the capacity to detect and speak to alien life forms:

The use of Psionics aboard exploratory voyages had become common about twenty years ago. At that time, one of the gifted humans had *experienced* the primitive emotional patterns of a spindly-legged creature found on the planet Nickalon 2. That telepathic contact had opened the doors of scientific inquiry into that creature’s theretofore mystifying behaviour. Since then, the consortiums had been scouting Earth and the settled planets, searching for those rare humans possessing strong extrasensory abilities. (Hinz 1988, 22)

It seems to be a trope that these mental connections are made by socially or psychologically deviant individuals, often women. In the case of Hinz, this is stated quite explicitly: “Research findings indicate that most of these Renaissance Psionics, who are powerful in all three telepathic categories, are sexually repressed. Mars Lea certainly fits that scenario – I don’t believe she’s had sex with anyone on the Alchemon.” (Hinz 1988, 75) One could also think of Kurt Vonnegut’s *Slaughterhouse-Five* (1969), where the protagonist seems to grasp the minds of the aliens simply because he himself is suffering from post-traumatic stress. Though it might work as a (problematic) literary device, it does not really help us to think about what a genuine first contact will look like.

The Myth of Cognitive Universality

These four solutions are dominant in science fiction, but not pervasive. There is a fifth category that addresses the question of first contact in a more interesting way. In many respects, it defines itself as a critique of the four previous categories, or of their shared assumption of what Stanisław Lem has called ‘the myth of cognitive universality’. Stanisław Lem’s own work is indeed the best embodiment of this fifth and critical perspective.

First Contact Fatalism

In many of his works Stanisław Lem is skeptical of the optimism that first contact will always be so successful. In *His Master’s Voice*, Lem portrays a different picture than the one preferred in books such as *Contact*, although it shares many of their plotlines. Once again, humanity receives a message from outer space, but this time humans radically fail to comprehend

the message. Even the question of whether there really was a message in the first place remains unclear:

The myth of our cognitive universality, of our readiness to receive and comprehend information absolutely new – absolutely, since extraterrestrial – continues unimpaired, even though, receiving the message from the stars, we did with it no more than a savage who, warming himself by a fire of burning books, the writings of the wisest men, believes that he has drawn tremendous benefit from his find! (Lem 1999, 26–27)

Deciphering the message thus radically fails, “because the object it designated simply did not figure in the categories of our conceptualizations. It was the plan of a cathedral sent to australopithecines, a library opened to Neanderthals.” (Lem 1999, 93)

This critique is a recurrent theme in Lem’s work. In *Fiasco* (1986) Lem tells the story of an expedition’s attempt to make first contact. When they arrive at the aliens’ planet, many attempts to communicate are made, including the implosion of their moon and projecting giant messages in the clouds. The aliens, however, refuse to answer or do so in a hostile manner. At the end, a human ambassador is allowed to the surface, under the guarantee that if he does not report back in time, they will bomb the surface. The ambassador does not encounter any alien life form, except a form of termite-hill like structures. Eventually he realizes that these mounds are the intelligent alien lifeforms they have been communicating with, but also that he has lost track of time. In the meantime, the deadline has passed and, before he can report his findings back to the job, the surface is bombed and the alien civilization obliterated.

But Lem’s most famous example is *Solaris*. Similar to Asimov’s *Nemesis*, humanity makes first contact with an ocean-like planet that somehow seems to be alive. But this time they don’t have a mystic daughter to make communication easy, and instead have to rely on good old science. As a result, the attempts to establish contact turn out to be a radical failure:

The first attempts at contact were by means of a specially designed electronic apparatus. The ocean itself took an active part in these operations by remodeling the instruments. All this, however, remained somewhat obscure. What exactly did the ocean’s ‘participation’ consist of? It modified certain elements in the submerged instruments, as a result of which the normal discharge frequency was completely disrupted and the recording instruments registered a profusion of signals – fragmentary indications of some outlandish activity, which in fact defeated all attempts at analysis. Did these data point to a momentary condition of stimulation, or to regular impulses correlated with the gigantic structures which the ocean was in the process of creating elsewhere, at the antipodes of the region under investigation? Had the electronic apparatus recorded the cryptic manifestation of the ocean’s ancient secrets? Had it revealed its innermost workings to us? Who could tell? No two reactions to the stimuli were the same. Sometimes the instruments almost exploded under the violence of the impulses, sometimes there was total silence; it was impossible to obtain a repetition of any previously observed phenomenon. (Lem 2016, 21)

This leads to the creation of an ever-growing, but chaotic, discipline of ‘solaristics’ which did not succeed in coming up with “a single indisputable conclusion”. The end result was a situation where the “sum total of known facts was strictly negative” (Lem 2016, 23). Humans simply failed to construct the right tools and concepts in order to start asking the right questions to Solaris.

Though Lem is the clearest example of this pessimistic take on first contact, he is not the only one. *Solaris* is probably better known from the cinematic adaptation by Andrei Tarkovsky in 1972. Tarkovsky made a similar attempt with *Stalker* in 1979, based on the novel *Roadside Picnic* by Arkady and Boris Strugatsky, which has a similar skeptical message, where first contact ends in a radical failure. This time aliens visited Earth, but left before we even realized it. However, they contaminated a certain part on Earth, called the ‘Zone’, with their alien artifacts

that defy all physical laws. The book deals with a group of people, called stalkers, who go into the Zone to collect these strange artifacts and sell them on black markets.

When the question is raised of *why* the aliens visited us, one of the scientists suggests the image of a roadside picnic:

Picture a forest, a country road, a meadow. A car drives off the country road into the meadow, a group of young people get out of the car carrying bottles, baskets of food, transistor radios, and cameras. They light fires, pitch tents, turn on the music. In the morning they leave. The animals, birds, and insects that watched in horror through the long night creep out from their hiding places. And what do they see? Gas and oil spilled on the grass. Old spark plugs and old filters strewn around. Rags, burnt-out bulbs, and a monkey wrench left behind. Oil slicks on the pond. And of course, the usual mess – apple cores, candy wrappers, charred remains of the campfire, cans, bottles, somebody's handkerchief, somebody's penknife, torn newspapers, coins, faded flowers picked in another meadow. (Strugatsky and Strugatsky 2012, 88)

First contact ends once again in failure. Not only is no meaningful framework found by which to make sense of these alien artifacts, but these aliens seemed to lack any interest in us whatsoever. Again, the Strugatsky brothers show us the amount of work required to make a meaningful interaction between humanity and an alien phenomenon possible. Indeed, it is rather silly to assume that such conditions are self-evident.

A final example is the *Southern Reach* trilogy by Jeff VanderMeer. Similar to *Roadside Picnic*, an alien visitation has left a part on Earth – called Area X – contaminated. The first book *Annihilation* consists of the journal of a biologist, who participates in an expedition through this Area X. Again, the central message is one of the failure to make any sense of these alien phenomena whatsoever. For instance, in the final confrontation with an alien being, hidden in the 'topographical anomaly' in the zone, the protagonist records how

This moment, which I might have been waiting for my entire life all unknowing – this moment of an encounter with the most beautiful, the most terrible thing I might ever experience – was beyond me. What inadequate recording equipment I had brought with me and what an inadequate name I had chosen for it – the Crawler. Time elongated, was nothing but fuel for the words this thing had created on the wall for who knew how many years for who knew what purpose. (VanderMeer 2014a, 178)

The books of VanderMeer offer no answers, nor do they aim to. Rather the diary of the biologist ends with the acknowledgment that "I am aware that all of this speculation is incomplete, inexact, inaccurate, useless. If I don't have real answers, it is because we still don't know what questions to ask. Our instruments are useless, our methodology broken, our motivations selfish" (VanderMeer 2014a, 192–193).

The second book, *Authority*, tells how the authorities deal with Area X and their failure to make sense of it. It offers more context, but no answers. Since then, the authorities have sent in numerous expeditions, aiming to establish some form of contact and understanding, without any success. What we get is a fundamental inability to find the right framework by which humans could address these alien phenomena:

How do you know if something is out of the ordinary when you don't know if your instruments would register the progressions? Laser, gravitational-wave detectors, X-rays. Nothing useful there. [...] We don't even understand how every organism on our planet works. Haven't even identified them all yet. What if we just don't have the language for it? (VanderMeer 2014b, 117)

Between fatalism and optimism

The works of Lem suggest a picture of first contact as radical failure. Seen this way, it is not a matter of not finding the right answers (Who are they? Where do they come from?), but of missing the right questions to ask in the first place. But what conclusions should we draw from this? In fact, there are at least three possible conclusions, of which Lem is embodying merely one.

The fatalistic conclusion that Lem suggests, is that of the fundamental impossibility that we will ever find the right questions to ask: first contact is doomed to fail. One could think of this option as the science fiction equivalent of the philosophy of alterity found in the work of Emmanuel Levinas or Jean-François Lyotard. They stress that the Other is ultimately irreducible to the self, and any such attempts will end in a form of violence. This is the main message of Lyotard's notion of the 'differend': "a case of conflict, between (at least) two parties, that cannot be equitably resolved from lack of a rule of judgment applicable to both arguments." (Lyotard 1988, xi) There simply is no common framework given that can do justice to both parties. Many of Lem's books, such as *Fiasco*, suggest a similar theme. There is no common frame of reference and the alien phenomenon presents itself as the radical Other, often leaving open the question whether the alien phenomenon even exists. In many cases humanity eventually tries to force communication through violent means. These attempts fail and end up killing the humans or aliens involved.

But other conclusions are possible as well. A second conclusion is found in Adam Roberts' *The Thing Itself* (2015). Roberts provocatively confronts the work of Immanuel Kant and the Fermi Paradox, referring to the apparent contradiction between the high probability estimates of the existence of alien life forms and the lack of evidence thereof. Already in the first pages, one of the protagonists puts his hand confidently on Kant's *Critique of Pure Reason* and states: "The solution to the Fermi Paradox? It's all in here" (Roberts 2015, 3).

The starting point of the novel is thus quite simple: if we start from Kant's insight that our perception of the world is structured according to time and space and the categories of our understanding, this also has its repercussions for our ability to detect alien life forms:

We look out and we see no aliens, and are surprised. But the real surprise would be to see aliens in such a vista, because that would mean that aliens are in our structures of thought. Surely there *are* aliens. Of course there are! But they don't live in our minds. They live in the Ding an sich. (Roberts 2015, 21–22)

The novel subsequently follows an Institute that aims to solve this problem by developing an AI that is able to go beyond our categories. "'We can't step outside our way of perceiving the universe,' I said. 'But computers can'" (Roberts 2015, 91). But an ambiguity remains concerning what this 'stepping out' entails. A first interpretation is a form of optimism that concludes that we should get rid of any category whatsoever to reach the original plurality of the *Ding an sich*. This optimism is found in *The Embedding* (1973) by Ian Watson. The book deals with an anthropologist studying an Amazonian tribe which, while using a specific drug, can speak a language with unusual properties (mainly linked to unlimited center-embedding of sentences) and a first contact story with an alien civilization. The communication with these aliens is easily solved in the novel, by simply sending them tapes of English. But the reason why these aliens are visiting us is what matters: they travel around the universe to collect different languages, and they visit Earth mainly for this strange Amazonian drug-induced language. The reason why they collect languages brings us to the issue of the *Ding an sich*, as the aliens try to explain: "'Their-reality', 'Our-Reality', 'Your-Reality' - the mind's concepts of reality based on the

environment it has evolved in – all are slightly different. Yet all are a part of ‘This-Reality’ – the overall totality of the present universe” (Watson 1973, 137). The reason they trade in these viewpoints is to ultimately go beyond these points of view and reconstruct the common underlying ‘This-Reality’ and even visit other dimensions (‘Other-Reality’): “We mean to put all these different viewpoints together, to deduce the entire signature of This-Reality. From this knowledge we shall deduce the reality modes external to It – grasp the Other-Reality, communicate with it, control it!” (Watson 1973, 137) But such an ambition to go beyond any category to the *Ding an sich* is not convincing, since it remains unclear what a perspective without categories, a perspective without a perspective, would entail.

There is therefore a third possible conclusion, between fatalism and optimism. This option acknowledges that going beyond all categories is impossible, but does not conclude that therefore any attempt of ‘first contact’ is *a priori* doomed to fail. Its more modest conclusion is that articulating a suitable framework to ask meaningful questions is possible, but not guaranteed. Rather, it requires work. Some less pessimistic science fiction authors display this attitude in their work. They do not take the capacity to ask meaningful questions for granted. Instead, they show what scientists have to do to establish the framework for raising them.

Take the example of *Cosm* (1998) by Gregory Benford. The story is about a group of physicists working with a particle accelerator. One day, however, an experiment goes wrong and a strange object is produced the size of a bowling ball. For the physicists, this “shiny ball was something utterly unexpected” (Benford 1998, 34). It seems to defy all categories and exhibits all kinds of strange behaviors. The physicists thus do not know which questions to ask, but rather are forced to “measure everything. It might all matter” (Benford 1998, 163). Eventually, they succeed in finding the right questions to ask, establishing the scientific field of ‘cosmo-metrics’ and opening up “the sudden possibility of studying quantum gravity using objects the size of basketballs” (Benford 1998, 292).

Another example is Liu Cixin’s *Ball Lightning* (2018). In the book, scientists encounter an alien phenomenon called ‘ball lightning’ that randomly appears around the world and can evaporate specific materials or persons in an instant. The book is a slow, but ultimately successful attempt to make sense of this phenomenon. At the start the issue is not solely that they have no answers, but also that they have no clue which questions to direct towards the phenomenon. Only when, in the middle of the book, someone suggests that ball lightning behaves like a giant electron, the protagonist found meaningful questions to ask the phenomenon: “I could breathe at last. My mind had been asphyxiating for more than a decade, and all that time it felt like I’d been immersed in water that was murky at every turn. Now I had burst to the surface, and I took my first breath of air, and saw the vast sky. A blind man probably has the same feeling on regaining his sight.” (Liu 2018, 207)

Scientific Discovery as First Contact

The importance of this typology of first contact goes beyond science fiction. As we saw in the introduction, first contact is also present in anthropology and scientific research. It is in that sense not surprising that even within science-fiction stories, typically scientists are responsible for making first contact happen. In this final section, therefore, I want to explore some of the consequences of the above reflections for philosophy of science.

A typology of scientific discovery

The above typology of science fiction can help us to classify different takes in philosophy of science on the problem of scientific discovery. For some, scientific discovery is self-evident and it is assumed that when scientists are confronted with a novel phenomenon, they will be able to understand it. Science is then seen as in continuation with common sense and ordinary

experience. Similarly, the perspective of violence shows itself in the form the claim that science does not aim to understand, but only aims to control the world. There is no communication, no first contact, only violence. It is a perspective associated with Martin Heidegger's analysis of how science and technology reduce the world to a resource to be used. But as in the case of its science-fiction counterparts, both these perspectives do not really raise the question of how novel phenomena are first encountered in science.

The third and fourth options are more promising. Just as in the case of science fiction, optimists concerning scientific discovery believe that contact with novel phenomena is guaranteed because of a shared mathematics between humans and worldly phenomena. In philosophy of science one could think of the position of structural realism: the belief that, though the content of our scientific theories might change throughout time, we can believe that the underlying mathematical structures are constant. New scientific discoveries will never break with the structures at work in our scientific theories, only with their more superficial content. Hence, there is no reason to believe that new discoveries would be radically incomprehensible.

How convincing such a point of view is depends on the level of discontinuity one accepts in the history of science. Assumptions about such a discontinuity are often at work in science fiction as well: believing that we would be able to understand more advanced alien civilizations depends on our belief that our own scientific theories more or less successfully capture reality, and will be shared with these aliens. In contrast, if you believe that aliens will have radically different scientific theories, one implicitly accepts a strong discontinuity in the history of science: "Unless the message was specifically tailored to a civilization just emerging into space, an extraterrestrial science book would be as incomprehensible to us as the wiring diagram of a radio would be to an aborigine." (Rood and Trefi 1981, 155) A similar pessimism is expressed by Benford:

Their arithmetic could be nonnumerical, that is, purely comparative rather than quantitative. They would think solely in terms of whether A was bigger than B, without bothering to break A and B into countable fragments. [...] For these beings, geometry would be largely topological, reflecting their concern with overall sensed structure rather than with size, shape, or measurement, à la Euclid. Such sea beasts would lack combustion and crystallography, but would begin their science with a deep intuition of fluid mechanics. Bernoulli's Law, which describes simple fluid flows, would be as obvious as gravitation is to us. (Benford 1987, 27)

Again, parallels with the history of science are at work, since Benford ends with a comparison with Aristotle: "Ask what Aristotle would've thought of issues in quantum electrodynamics and you soon realize that he would have held no views, because the subject lies beyond his conceptual grasp. His natural world didn't have quanta or atoms or light waves in it. In a very limited sense, Aristotle was alien." (Benford 1987, 28)

The fourth option can also be found in philosophy of science, and suggests that not all scientists are capable of genuine scientific discovery, but that it requires a special form of intuition or creativity. This is a very popular way of thinking about scientific discovery, and part of the mythology of scientific research. One could think of Henri Poincaré's (1904) emphasis on the role of intuition in the history of science; or Evelyn Fox Keller's interpretation of the work of Barbara McClintock, claiming that she was capable of making her discoveries because of her 'feeling for the organism' (Keller, 1983). But just as in the case of science fiction, such explanations often seem to be rather ad hoc. It makes a systematic analysis of how scientific discovery takes place impossible.

Beyond Scientific Cognitive Universality

Again, there is a fifth option, inspired by Lem's criticism on 'cognitive universality': we cannot *a priori* assume that scientific practices have the right framework to even start to understand certain scientific phenomena. Again, multiple conclusions can be drawn. One conclusion is a fatalism similar to that of Lem: there is no guarantee that science will ever be able to develop the proper framework to capture at least some novel phenomena. But the other two conclusions are possible as well. For instance, perspectival realism embodies the ambition to acknowledge the existence of particular human points of view, but also sometimes the dream to transcend it by combining different points of view.

The third option, that claims that going beyond all categories is impossible, but does not conclude that therefore any attempt of 'first contact' is *a priori* doomed to fail, is also found in philosophy of science. This is often found in positions that endorse an interventionist point of view on scientific practices: science is not so much in the business of representing the world, but rather in (re)constructing the world in such a way that it becomes intelligible and controllable. Let me give two examples.

Authors such as Friedrich Steinle have stressed that electromagnetism was initially a radically alien phenomenon. Steinle argues that although Hans Christian Ørsted's "spectacular result provoked a wave of research throughout Europe, a conceptual framework appropriate to deal with the new effect, or even a theory of it, was not readily available for most natural philosophers" (Steinle 1997, S66). What scientists interested in electromagnetism had to deal with was not so much a lack of theory to explain electromagnetism, but first and foremost that "there was no language, and thus no conceptualization available even to formulate the experimental results in somewhat general terms" (Steinle 2002, 413). To grasp this difference, he introduces the distinction between "hypothesis-driven experimentation" and "exploratory experimentation", arguing that much of the work by Faraday and Ampère fell under the second category.

A second example is the work of Hans-Jörg Rheinberger on 20th-century molecular biology. In Rheinberger's work, one can find a similar attention for the work needed to capture "how novel objects come into existence" (Rheinberger 1997, 1). According to Rheinberger, sciences should not be analyzed through a focus on theories, but rather on experimental systems. Experimental systems are about more than just finding answers and constructing theories. For Rheinberger "[t]hey are not simply experimental devices that generate answers; experimental systems are vehicles for materializing questions" (Rheinberger 1997, 28). They thus both entail the work of constructing questions and constructing answers. To grasp these two different sides, Rheinberger introduces the notions of *epistemic things* and *technical objects*. *Epistemic things* are the material entities and processes that constitute the later well-defined objects of research. They are thus paradoxically "absent in their experimental presence" (Rheinberger 1997, 28). Or, put differently, "[t]he reality of epistemic things lies in their resistance, their capacity to turn around the (im)precisions of our foresight and understanding" (Rheinberger 1997, 23). Rheinberger stresses that these epistemic things are not just given. Part of the work of experimentation consist in "bringing epistemic things into existence" (Rheinberger 1997, 107).

Once scientists have produced well-established epistemic things, they can start proposing theories to grasp the behavior of these epistemic things. Once these attempts are successful, scientists end up with what Rheinberger calls *technical objects*. In contrast to epistemic things, these objects are fully understood. One could think of objects such as isotopes or fluorescents, that once fully understood could be used in isotopic labeling or dye tracing methods in biology and medicine. It is thus the case that former epistemic things, once understood, transform into the tools to understand other epistemic things. In this sense, there is a close interaction between epistemic things and technical objects, where "technical conditions determine the realm of

possible representations of an epistemic thing; and sufficiently stabilized epistemic things turn into the technical repertoire of the experimental arrangement” (Rheinberger 1997, 29).

Through the lens of Lem’s critique of cognitive universality we can thus see what these philosophers of science are pointing at. They highlight a second, often neglected dimension of scientific work: prior to the transition from *unexplained* to *explained phenomena*, which has been the central question of philosophy of science, there is the transition from *unarticulated* to *articulated phenomena*. Or in other words: if we abandon the assumption of cognitive universality, we have to acknowledge that before finding the right answers, we have to articulate the right questions. This requires an additional type of work, aimed to construct a frame of reference from which certain phenomena and questions start to make sense. This is what I call the work of articulating phenomena.

In reverse, these studies in philosophy of science also offer an important lesson for science fiction. There is a risk in both philosophy of science and in science fiction to restrict the way how science interacts with the world to linguistic or cognitive means. As if science is only a matter of finding the right way to *speak* or *think* about the world. Steinle and Rheinberger present a different picture: science is also finding the right way to *materially* interact with the world. In their reflections on the issue of first contact, many science-fiction authors needlessly restrict the question of first contact to linguistic means. But in their stories, we often find a richer image, namely one of establishing a material contact with the alien phenomenon, through the right instruments, technology or experiments. This is present in Lem’s *Solaris*: the scientists involved try to communicate with the planet first and foremost through material means. A similar picture is painted in Benford’s *Cosm* and Liu’s *Ball Lightning*.

Conclusion

In this article we examined the problem of ‘first contact’ in science fiction as an epistemological problem: in what way will humans be capable to communicate with an alien phenomenon? I offered a typology of different takes, of which the fifth option seemed to be the most interesting one: a perspective through which first contact is risky, and most likely to fail, because no *a priori* common framework between us and the alien phenomenon can be assumed. This perspective is embodied by the work of Stanisław Lem and his criticism of the ‘myth of cognitive universality’. But we also saw that Lem took his pessimism too far, ending up in a fatalism: first contact is doomed to fail. There are alternative takes: first contact is then neither guaranteed to succeed nor to fail. It only implies that work needs to be done to establish a common framework for first contact. Whether it works cannot be determined *a priori*.

Reflections on first contact can thus lead to an understanding of a broader set of issues, of which we only explored those in philosophy of science. Also, in scientific research there is the question of, before finding the right answers, finding the right questions to ask to a novel phenomenon. I called this the work of ‘articulating phenomena’. As hinted in the introduction, first contact opens questions in other domains as well, that I have left out in this article. For instance, several science-fiction authors also draw a parallel with the human encounter of God. Also, in this case there is a ‘first contact’ with a radically transcendent phenomenon.

The relevance of reflections on first contact is also found in current debates about ecology and the Anthropocene. Several science-fiction authors such as Jeff VanderMeer link the two, embodied by the recent resurgence of ‘weird fiction’. In the Anthropocene we witness a ‘first contact’ with what was assumed to be the passive backstage of ‘nature’. According to Timothy Morton, for instance, the Anthropocene encourages us to “develop an ethics that addresses what Derrida calls *l’arrivant*: the absolutely unexpected and unpredictable arrival, or what I call the *strange stranger*, the stranger whose strangeness is forever strange – it cannot be tamed or rationalised away” (Morton 2013, 123–124). In a similar vein, Lukáš Likavčan speaks

of *xenorationality*, “as the term for those forms of reason alien to the human subject which can be met in allusive aesthetic encounters” (Likavčan 2016, 110). The example he uses is that of AlphaGo, who has shown surprising, yet alien moves in his defeat of the human champion in the game go. “Without even grasping the complexity of its strategy by humans watching the game, the machine claimed a decisive victory. Human players were astonished by this confrontation with radical otherness, wholly objective and external.” (Likavčan 2016, 112) In that sense, ‘first contact’ seems to be more omnipresent than many of us are inclined to think. Or again in the words of Likavčan: “Thinking with nature and understanding aliens appear to be strongly similar tasks.” (Likavčan 2016, 116)

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