

VII. Do we disturb the universe?: Diversity in space as a grotesque hope for humankind

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Abstract

In this paper I will present an astrophysicist's view on the anthropological aspects of space exploration and emigration in the future. Discussions by Lévi-Strauss, Hannah Arendt and Freeman Dyson are introduced to show that the expansion of human beings to space will increase cultural and biological diversity. It seems to be in line with the history of the universe, but whether it contributes to the well-being of the contemporary and foreseeable human beings is unclear.

Keywords: Space exploration, Space emigration, Cultural diversity, Biological diversity

1. Introduction

Tohru Moriyama, an ethologist at Shinshu University, studies the mind of pill bugs. One may wonder if pill bugs have anything that can be called a mind, and then one may start wondering what is the definition of a mind after all. Aside from the definition of a mind for the moment, it is known that pill bugs in nature show turn alternation, namely a left turn followed by a right turn, when they encounter an obstacle. This had been thought to be a mere instinct. However, when Moriyama put a group of pill bugs into a maze in which they have to repeat the turn alternation endlessly, some of the bugs, not all, started to show distinct behavior such as climbing the wall of the maze, after exercising the turn alternation many times (Moriyama 1999).

This result may be considered as the emergence of the hidden "mind" of the pill bugs, who could not stand the endless turn alternation without any outcomes, and eventually decided to behave differently. No matter what the psychological interpretation is, the important point here is that this discovery would not have been possible if one observed the pill bugs in nature. It was the experience of an unprecedented situation which unveiled

the hidden “mind”, about which the pill bugs themselves were perhaps unaware.

Space is the Moriyama’s maze for human beings. The unprecedented and extremely different environment in space will unveil the unknown nature of human beings and their society. In the era when human beings are expanding their activities out of the Earth, space is the place to look at for those who are eager to explore the wonder of human existence.

The similarity between astronomy and anthropology was pointed out by Claude Lévi-Strauss(2013):

That remoteness (to the exotic societies) reduces our perception to a few essential outlines. I would say that, in the social and human sciences as a whole, the anthropologist occupies a place comparable to that falling to the astronomer in the physical and natural sciences... the distance of the heavenly bodies allowed for a simplified view of them (Lévi-Strauss 2013, pp18-19)

When I read this I also found different analogies. Astronomers have been exploring the universe and revealed the diversity of the physical world, such as black holes, neutron stars and exoplanets. Likewise, anthropologists have been exploring the various cultures in the world and revealed the diversity of the humanity. Astronomers study various stars and planets and eventually deepen the understanding of the Sun and the Earth. Likewise, anthropologists study various cultures and eventually deepen the understanding of their own. It is also interesting to note that the title of Paul Gauguin’s famous painting “*D’où venons-nous ? Que sommes-nous ? Où allons-nous ?*” (“*Where do we come from? What are we? Where are we going?*”), often quoted by anthropologists, is also mentioned in the document entitled “The Global Exploration Strategy: The Framework for Coordination” issued by 14 national and regional space agencies as the fundamental questions for the space explorations. However, the second question in this document, “What is our place in the universe?”, is slightly modified from that of Gauguin so that it can be answered by physical sciences.

The scope of space anthropology should not be limited to the exceptional people such as the professional astronauts. The changes of the cognition of the universe have been the source of inspiration to the human thoughts and cultures, and today the space utilization is already indispensable, integrated part of the modern civilization. And if the day comes when a group of people starts to inhabit outside the Earth, or when we discover, if not encounter, the extraterrestrial lives, the impact will be comparable, or even larger, than those brought by Copernics and Apolo missions.

Perhaps the Gauguin’s question are still being asked by our descendants – who might not be the same human being as we are now – in a thousand years future.

Even now, we cannot think over the questions without considering the interaction between the physical universe and life, especially human beings. In the following I will present my personal view on this matter as an astrophysicist, in order to provoke the responses from anthropologists as well as the scholars in other fields.

2. History

To begin with, let us briefly overview the temporary answer from natural sciences to the Gauguin's first question. I begin from just after big bang, the birth of our universe 13.8 billion years ago. I omit the question of how and why it happened, which is of course very interesting both philosophically and scientifically.

Although the early universe has been fascinating many physicists and astronomers, I would dare to say that it was a simple, boring place compared with the contemporary universe. The scenery was quite featureless as the space was filled with homogeneous gas, and there was no element that can compose Earth-like planets and lives, except for hydrogen and helium (with a tiny fraction of lithium and beryllium).

However, there was a slight fluctuation of the density of the gas (and the dark matter), which is the origin of our existence today. Due to the self-gravity, the dense parts attracted more and more gas, that eventually form stars and galaxies, and the space in between became almost a vacuum. Thus the initially featureless universe started to show a little more complicated scenery.

Inside the newly formed stars, nuclear fusion was ignited, and various heavy elements, such as carbon, oxygen, nitrogen and iron were synthesized. When the stars came to the end of their lives, they scatter the synthesized elements back into the interstellar space, from which next generation stars were formed again. As this process occurred repeatedly, the fraction of the heavier elements in the universe increased, allowing the formation of Earth-like planets with rocky surface and water around the newly born stars. (Strictly speaking, other processes such as type Ia supernovae also contribute to the element syntheses in the universe).

Thus our solar system was born about 4.5 billion years ago, or 9.3 billion years after big bang, which has rocky planets, liquid water, and materials for life. Although recent astronomy has revealed that similar environments commonly exist in our galaxy, we do not know yet how common the lives and their evolutionary processes are. Either by chance or by necessity, life emerged in the Earth 3.8 billion years ago at latest. It is not known how diverse the life was in the beginning, but all the life we have found so far are considered to be the descendants of the common origin, as their DNA have common

parts. Roughly speaking, Eukaryotes, who have a nucleus and other organelles enclosed within membranes, emerged during the first two billion years. Then multi-cell organisms emerged during next one billion years, allowing the evolution of larger and more complex lives. During next one billion years, the number and variety of species increased rapidly. The prey-predator relationship developed, some plants and animals moved from sea to land, dinosaurs flourished then mammals. Homo sapiens diverted from their cousins about two hundred thousand years ago, started to develop civilization about five thousand years ago, and landed on the Moon about 50 years ago.

Lévi-Strauss pointed out that scientific thought on the history of the universe and life is overlapping with mythic thought.

Even as science progresses, however, it convinces us that we are becoming less and less capable of mastering spatial and temporal phenomena that, by their spatial and temporal orders of magnitude, escape our mental capacities. In that sense, the history of the cosmos is becoming a kind of great myth for the ordinary mortal: it consists of the unfolding of unique events whose reality, because the events occurred only once, has never be proven. (Lévi-Strauss 2013, pp85-86)

When we read the history of the universe revealed by science as a mythic story, it looks a story in which the universe has been growing complexity and diversity in it. Then, how can we put the expansion of human civilization in that context?

It is often pointed out that photographs of the Earth taken from space, particularly those delivered from Apolo missions, significantly contributed to cultivate the cosmopolitan way of thoughts. Takashi Tachibana, a Japanese journalist and writer who did extensive interviews to the astronauts including those landed on the moon, once said in the panel discussion at the

That the image of the blue Earth taken from the space was shared by the people through the media eventually put an end to the cold war, which had been thought to be endless by the contemporary people. The view of the blue Earth became the common experience of the human race. It was the first change of the consciousness of the human race brought by its expansion to space. (Tachibana 2001, at the panel discussion held during the 28th international symposium on space technology and science in Okinawa. Also recorded in Iwata 2012. Originally in Japanese.)

Such a cosmopolitan way of thought is still important today when there are issues like climate change and regional disputes. At the same time, it may also accelerate the formation of global and uniform culture and thought. Roughly speaking, one of the consequences of the space exploration so far is so called globalization. I am not trying to make a value judgment here, but it seems to be opposite to the history of the universe,

or our mythic story, of increasing complexity and diversity.

However, the consequence of the space exploration on human culture and thought may alter when some people start to inhabit outside the Earth so that the space is no longer a place for temporary visit before returning to the Earth. Globalization has been driven by the advances in communication and transportation technologies. That being the case, will the vast distance and the difficulty in transportation between terrestrial and extraterrestrial societies provide a new opportunity to grow diversity? Let us quote Lévi -Strauss again:

When integral communication with the other is achieved completely, it sooner or later spells doom for both his and my creativity. The great creative eras where those in which communication had become adequate for mutual stimulation by remote partners, yet was not so frequent or so rapid as to endanger the indispensable obstacles between individuals and groups or to reduce them to the point where overly facile exchanges might equalize and nullify their diversity (Lévi-Strauss 1985, pp24)

Similarly to emigrants today, future extraterrestrial emigrants will probably keep some communication with people on the Earth. But the speed and amount of communication will be smaller, and transportation of goods and passengers will be very limited. This is exactly the condition of the creative era suggested by Lévi-Strauss. One can imagine that, through the struggling efforts to adopt the extremely different environments, people of the extraterrestrial society may foster new thoughts, ethics and social systems that are distinct from, or even incompatible with, those prevailing on the Earth. Moreover, they may also use genetic engineering and other enhancement technologies to living organisms including human, that are considered to be immoral in most of cultures today, to enhance their ability to adopt the new environment.

Thus, space emigration is a likely source of diversity, both cultural and biological. From the viewpoint of an observer of the universe, it will be seen as the process of increasing diversity and complexity, making the universe more interesting place. However, this does not necessarily mean peace and welfare of individuals living in it. One may recall the argument of Hannah Arendt that such a viewpoint of scientists, which she called Archimedes' point, threatens the human stature.

If we look down from this point upon what is going on on earth and upon the various activities of men, that is, if we apply the Archimedean point to ourselves, then these activities will indeed appear to ourselves as no more than "overt behavior," which we can study with the same methods we use to study the behavior of rats. (Arendt 2007, pp.54)

In the next section I shall discuss some perspectives in a hypothetical space emigration in future, keeping in mind the ambivalence about diversity and welfare of human beings.

We are doubtless deluding ourselves with a dream when we think that equality and fraternity will someday reign among human beings without compromising their diversity. Humanity, however, if not resigned to becoming the sterile consumer of the values that it managed to create in the past, is capable only of giving birth to bastard works, to gross and puerile inventions, and must learn once again that all true creation implies a certain deafness to the appeal of other values, even going so far as to reject them if not denying them altogether.

(Lévi-Strauss 1985 pp24)

3. Future

Freeman Dyson is a physicist who is fascinated in thinking about the future. He loves diversity and believes that the expansion of human race into the universe is the only solution for the long-run preservation of diversity. While he thinks cultural and biological diversity is crucial for our survival and development, he is aware that the strain caused by the space-born cultural and biological diversity will be similar to but a hundred times worse than the strain caused by the diversity of human skin color, and hence the ethic of human brotherhood must prevail our desire for diversity as long as we remain confined to the Earth. He is a rare scientist who can stand both at the Archimedes' point and at the viewpoint of a man on the Earth looking up the universe. According to the words in his autobiography, *Disturbing the Universe*, we are not merely spectators; we are actors in the drama of the universe (Dyson 1979).

In the same book, Dyson made a comparison of intercontinental expeditions in history and interplanetary expeditions in the future. Table 1 summarizes the date, number of people, payload and cost of two historical expeditions, *Mayflowers* and *Mormons*, and two future enterprises in space. One of the latter is a huge space colony that accommodates ten thousand people in artificial construction put at the Earth-Moon Lagrange point L5. The other is a much smaller number of settlers who take a risk to move from the L5 colony to homestead the asteroids. The most important number is the bottom one, the cost per family in the unit of average annual income at the time of the expedition. Namely, if this number is 10, an ordinary family has to save the entire income for 10 years to participate the expedition. It was estimated to be 2.5 for the

Mormons and 7.5 for the Mayflowers. Since 2.5 is affordable for an ordinary family but 7.5 is not, the Mayflowers had to struggle to pay off the debts.

Expedition	Mayflower	Mormons	Large L5 Colony	Asteroids
Date	1620	1847	1990+	2000+
Number of people	103	1,891	10,000	23
Payload (tons)	180	3,500	3.6 million	50
Payload (tons) per person	1.8	2	360	2
Cost (1975 dollars)	\$6million	\$1	\$96000M	\$1M
Cost per pound (1975 dollars)	\$15	\$2	\$13	\$10
Cost in man-years per family	7.5	2.5	1,500	6

Table 1: Comparison of expeditions. Adopted from Dyson (1979)

It immediately follows that the cost of large L5 colony, 1500 annual income per family, implies that it cannot be a private enterprise. If it ever happens, it will be a government project. On the other hand, the settlement to asteroids seems doable for a small number of people who are willing to take the risk. Dyson (1979) also pointed out that it took 128 years from the Voyage of Columbus to that of the Mayflower. During the 128 years, kings and queens invested in establishing the commercial infrastructure that would make the Mayflower possible. The future space emigration will also be a mixture of governmental, industrial and private activities.

Space emigration may not be a rational thing to do, at least within the foreseeable future. But because a private enterprise does not have to justify itself like

governmental ones, it can do what seems irrational to the majority as long as it affords the necessary cost – like Mars One. This indicates that there already is a bias in the emigrants toward different thoughts and culture. Hence it will help the growth of the cultural diversity of whole humankind as we discussed above.

Although the thoughts and culture do not have to be rational, a rational economy will be required to sustain the emigrants' lives. Mining of mineral resources and tourism have been considered, but since they both require massive and/or frequent transportation, wherever they are the main contribution to the economy the growth of diversity we discussed above will be restricted. However, it was also suggested by Dyson (1985) that the cash crops which sustain the economy of the asteroid colonists will be genetic and biological products. These products may be manufactured by exploiting the physical environment as well as the different ethical/legal restrictions in the asteroid colony. If this is the case, it will accelerate the biological diversity of the whole solar system ecology.

4. Concluding remark

After all, is the space exploration a hope for humankind, as is often advocated? I do see a hope in it. But it is not a mere hope for better tomorrow, nor a gleam of hope for the survival of humankind in danger of extinction. It is a hope as a continuous fountain of diversity. By going out of the Earth, we can actively “disturb the universe” to make it more complex, diverse and interesting place. It will give us the meaning of being in this universe which is probably finite both in space and time. However, what we find in the future human civilization that expands into the universe is the figure of ourselves that look, as Haldane (1927) expressed, “not only queerer than we suppose, but queerer than we can suppose”. Space exploration is a hope in this sense. A grotesque hope.

As an astrophysicist, I honestly confess that I have a strong desire to witness the queer universe disturbed by human beings. However, I am not confident at all that it is a good choice for the well-being of my contemporaries, myself included, and our descendants in the foreseeable future. I hope to share this ambivalence with anthropologists to think together about the future of humankind in this universe.

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