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Preface to "*Challenges of Space Anthropology*"

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I was watching the European Space Agency (ESA)'s webcast on the evening of November 12, fascinated by the landing of the Philae deployed from Rosetta on the Comet 67P/Churyumov-Gerasimenko. The mother probe Rosetta was built and operated by ESA, while the Philae by the consortium of European nations. The mission is to search for organic molecules and leftovers that initially formed the solar system about 4.6 billion years ago, providing us with information on the formation of the solar system and clues on the origin of life. I felt as if space agency managers, engineers, scientists, and politicians appeared in the webcast are unanimously telling us that we *Europeans* did this. Apparently such an extraordinary feat in space affects people's perspective on their geographic, cultural, and political identity, perhaps with growing significance, from a photo of the lonely Earth by Apollo 17 to the construction and continued operation of the International Space Station.

A remarkable discovery by astronomers in recent years is that 60% of stars in universe harbor planets. Furthermore, ~60 planets so far discovered are located in the habitable zone with distance range from the central stars adequate for life to emerge and to survive. Astronomers do anticipate that in a few tens of years from now, with the most advanced telescopes deployed in space, the signatures of bio-makers indicating the existence of water, ozone, carbon-dioxide, methane, and any other essential materials for life will be found on the surface of those planets. The discovery, once made, may deliver fundamental and permanent impact to humanity: *Where Do We Come From? What Are We? Where Are We Going?* People on this globe may even consider the possibility of Carl Sagan's *CONTACT* situation more seriously.

The National Museum of Ethnology in Osaka, which is one of my favorite tranquil places, beautifully exhibits ethnical diversity in life, culture, and language in space and time domain on this globe. For a layman such as myself, anthropology appears to be an

attempt to better understand humanity through studies of the regional diversity and the cross-cultural comparison. These proceedings are unique and courageous extension on the scope of anthropology to space, and address diverse issues such as influence of space to humanity on ground, humankind in space (effect of space environment to humankind), and extra-terrestrial life form. We encourage you to visit and see the fine articles in "*Challenges of Space Anthropology*".

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Ⅰ． The Two Faces of Tomorrow: Human Bio-sociocultural Diversity Expanded through Space Development

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1 Introduction: Quo Vadis Anthropos?

What reaction do you have to the following two photos (Figures 1 and 2), which are reputed to represent one of the most beneficial outcomes of the Apollo program as well as one of the most important events in human history? Do these photos not confront us with a fundamental question about the future of human society? Namely, whether humans will remain on Earth?

Starting Point: Two Photos of the Earth

The first photo was named “Earthrise,” and it depicts an image of the Earth rising from the lunar horizon, as seen by human beings for the first time in their 250,000 years of history. The photo was taken during a lunar orbit by a crew member of the Apollo 8 spacecraft on December 24, 1968. The second, named “The Blue Marble,” was taken by a crew member of the Apollo 17 spacecraft, which was on a mission to the moon on December 7, 1972, at a distance of approximately 45,000 kilometers from the Earth’s surface. This image was the first in human history to depict Earth as a full globe from a detached viewpoint.

To any life form inhabiting the Earth, including humans, the Earth is massive and indefinitely expansive to view in its entirety. Though it is impossible for humans to see the entire globe with the human eye, it has been possible throughout human history to

Figure 1: Earthrise
(NASA: AS8-14-2383)

Figure 2: The Blue Marble
(NASA: AS17-148-22727)

imagine the globe through inference or on the basis of data from observation devices. A full view of the Earth has, however, been largely unattainable to humans, who have inhabited the Earth's surface for a long period of time. This is why the photos presented here are said to represent one of the most beneficial outcomes of the Apollo program and one of the most important events in human history. The photos commemorate the historic moment at which human beings escaped to great distances from the Earth, and for the first time in human history, attained a viewpoint that objectified the world. These images have thus had a crucial influence on the human imagination.

A lone, blue marble is suspended in the profound darkness of deep space. National borders are not identifiable. The tiny and beautiful bubble is isolated but exuberant. With one glance at the image, one realizes the Earth's fragility and the fate of those who inhabit it regardless of nationality, race, and species.

The slogan "We must protect the precious Earth" likely had its birth in reaction to these photos, as they have been frequently used as icons by environmentalists. These images of the Earth as a full globe without national or ideological boundaries may have accelerated the development of "modernity" and the current historical phenomenon of "globalization." Regardless of the outcome, as is frequently highlighted in journalism

and various other disciplines, it is safe to assume that these photos had a significant impact on human history.

Quo Vadis Anthropos? Questions of the Future of Human Society Inspired by the Two Photos

Half a century has passed since these photos were taken.

The phenomenon of globalization has advanced since the collapse of the Berlin Wall at the end of the Cold War era in 1989. Although a global system of industrial capitalism and an ideology of democracy have since dominated the world, national borders have not disappeared. Direct conflict between the East and West gave way to an outbreak of low-intensity conflicts. As mechanisms of capitalism endured unchanged, globalization has continued to spread while economic disparities grew between the Global North and South, wherein the rich populations grew richer as the poor became poorer. Human beings have gradually lost elements of cultural, linguistic, and biological diversity under the influence of globalization. In addition, they have been confronted with various other challenges related to population growth, food security, climate change, environmental destruction on a global scale, and so on.

On the other hand, efforts have not been made to revisit outer space, where the photos shown here were taken half a century ago. The moon still remains far afield from humanity, contrary to expectations. It is, of course, not the case that space development has not advanced since the photos were taken, as demonstrated by the construction and operation of the International Space Station (ISS), investigations of the solar system by unmanned space probes, the deployment of numerous satellites for various purposes, and so on. Space technologies, including aerospace engineering and computer and life-support technologies, have achieved levels of progress far beyond what humans could have imagined. It is now even considered to be technologically possible for humans to construct a moon base and conduct a manned Mars exploration. Aspects of daily life would indeed be impossible without space exploration given the spread of GPS and satellite communication.

Bearing these present conditions in mind, we refer to the photos again. Do these photos not confront us with questions surrounding the future of humans, namely, whether we will remain on Earth? Are we not faced with the important decision of whether to remain on Earth, a limited and fragile planet, or venture into the new frontier of deep space to realize our potential? Where is it that we want to or have to go? What kind of society do we want to become? Do these photos not ask us, “Quo vadis

anthropos?" that is, "Where are you going, O Human?"

For anthropologists, these questions are crucial because anthropology as a discipline examines where human beings originate, their current realities, and where they are going. Indeed, no one can know or predict the future of human society. Although a small group of specially trained astronauts currently reside semi-permanently on the ISS, it is still uncertain whether human beings will have the opportunity to enter outer space. As this option may yet remain, it is necessary to henceforth discuss it and draw conclusions concerning it. However, regardless of the decision that is ultimately made, it is still beneficial to investigate the possibility of human beings in outer space on the basis of the knowledge of human evolutionary history and our present conditions, which anthropologists have been documenting from the very beginning of the last century. This would be conducive to discussing and drawing decisions on the future of human society.

This is the purpose of this study. It examines the anticipated future of space development on the basis of patterns of human evolution, focusing on the human ability to freely multiply extensions of the human mind into the environment.

First, on the basis of the hypothesis on "cumulative cultural evolution" proposed by Tomasello and Bateson's model on the evolution of learning, I describe how this capability enabled human beings to multiply across the surface of the Earth. Next, through a case study examination of Inuit societies in the Canadian Arctic and their relationships to the global network, I examine the present conditions of human society and describe the connections between diverse, regional subsistence societies and the global network in consideration of future space development. Then, on the basis of this consideration and "The Vienna Vision on Humans in Outer Space," the projection for future space development by the European Science Foundation (ESF) and European Space Policy Institute (ESPI) in 2007, I consider the future of modern human beings in outer space and the task of anthropology in this future. Finally, I argue that future space development should follow two objectives: (1) it must continue to extend human society as far as possible beyond the terrestrial world into outer space, and (2) it must also protect human bio-sociocultural diversity so that it flourishes both on Earth and in the outer space, now and in the future.

2 The Evolutionary Basis of Human Beings: The Ability to Freely Realize Extensions of the Mind

A mystery of human evolution that has puzzled anthropologists over many years is how cognitive skills unique to modern human beings have evolved over only 250,000 years, which is a very short time, evolutionarily speaking (Tomasello 1999). It has been highlighted that 250,000 years is not sufficient time for normal processes of biological evolution that involve genetic variation and natural selection to have developed the cognitive skills necessary to invent and maintain complex tool-use industries and technologies, complex forms of symbolic communication and representation, and complex social organizations and institutions.

Tomasello's hypothesis of "cumulative cultural evolution"

To explain this phenomenon, Tomasello (1999) proposed the hypothesis of "cumulative cultural evolution." According to Tomasello, only modern humans have acquired species-unique modes of cultural transmission, that is, features of "cumulative cultural evolution." This process "requires not only creative invention but also, and just as importantly, faithful social transmission that can work as a ratchet to prevent slippage backward—so that the newly invented artifact or practice preserves its new and improved form at least somewhat faithfully until a further modification or improvement comes along" (Tomasello 1999: 5). It is this mechanism of "cumulative cultural evolution," which works on time scales several orders of magnitude faster than those of biological evolution, that has enabled modern humans to develop in only 250,000 years cognitive skills and products that other animal species have never achieved.

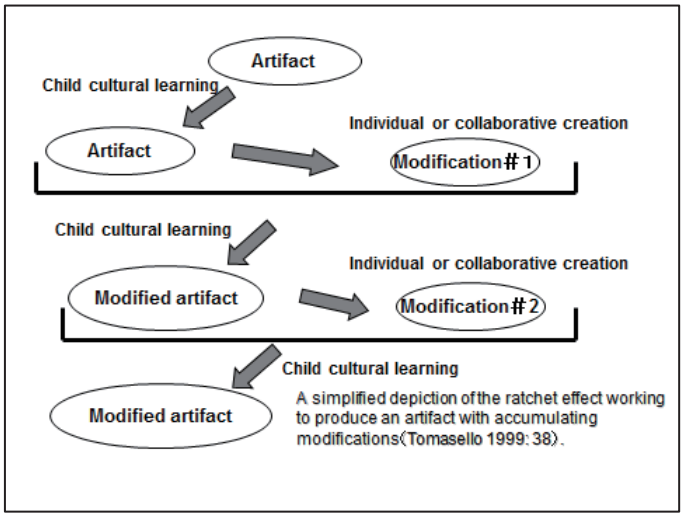

Figure 3: cumulative cultural evolution (Tomasello 1999: 38)

This "cumulative cultural evolution" involves the following two stages, as shown in Figure 3:

(1) Child cultural learning: The ratchet of cultural evolution

This denotes the process in which children or novices learn existing cognitive skills through cultural learning. It is through this process that the pool of cognitive skills and products that have been created or invented in the past are faithfully transmitted over generations and preserved as resources for future innovation. This process functions as Tomasello's "ratchet."

(2) Individual or collaborative creation: The driving force of cultural evolution

In this process, individuals or groups of individuals modify existing cognitive skills and products or invent new ones on the basis of the accumulated pool of cognitive resources such as tools, technical processes, symbolic communication devices, and social institutions. This process accelerates the rate of cultural evolution, and thus may be understood as its driving force.

Two Mental Abilities of Modern Human Beings

As I have demonstrated elsewhere (Omura 2014), a close examination of Tomasello's hypothesis according to Bateson's model on the evolution of learning (Bateson 1972) shows that modern human beings possess two species-unique mental abilities in accordance with the two stages of "cumulative cultural evolution." These abilities are as follows.

(1) The ability to engage in "theory of mind" (the ability essential to "cultural learning")

According to Tomasello, cultural learning comprises three types of learning: "imitative learning," "instructed learning," and "collaborative learning"; it is based on "the ability of individual organisms to understand conspecifics as beings like themselves who have intentional and mental lives like their own" (Tomasello 1999: 5).

"Imitative learning" denotes forms of learning in which "youngsters actually reproduce the behavior or behavioral strategy of the demonstrator, for the same goal as the demonstrator" (Tomasello 1999: 26). "Instructive learning" denotes the learning process that "comes from the 'top down,' as knowledgeable or skilled individuals seek to impart knowledge or skills to others" (Tomasello 1999: 33). In "collaborative learning," novices learn through collaboration with knowledgeable and skilled individuals. These types of cultural learning would not be possible without the ability of learners to understand the intentions behind the behaviors of others.

Then, Tomasello indicates that the ability of cultural learning functioning as the ratchet of cultural evolution, which enables modern humans to accumulate

modifications through historical time, is restricted to modern human beings. Therefore, he concludes that the differences in learning ability between modern humans and other animal species lie in the ability to engage in cultural learning. This ability is in turn based on the ability of learners to understand conspecifics as beings that follow intentional and mental lives similar to their own. This may also be understood as the ability to engage in "theory of mind."

(2) The ability for objectification (the ability essential to "creation")

According to Bateson's model regarding the evolution of learning, it is important to objectify what has already been learned via cultural learning to creatively modify existing cognitive skills and products or to invent new ones by drawing from the accumulated pool of cognitive resources.

During infancy, human beings learn conventional technical processes, socially acceptable behaviors, conventional ways of understanding the world, and other forms of "character" (Bateson 1972: 303), style, or culture via cultural learning. Thus, cultural learning enables subsequent generations to develop creative modifications and inventions by drawing from the accumulated pool of cognitive resources without having to invest the time and effort necessary to invent skills and products from scratch. However, the attainment of knowledge via cultural learning is likely to persist throughout a learner's life through reflectively unexamined learning processes and unconsciously automatized skills. This often develops cultural bias in the learner, which primes learners to adhere to what they had learned through this process and conservatively resist changes. Cultural learning thus often impedes the possibilities for creative modification and invention.

Therefore, it is necessary to "throw these unexamined premises open to question and change," (Bateson 1972: 303) that is, to achieve "freedom from the bondage of habit" (Bateson 1972: 30), to creatively modify existing cognitive skills and products, or invent new ones. In other words, it is essential to detach from and consciously objectify one's own habits including reflectively unexamined premises, and unconsciously automatized skills. If conventional technical processes and ways of understanding the world are not consciously objectified, and instead remain as unconsciously automatized and unexamined premises, modifying or changing these perspectives will be impossible. Therefore, it is necessary for modern humans to develop the ability to not only engage in "theory of mind," on which cultural learning is based, but also objectify conventional habits learned via cultural learning. This would allow modern humans to fully realize the possibilities of "cumulative cultural evolution" and thereby develop species-unique,

complex cognitive skills and products that are derived from them.

Thus, these two abilities, which allow modern human beings to acquire species-unique modes of cultural transmission, or "cumulative cultural evolution," bestowed humans with marvelous creative abilities that led to explosive improvements in their cognitive skills.

From the former ability to engage in "theory of mind," humans were able to avoid investing time and effort on inventing problem-solving strategies anew for every problem encountered. However, this simultaneously resulted in rigidity and strict adherence to pre-existing, conventional problem-solving methods even under changing conditions. Hence, the latter ability for objectification enabled humans to objectify and disassemble skill sets learned via cultural learning, and thereafter rearrange or add new components to these sets to modify skills or invent new ones. This is the unique feature of human evolution that Tomasello revealed. Modern human beings are able to develop the necessary cognitive skills required to create complex products, such as technologies, communication devices, and social institutions, through the species-unique mechanism of cultural evolution, which is based on the two major abilities: 1) the ability to engage in "theory of mind," and 2) the ability to objectify what has already been learned via cultural learning.

The Evolutionary Basis of Human Beings: The Ability to Freely Apply Extensions of the Mind

These two abilities relate to another important, species-unique characteristic of modern human beings: the ability to freely apply an extension of one's own mind to the environment.

From the 1980s, cognitive scientists including anthropologists and psychologists have demonstrated that cognitive processes of the human mind are not limited to the brain and body but extend through the body into the environment. This characteristic of the human mind has been referred to as the "extended mind" (Clark 1991, 1998), "situated cognition" (Lave 1988, 2011), and the "distributed mind" (Hutchins 1996).

For example, as Bateson (1972) highlighted, the mind of a logger does not operate strictly within his brain but extends to the relationship between him and the tree that he is cutting down. By adjusting his movements according to the changing condition of the tree with each blow of the ax and thus communicating with the tree through this action, the logger gradually changes the tree's condition until it is finally felled. Throughout this process, the logger's brain and body coordinated by his nervous and

endocrine system, the tree, and the ax are integrated as a recursive circuit. This circuit functions as his mind. The same is true on a larger scale in the case of the mind of a pilot operating an aircraft. Hutchins et al. (Hutchins 1996; Hutchins & Klausen 1996; Hutchins, Holder & Pérez 2002) demonstrated through field work that the mind of a pilot extends throughout the entire airplane through his colleagues, instruments, steering devices, and so on. Given that the aircraft is continuously being tracked and supported by ground controllers through radar and radio communications, it can be said that the pilot's mind extends further to a control network that spans the entire globe.

However, the ability of the mind to extend into its environment is not a distinguishing trait limited to modern human beings. As was first highlighted by Merleau-Ponty (1995) and later demonstrated by ecological psychologists (Reed 1996), any organism can extend its mind to its environment through its behaviors, and can create and maintain each recursive circuit that involves itself and its surroundings. However, only modern human beings can create tools or modify their living environments for the purpose of further creating and modifying them. Only modern humans can freely multiply extensions of their minds by endlessly grafting one recursive circuit onto another, and thereafter make tools for making tools for making tools *ad infinitum*, or modify living environments to endlessly develop them further.

The two abovementioned abilities broaden the ability of modern humans to freely multiply extensions of their minds. This is because it is essential to objectify one's own conventional methods of problem-solving as recursive circuits of mind and understand the intentions behind these circuits to freely multiply extensions of one's mind. In cases where recursive circuits of mind are not consciously objectified, it should be impossible to combine or graft one recursive circuit to another. Likewise, when the intention behind each recursive circuit is not understood, it would be impossible to combine or graft one recursive circuit to another and compose a coherent system. Only after recursive circuits of mind are consciously packaged on the basis of intentions does it become possible to freely multiply the extension of one's mind.

It should now be clear that the process of "cumulative cultural evolution" discussed by Tomasello is an aspect of this free multiplication of the mind's extensions, which surfaces in the case when one focuses on diachronic extensions of mind over generations. This process also involves synchronic extensions of mind across space, which is demonstrated in the example of the aircraft pilot noted above. A mere glance at our daily lives is enough for us to realize how far-reaching and broad the synchronic extensions of mind are in the present era. This is indeed apparent given current processes of "globalization." It is now possible to extend our minds to the entire globe by

connecting with various networks dispersed across the Earth such as the Internet and physical distribution networks. Modern human beings are thus able to freely and endlessly multiply extensions of mind in time and space as a result of possessing two cognitive abilities: 1) the ability to understand intentions behind circuit packages through engagement in "theory of mind," and 2) the ability to objectify and modify packages learned via cultural learning.

3 Present Conditions of Modern Humans: The Diversity of Human Societies Flourishing on Earth

It should now be clear that the contemporary phenomenon of globalization results from this human ability to freely and endlessly multiply extensions of mind across time and space.

The multiple circuit chain of making tools for making tools for making tools *ad infinitum* resulted in the development of large industrial complexes that are based on physical distribution networks that span the Earth. The multiple extensions of communication via oral, literal, graphical, and electronic media, which are supported by terrestrial and extraterrestrial communication networks, not only span the entire globe and connect nearly seven billion people but also extend to outer space, broadening our cognitive horizons. Although globalization has caused many problems, as discussed in the beginning of this study, such as global environmental destruction and the increasing economic disparity between the Global North and South, the phenomenon has also improved lives and broadened human cognitive horizons in addition to interconnecting seven billion people, thereby promoting exchange between people at magnitudes greater than ever before. In this sense, globalization is undoubtedly one of the greatest accomplishments that modern human beings have achieved as a result of the two abilities that set us apart from other species, although many problems must still be resolved.

It is important, however, to understand that while the two abilities unique to modern human beings brought about important results, they are likely to be disguised behind the processes of globalization. These two abilities allow humans not to be strictly bound to only one mind extension circuit or, in other words, one way of life, and to instead live while moving between multiple extension circuits. This is because humans acquired the ability to consciously objectify and package extension circuits of mind depending on their intentions. In fact, in addition to the global networks that resulted from globalization, numerous extension circuits of mind currently exist, and humans

move constantly between them.

It is indeed true and widely known that a number of minority languages have disappeared, and the lifestyles of modern human beings have rapidly and radically homogenized under the influence of globalization. It is not without reason that the loss of linguistic and sociocultural diversity is considered an important issue in present-day society. However, numerous anthropologists conducting exhaustive fieldwork in various global regions from the end of the 20th century have found that all the people are not entirely absorbed into only one extension circuit or global network despite the increasing influence of globalization. Rather, it has been found that various ways of life wherein humans move backward and forward across plural extension mind circuits (including global networks) are practiced in numerous places worldwide. The following case of the Inuit, an indigenous people living in the Canadian Arctic, provides an example of a community that follows a lifestyle that involves moving between global networks and a local mind circuit extension (Omura 2010, 2012a, 2012b, 2013). The local circuit in this case involves a subsistence system that has been handed down from their ancestors.

Present Conditions of the Inuit Society

The Canadian Inuit are involved with and absorbed into global network as they, like all human beings, live under the influence of globalization. More than a century has passed since they became part of the global capitalist system through their involvement in the fur trade from the beginning of the 20th century. Moreover, half a century has passed since this group was first subsumed into a modern nation-state through sedentalization into hamlets by the Canadian federal government under its assimilation policy in 1960s. Consequently, typical hunter-gatherer ways of life fell into the background, and contemporary Inuit society underwent dramatic sociocultural changes. Ways of life characterized by seasonal migrations following game are now a story of the past told by elders.

Undoubtedly, it is true that subsistence activities such as hunting, fishing, trapping, and gathering are still vigorously pursued, and it is even said that “Inuit who do not engage in subsistence activities are not Inuit” (Omura 2013; Stewart 1995, 1996). In addition, although the use of cash income to buy processed foods has become general practice, meat from wildlife hunted through subsistence activities is still venerated as indispensable “real food” (*niqinmarik*) that helps to maintain ethnic identity. Furthermore, distribution of this meat continues to function as one of the cornerstones of the preservation of social relations. (Kishigami 1996, 1998, 2007; Stewart 1992;

Wenzel 1991).

However, the forms through which these activities manifest today have certainly changed; many hunters now engage in wage labor and participate in subsistence activities on a part-time basis. This has occurred as activities such as hunting have become highly mechanized through the use of equipment including, for example, high-powered rifles, four-wheel-drive buggies, and metal boats with outboard motors. It has also occurred out of the need for funds to meet the costs of procuring and maintaining equipment and also for buying gasoline and ammunition.

Moreover, the contemporary life of the Inuit is supplemented by the presence of home electronics and machines; houses are equipped with central heating systems, refrigerators, freezers, washing machines, dryers, computers, TVs, DVDs, iPads, iPods, and cable systems. Power plants in each community operate at all hours to maintain constant energy supplies in these communities. Icebreaking freight vessels and aircrafts regularly deliver processed foods such as hamburgers, chips, and soft drinks as well as other merchandise produced in Southern Canada and the US, which are supplied to local grocery stores. Children become fans of Japanese animation while older youth are obsessed with net-surfing and online shopping. Most hunters are also workers in government offices or construction sites who depend on public welfare, government subsidies, and public projects. News on Canadian politics and economics and global political and economic trends bring both joy and sorrow to them.

There is no doubt that the Inuit are participants in the global network of industrial capitalism and are positioned at the margins rather than at the center of the system. They have no choice but to accept global political and economic trends as a result of this marginality. Despite achieving ethnic autonomy within Canada in 1999 through successful political negotiations with the Canadian government that gave birth to the Nunavut Territory, when the fiscal situation of the Canadian government becomes meager because of a slowdown in the global economy, individuals in this community risk losing their jobs in public administration or construction owing to cuts to public projects and government subsidies. Just as Inuit fur exports were seriously damaged by the overhunting of harp seals by Western business enterprises (which resulted in an embargo on seal fur to the European Union that led to a significant loss of an important source of income for the Inuit even though they were not responsible for the practices of these corporations) (Wenzel 1991), Inuit society is greatly affected by the world economy and political decisions of the nation-state. Inuit society is subordinated to global capitalism and the modern nation-state.

Nevertheless, massive external pressures and dramatic changes in lifestyle have

not caused the Inuit to lose their identity. They are supported by solid confidence that will lead them into the future, as expressed in the following words of an Inuk person.

"Inuit Culture, which thrived in the harsh Arctic environment, will also thrive and advance in a global environment. What will remain, and what links the past, present, and future, is the sense of community, the willingness to help each other out, to be innovative and resourceful, in a word, to be Inuit, to be Human Beings'" (GN 1999: 1) (Statement of Jaypeetee Arnakak, Senior Communication Advisor, Nunavut Department of Sustainable Development).

How is it that the Inuit have acquired the confidence and drive that will lead them into the future?

The Multiple Worlds of the Inuit Society

The source of the Inuit's confidence can be traced back to the resilience of their extension circuits of mind—the subsistence system (*cf.* Omura 2012a, 2012b). This system has been maintained to bolster the autonomous reproduction of Inuit society despite continuous interventions from the outside world. The subsistence system lies at the core of the political, economic, and cultural identity of Inuit society and involves acquisition, distribution, and consumption activities that are primarily structured through kinship. Through the following recursive process of its operation, both the relationships among the Inuit and that between the Inuit and wild animals are ceaselessly generated, regenerated, and integrated into the land (*nuna*)—their life world composed of Inuit and wild animals—into which minds of the Inuit are extended.

The Inuit first enter an ecological relationship with wild animals as "providers/receivers of food" by obtaining individual animals through hunting, fishing, trapping, and gathering techniques of subsistence. The food (or other subsistence supplies) is then received and shared among the Inuit. This sharing process creates and defines the extended family—a foundation for sociopolitical relationships among the Inuit—which is based on cooperation and trust. This trusting and cooperative environment provides opportunities for the Inuit to share subsistence techniques. By elaborating on subsistence techniques, the Inuit can hunt a greater number of animals, and in doing so, they recreate its "self/other" relationship with animals into a "receiver/provider" relationship. This infinite cycle of subsistence simultaneously separates and synthesizes the Inuit and wild animals into *nuna*, which denotes a hybrid, sociocultural-natural network of human and nonhuman attributes.

Relationships that are generated through this circular process with wild animals are not limited to a specific type of wild animal but are instead open to many species; therefore, the extended family of the Inuit emerges at the intersection of multiple circular relationships between the Inuit and a diverse variety of wild animals. Moreover, the wild animals that are connected to the Inuit are ecologically interrelated. These animals are articulated as groups embedded in the network of their ecological relationships. This implies that the Inuit extended family comes into being blended as one articulation point in the vastly extended, interconnected ecological network of relationships through which several other groups of animals are also demarcated. This vast network that is ordered and woven through ecological and societal relationships forms the life world of the Inuit, which is called *nuna*. Thus, through the practice of subsistence activities, the minds of the Inuit extend into an extension circuit of mind called *nuna* that is woven through ecological and societal relationships between humans and wild animals.

The most important characteristic of this system lies in its resilience. This system has not collapsed but flexibly adapts to changing circumstances under any interventions from the outside world as long as the Inuit maintain their circular practice of subsistence. This is because the system is autonomously closed but simultaneously open to the outside, and forms what Maturana and Varela (1980) called an autopoietic machine.

In this subsistence system, social relationships among the Inuit and their ecologic relationships with various wild animal species are closed in their circulation. The acquisition of resources such as food and adjustments of social relationships in realms such as politics and economics (and thus their entire way of life) can be satisfied within the system. Therefore, the autonomy of subsistence as a way of life for the Inuit will remain unchanged if they continue to practice subsistence activities despite being subordinately connected to the globalized world network. Moreover, as long as social relationships among the Inuit and ecological relationships between humans and wild animals are cyclically generated, this system can maintain itself while accommodating external interventions. As previous studies indicate (Fienup-Riordan 1983; Kishigami 1996; Nuttall 1992; Stewart 1992, 1995; Wenzel 1991), Inuit society will be sustained through the continued practice of subsistence and will endure through the introduction of high-tech gadgets to subsistence techniques, and despite new tendencies toward eating processed foods such as hamburgers and pizza.

This is why the Inuit remain confident in being themselves and how they have retained a sense of drive that will lead them into the future. Despite being integrated

into global networks and marginalized and subordinated in systems of global capitalism and the modern nation-state, the Inuit may at any time escape from these networks and autonomously achieve the lifeway of their mind circuit through extension into *nuna*. This will continue as long as the subsistence system operates independent of global networks. In short, the Inuit have retained alternative ways of life, enabling them to survive when they escape from global networks. As a result, in situations where the Inuit engage in global networks, they do not passively engage with global capitalism and the modern nation-state, but remain autonomously independent as the Inuit entity incorporated in *nuna*.

It is this subsistence system that the Inuit has made longstanding efforts to protect through the Indigenous Peoples' Movement from the 1970s (*cf.* Omura 2010). These efforts have enabled them to maintain alternative ways of life and thus remain confident in Inuit identity. It is important to note, however, that the ability to create, maintain, and move between multiple extension circuits of mind is necessary for them to practice such an endeavor. It would be impossible for them to maintain and flexibly move between two extension circuits of mind if they engaged in only one extension circuit or were unable to objectify circuits despite having access to more than one. The contemporary Inuit lifeway, which involves flexibly moving between *nuna*—their own life world—and a global network, is made possible through the species-unique ability to consciously objectify and freely multiply extension circuits of mind.

The Diversity of Human Sociocultures that Have Flourished on Earth

This form of lifestyle that involves moving between multiple extension circuits of mind is not restricted to contemporary Inuit ways of life. Anthropologists have shown that various communities worldwide follow this practice. Such systems span broad networks including the global network extended from the West, Islamic networks, overseas Chinese networks, and local networks such as the Inuit *nuna*. From the ability to freely multiply extension circuits of mind, modern human beings have not only extended their minds globally but have also been able to create and maintain multiple local extension circuits of mind, or various ways of life, while moving between them.

This ability has also enabled modern humans to occupy all surfaces of the Earth. Modern human beings have effectively adapted to diverse ecological environments from the equatorial belt to the arctic tundra while maintaining their identity as a species. This has occurred because humans can create or improve extension circuits of mind as extra-somatic, optional devices to adapt to various environmental conditions because of their ability to consciously objectify the circuits. If recursive circuits of mind were not

consciously objectified and packaged according to intentions, it would be impossible to even come up with the idea of creating or improving circuits according to environmental conditions. On encountering new environments during migration, humans improve existing circuits or create new ones as optional devices to adapt to these environments, and optionally use them without being limited to existing circuits created to adapt to past environment. Consequently, humans settled globally while retaining their identity as a species.

Anthropologists refer to this ability to extend circuits of mind as optional devices for adapting to environments as "socioculture." With this ability to freely multiply extension circuits of mind, modern human beings have not only extended their minds globally but have also cultivated various sociocultures that are now ingrained in various environments worldwide. It can hence be concluded that the ability to freely multiply extension circuits of mind has resulted in two trends: 1) global networks extended across the Earth's surface, and 2) local extension circuits of mind, which adapt to and are ingrained in each environment.

4 Bio-sociocultural Diversity Accelerated by Space Development: Outer Space as a Challenge to Modern Human's Ability to Multiply Extension Circuits of Mind

If the ability to freely multiply extension circuits of mind represents a species-unique ability of modern humans, how will this shape the future of human society?

We can address this question on the basis of the opportunities and limits of human's species-unique abilities by studying various types of extension circuits of mind that have been developed by modern humans from the beginning of human history to the present through a review of anthropological records. However, it is now possible to address this question through another method, given that half a century has passed since modern humans first entered outer space, creating possibilities for humans to commence activities in this new environment. I approach this problem by considering the opportunities and limits that affect our abilities in outer space, which is an extraordinarily different environment from that of the Earth in which humans have adapted. The analysis will examine the following questions. Will humans be able to adapt to environments of outer space with the aid of this ability? If so, how would humans adapt to the environment, to what extent would humans adapt, and what forms of extension circuits of mind would be required? In the following section, I will examine these questions in depth.

Bio-sociocultural Diversity of Modern Humans Accelerated through Space Development

Outer space is a harsh environment for modern human beings who have evolved while adapting to the Earth's environment. It is virtually impossible for humans to survive in such an environment, where there no essential resources to human life available such as air, water, and food and where cosmic rays and solar winds would ruthlessly destroy human physiological systems. Even if environments enabling humans to survive were realized, as in the case of the ISS, human activities in outer space require special skills that differ from those developed by modern humans while adapting to the Earth's environment. As the human anatomy is profoundly influenced by microgravity, the human skeletal and muscular system would degrade through rapid adaptation to space conditions, and space sickness would occur through disturbances to sensory organs. Moreover, under conditions of microgravity, basic and trivial tasks, such as turning a screw or moving objects, require specialized cognitive and physical abilities unique to this situation.

Nevertheless, modern humans have already overcome such difficulties by commencing activities in outer space such as manned lunar investigations including the Apollo project, and long-duration stays in space stations such as the Mir and the ISS, although activities are restricted, which only few astronauts who are specially trained to perform special missions can achieve. In this sense, the global extension circuit of the human mind has already left the Earth and extended into outer space. Consequently, there has been a gradual adaptation of the extension circuit of mind to the outer space condition, as noted by anthropologists who have begun to study human activities in outer space. (Battaglia 2012; Codignola-Bo & Schrogl eds. 2010; Landfester, Remuss, Schrogl & Worms eds. 2011; Valentine, Olson & Battaglia eds. 2012)

For example, astronauts living and working on the Mir and the ISS have gradually devised new strategies for maneuvering, operating, and arranging their bodies and inanimate objects such as tools, commodities, and food, which are adapted to space station conditions, that is, a closed environment under conditions of microgravity. Since the sense of orientation is frequently disturbed because vertical relationships are never fixed by gravity, objects placed on a table or shelf drift about without notice, and a pen can turn into a missile due to a trivial operational error. Moreover, the art of social intercourse in closed environments has been gradually nurtured. Attention must be paid to human relationships and collaboration patterns across nationalities, strategies for cooperation that limit invasions of privacy within closed, narrow environments, and

even ways to exchange jokes with crew members under the stressful circumstances of outer space.

Given the diversity of environments in the extraterrestrial solar system that includes planets, asteroids, moons of planets, and space colonies in Lagrange points, the extension circuits of mind created in outer space would not be restricted to the global networks that already extend into space. Rather, future human beings would undoubtedly develop various forms of extension circuits of mind specific to unique environments, and with each encounter during space travel, humans will use the global network as a foothold. As a result, both global networks extended from Earth and many types of extension circuits locally created in accordance with various extraterrestrial environments would coexist in outer space, as in the case of various extension circuits of mind, from wide-area networks to local-area networks that coexist on Earth today. In this sense, with human expansion into outer space, the nature of future human society should possess two features: 1) global networks derived from the Earth that act as a foothold in outer space, and 2) local extension circuits of mind that adapt to and are ingrained in each extraterrestrial environment.

Furthermore, as several anthropologists highlight in relation to possibilities for biological human evolution in outer space, (Masali, Ferrino, Argenta & Cremasco 2010; Pálsson 2010) it is likely that the human body would significantly metamorphose over the course of generations in the adaptation to various extraterrestrial environments. While modern human beings have so far experienced biological changes through processes of adaptation to various terrestrial environments with human settlement across the Earth's surface, such as acclimation to cold weather, these adaptations have been restricted to variations within the same species. However, given that the bodies of astronauts, and skeletal and muscular systems in particular, are degraded under conditions of microgravity because of rapid adaptation, necessitating readaptation training upon return to Earth, it is highly possible that the human body may change through adaptation to extraterrestrial environments if changes between generations were to begin in this environment. Moreover, considering the advances in genetic engineering and cyborg technologies, it is possible that modern humans would modify their bodies to adapt to extraterrestrial environments. (*cf.* Pálsson 2010).

It follows from the above considerations that human expansion into outer space should bring about the greatest degrees of biological and sociocultural diversity among future human beings witnessed in human history. Using global networks extended from the Earth as a foothold in outer space, modern humans could extend their minds endlessly into space while developing various extension circuits of mind suited to each

extraterrestrial environment with every new environment they encounter when traveling within the solar system and beyond. Such environments may include space colonies at Lagrange points, extraterrestrial planets, asteroids, and moons of exterior planets. Thus, various extension circuits of mind created through the processes of adaptation to various extraterrestrial environments would arise from an enormous matrix of extension circuits of mind, that is, a global network centered on Earth. Moreover, given the possibilities of biological human evolution in outer space, human adaptation to different extraterrestrial environments would induce the highest degrees of bio-sociocultural diversity witnessed in human history, wherein extension circuits of mind act as extra-somatic, optional devices for adapting to environments and the biological body itself becomes diversified. Degrees of bio-sociocultural diversity would thus explosively develop through synergies between biological and sociocultural diversity.

Outer Space: A Challenge to the Abilities of Modern Humans to Multiply Extension Circuits of Mind

If human expansion into outer space resulted in unprecedented levels of bio-sociocultural diversity among future human beings, what types of extension circuits of mind would be created in this setting and on the basis of what types of biological changes? In other words, what features of bio-sociocultural systems would develop in this setting? Armed with bio-sociocultural devices for adaptation, to what extent would humans adapt to extraterrestrial environments that remarkably differ from those of the Earth where humans have adapted? Then, would it still be possible to refer to our descendants as "human beings," as they will have undergone forthcoming metamorphosis through processes of bio-sociocultural adaptation to various extraterrestrial environments? Rather, should they be viewed as a new species?

Outer space as a frontier confronts us with these questions. Certainly, it is difficult to provide answers to these questions now when human expansion into outer space has only just begun through the gradual extension of the global network to Earth orbits. However, assuming that human society will expand into outer space, is it not appropriate to at least consider what would happen to future human beings under such circumstances, and thus determine new topics that future anthropological studies should examine. Rather, anthropological studies must begin to discuss such problems under the current conditions, wherein the global network has already begun to extend into outer space, because anthropology as a discipline examines where human beings originated, their current situation, and where they are going. This proposal was

addressed at the symposium hosted by the ESF and ESPI in 2007, where specialists of the social sciences and humanities, including psychology, sociology, history, philosophy, anthropology, cultural studies, political sciences, and law, are invited to discuss the future of human society in outer space over the next 50 years. (Codignola-Bo & Schrogl eds. 2010; Landfester, Remuss, Schrogl & Worms eds. 2011).

Therefore, I finally consider what would happen to modern human beings in outer space and outline topics on which future anthropology should focus on the basis of this projection. I frame this discussion through reference to "The Vienna Vision on Humans in Outer Space" (*cf.* ESF 2010), which was adopted at the said symposium in 2007. In recognition of the fact that modern human society has already begun to expand into outer space, the following three periods of human society development in outer space over the next 50 years are predicted: 1) first odyssey, wherein human activities are performed within Earth-circling orbits; 2) second odyssey, wherein explorations into extraterrestrial space within the solar system would be executed; and 3) third odyssey, wherein migration to extraterrestrial environments would begin and colonization would proceed at full capacity. After elaborating on this vision, I consider the future of modern human beings in outer space and the task of anthropology in this future.

(I) Stage 1: The First Odyssey Period

This stage began when human beings started activities in Earth-circling orbits, though these activities have been restricted to narrow limits, as in the case of the ISS, wherein only few astronauts specially trained to conduct special missions have been able to participate.

According to the Vienna vision, during stage 1, technological problems will be handled so that technological developments will contribute to not only future space development directly but also solutions for problems on Earth from various technological spin-offs. Moreover, "through endeavors such as the ISS new partnerships are built, which can cultivate international cooperation in a spirit of friendship and mutual understanding" (ESF 2010: 230). Consequently, the identity of citizens of the Earth would be nurtured among human beings with an awareness that the Earth is a fragile oasis to be protected from natural and man-made threats. Moreover, the legal framework for space activities would be developed further "in a way that cultivates peaceful uses of outer space and equal rights for all humankind" (ESF 2010: 230).

According to the considerations listed in the above section, stage 1 can be understood as a preparatory period during which the global network has covered the Earth's surface while having begun to extend into Earth-circling orbits, thereby

developing a platform for future expansion into outer space. At this stage, space developments within Earth-circling orbits will be executed as an extension of the global network because the support provided by the network will be indispensable in maintaining human activities in space. This is already apparent in the present condition of activities on the ISS, wherein human activities are absolutely impossible without support from the global network on Earth in areas such as food and air supply, mechanical equipment maintenance, and control of navigation and daily activities. Thus, this stage involves making preliminary arrangements for future expansions of the global network into outer space as a nursery for different extension circuits of mind, which would develop at various extraterrestrial environments in the solar system.

The role of anthropological studies at this stage is to execute fieldwork at space stations (such as the ISS) and to describe and analyze the extension circuits of mind developing there. This must be executed in collaboration with related disciplines such as psychology, medical sciences, and biology. Anthropologists must then consider the opportunities and limits of both extension circuits of mind and the biological metamorphosis of future human beings through analyses of data gathered through fieldwork.

(II) Stage 2: The Second Odyssey Period

At this stage, explorations into extraterrestrial space within the solar system will be conducted using the global network as a foothold for expanding into outer space. According to the Vienna vision, at this stage, not only will various discoveries be made, including the development of new resources, but also human relationships across nationalities will be gradually established between international corporations and through the development of laws for long-term exploration.

This stage will also involve preliminary arrangements for future expansion of the global network into outer space as a nursery for future bio-sociocultural diversity, which would flourish in various extraterrestrial environments within the solar system. During this stage, human activities will continue to be advanced as extensions of the global network centered on Earth, though these activities will become more independent from the Earth owing to the need for self-support and the establishment of logistics for long-term and long-distance explorations.

Anthropologists at this stage must attend to explorations through the same types of fieldwork executed during stage 1. Considerations of the opportunities and limits of modern human beings in outer space will also be necessary at this stage. This must be conducted through the description and analysis of how extension circuits of mind will

develop and how the biological body will be influenced under the conditions of long-term explorations. Through these efforts, anthropologists may estimate the future bio-sociocultural diversity of future human beings in outer space.

(III) Stage 3: The Third Odyssey Period

This stage will begin with the birth of a child in an extraterrestrial environment as a result of human migration to such an environment. According to the Vienna vision, at this stage, modern human beings will gradually adapt to extraterrestrial environments that they encounter while traveling within the solar system, certain environments where they will likely encounter other forms of life. Consequently, human lifestyles, beliefs, values, and worldviews will radically change to the point where humanities and social sciences specialists studying these aspects of human beings in outer space would increase in importance.

According to the considerations listed in the above section, stage 3 can be viewed as the stage wherein the bio-sociocultural diversity of human beings begins to increase across the solar system on the basis of a vast extension circuit of mind, that is, a global network centered on Earth. Future human beings, who will have migrated to extraterrestrial worlds, such as space colonies at Lagrange points, the moon, exterior planets and their moons, and asteroids, will start to live self-sufficiently and autonomously to the point of raising children in these environments while maintaining connections with the global network centered on Earth. It is difficult to predict the forms of metamorphosis that would occur in the human biological body and the types of extension circuits of mind that would be developed at this stage. However, it is probable that bio-sociocultural extension circuits of mind locally adapted to each extraterrestrial environment in the solar system will arise from a global network acting as a nursery, allowing human bio-sociocultural diversity to flourish.

Anthropologists at this stage would visit diverse extraterrestrial societies and execute fieldwork similar to that conducted by anthropologists on Earth to investigate unique bio-sociocultures that will have developed from extraterrestrial environments, and thereupon examine opportunities and limits faced by future human beings. The most important issues that anthropologists should address in these investigations will be concerned with the following two facets of future human beings: 1) diverse bio-sociocultural extension circuits of mind created from various extraterrestrial environments in the solar system; and 2) a global network extended from the Earth as a nursery for diverse bio-sociocultures, which will thereafter act as a connecting network between them.

At this stage, the diverse bio-sociocultures that develop within the various extraterrestrial environments of the solar system should in turn become breeding grounds for further human expansion, and the opportunities and limits faced by future human beings would be explored by testing how far humans could adapt to more diverse environments beyond the solar system. Likewise, a global network centered on Earth, and spread across the solar system as a base and connecting network for diverse bio-sociocultures, would have the potential to not only provide a common ground for peaceful coexistence of and productive intercourse between these bio-sociocultures but also drive future human expansion beyond the solar system and further generate bio-sociocultural diversity in deeper outer space. It is also necessary to protect both bio-sociocultural diversity and the global network as a common ground that extends beyond the solar system and to examine the opportunities and limits to be faced by future human beings by studying them. These objectives will be of upmost priority for future anthropologists during stage 3.

While executing such tasks, future anthropologists will be confronted with a fundamental question: what is a human being? Future human beings will likely be radically metamorphosed both biologically and socioculturally from thorough adaptation to their extraterrestrial environments to the extent that they may evolve into strange beings that no longer appear human. The biological body will change radically, and in some cases the entire body may become a cyborg. The brain may no longer be a protein-based organ but a silicon chip. Moreover, the extension circuits of mind based on such metamorphosed biological bodies are likely to exhibit further radical changes. Under these conditions, anthropologists should address the question of whether future human beings that have radically metamorphosed biologically and socioculturally should be called "human beings."

As Battaglia (2005, 2010) has already predicted, anthropologists should further reconsider how to identify future human beings as bio-sociocultural species and explore ways for them to interact in circumstances of more radical differences than modern human beings have so far experienced. Is it possible to interact in the presence of radical differences in a future world where bio-sociocultural diversity increases to a degree where commensurability among future human beings grows more and more indefinite? This issue will become central, as the Vienna vision highlighted, when humans encounter other forms of life.

5 The Two Faces of Tomorrow: Human Bio-sociocultural Diversity Expanded through Space Development

In this study, I examined the future of space development on the basis of human evolution, focusing on the human ability to freely multiply and extend circuits of mind to the environment. First, on the basis of the hypothesis of "cumulative cultural evolution" proposed by Tomasello and Bateson's model regarding the evolution of learning, I showed how this ability has enabled human beings to expand across the Earth's surface. Then, referencing Inuit societies of the Canadian Arctic as a case study, I examined the present conditions of the human world while focusing on the relationship between a global network and diverse, regional subsistence sociocultures. Finally, in accordance with this consideration, I proposed that space development should have two facets: (1) it should continue to extend the human world as far as possible beyond the terrestrial world and into outer space, and (2) it should also protect human bio-sociocultural diversity so that it flourishes on Earth as well as in outer space in the future.

On the basis of these considerations, I then predicted issues that future anthropologists must address and proposed numerous essential focuses. Just as modern anthropology has so far been required to protect and study modern human sociocultural diversity, including global networks, to determine ways to maintain interactions between diverse sociocultures on Earth, future anthropologists should be required to protect and study future human bio-sociocultural diversity, including global networks centered on Earth, to identify methods for maintaining a circuit for communications between bio-sociocultures in outer space. In this sense, future anthropologists should engage in the same tasks of modern anthropology by protecting diversity and simultaneously maintaining circuits for communications beyond it, though the magnitude of diversity that they would have to address would be different.

Although it is not known what type of future awaits us in outer space, it is likely that future human beings living in space would be more diverse than we can now imagine. Certain humans may metamorphose both biologically and socioculturally. They may seem strange to us, and we may feel a sense of repulsion toward them; however, such would also be the case for our ancestors born on Earth 250,000 years ago. Our ancestors might be repulsed if they saw us, as we have radically metamorphosed since then. Rather, it is in this ability to radically change beyond our current imaginations that the potential of human beings should be latent. Without such an ability, modern human beings would have never settled across the surface of the Earth. Freely multiplying extra-somatic, optional extension circuits of mind, namely sociocultures, humans have been able to socioculturally change to adapt to diverse

terrestrial environments from the equatorial belt to the arctic tundra, realizing marvelous sociocultural diversity. Moreover, it is because we have maintained a circuit for intercourse between such diverse sociocultures that we have been able to launch into outer space.

This may also be the case for outer space; rather, given the conditions of outer space, where environments are more severe and diverse than they are on Earth, levels of bio-sociocultural diversity should increase our viability as species more than sociocultural diversity has helped us flourish on Earth. Can future human beings that metamorphose according to extraterrestrial environments still be called "human beings," or should they be viewed as having been reborn as a new species? To what degree is it possible for future human beings and new species to maintain communications beyond bio-sociocultural diversity expanding more than we have so far experienced? If it is possible, it should be far more difficult to maintain relationships than we can imagine now. However, challenging these crucial problems, future anthropology should fully and truly mature as the discipline that asks where human beings originated, their current situation, and where they are going. In this sense, the goals of future anthropologists should be to serve future human beings and new species as guardians that protect both bio-sociocultural diversity and communication circuits beyond it.

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Ⅱ. Television and Japanese imagination of outer space

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Abstract

This study examines the characteristics of the Japanese imagination of outer space in conjunction with its representations in television and cinema during the late 1960s. Cinema and television have offered the Japanese many films and television programs in the form of dramas, news programs, documentaries, and variety shows on the topics of space, the space race, space flight, and astronauts. An historic event was the live broadcast of Apollo 11's moon landing on August 20, 1969. These programs constructed and changed Japanese viewers' perception and imagination of outer space. Applying the methods of film studies, this study analyzes these television programs and related films with the aim of historicizing one aspect of the Japanese imagination of space.

Keywords: cinema, television, media, Apollo, film

This study examines changes in the Japanese imagination of outer space through visual media such as television and cinema. I have studied many news and other television programs on Apollo 11, which was launched on July 20, 1969[1]. Many television networks carried a live broadcast of Apollo 11. This programming achieved the highest audience rating (over 60 percent) in Japan ("Gurabia" 35), and this historical media event has been long remembered by the Japanese.

Our imagination has been constructed and, at the same time, restricted by the historical context of audio-visual media and each decade's technological networks of media. In this sense, the live broadcast of Apollo 11 was a groundbreaking and historical event that

[1] This work was supported by the "Trial Project on Academic Use of the NHK Archives" from October 2013 to March 2014.

human beings had not witnessed before. As Takeshi Kawai, one of the editorial committee members of the *Mainichi* newspaper, wrote in 1969 that this live broadcast of Apollo 11 represented a moment in which people were able to think of themselves as human beings for the first time (Kawai 45).

Before this event, several famous photographs and moving images of outer space had influenced many people. One is the color photograph that we call "Earth rise," which an Apollo 8 astronaut took from space in 1968. Another photo, "Blue Marble," was taken by Apollo 17 crewmembers in 1972 (AS17-148-22727). Cultural geographer Dennis Cosgrove stated that "Blue Marble" changed and evolved the Western global image and "the world is radically decentered" (Cosgrove 261). In fact, "Blue Marble" has since been used as part of the logos and trademarks of many international and natural environment societies and institutions.

Onemovies about space had appeared before the live broadcast of Apollo 11: *Powers of Ten* (1968), directed by Charles Ormond Eames and Ray Eames and based on the children's book *Cosmic View*, which was published in 1957 by Dutch scientist Kees Boeke (Borke). In the book, pictures of different scales are separated by each page, and so the reader has to turn the pages to see the different scales of another picture. But, the film, *Powers of Ten*, depicts the changes in the scales through one continuous long take through tracking shots of the camera. This film gives viewers a new visual perspective in which the entire world, from the earth to the universe, can be seen in a few minutes. This film was screened in many countries and influenced many people around the world. During the 1960s and the early 1970s, these global images enhanced our perception and imagination of space and the universe, and provided us with a new visual recognition that enabled us to see human beings from an objective perspective.

However, the impact of the above mentioned photographs and moving images were not the same as that of the live broadcast of Apollo 11 in 1969. The differences can be described in words such as "simultaneity" and "real-time." The invention of broadcasting satellites in the early 1960s enabled television networks to transmit programming live all over the world, and as a result, more than 600 million people saw the live broadcast of the Apollo 11 moon landing (Kawai 43).

In 1963, the first US–Japan satellite broadcasting was conducted using the Relay 1 satellite. Thus, in 1964, when the Tokyo Olympics were held, many of the sports competitions were transmitted live from Japan to the US.

In 1968, the Mexico City Olympics were broadcast live every day for the entire period. In terms of Apollo, broadcasting from space began with Apollo 7 and lasted until the end of the project. But, Apollo 11's journey was exceptional because that spacecraft landed

for the first time on the moon's surface. NASA revealed that media crews from 57 countries came to NASA to report this historical event and live images were broadcasts to 47 countries (Ishida 20). It was estimated that about 17 percent of the world population saw the live broadcast of Apollo 11.

Now, focusing on the live broadcasts of Apollo 11 in Japan, the historical importance of transmitting the Apollo 11 event in the US has been discussed in prior research and previous studies, such as those by Harlen Makemson and Michael Allen (Makemson, Allen); however, concerning these broadcasts in Japan, no prior studies exist from the perspective of film studies and media studies.

Three major Japanese television networks broadcast the Apollo programs: NHK, NTV, and TBS. But, the most successful network was NHK. At the moment when Apollo 11 was launched, the audience rating in Japan was 63.1 percent. And, when the lunar module landed on the surface of the moon, the audience rating was 26.7%, which was very low because, at that moment, it was around 5 am in Japan. The audience rating for Neil Armstrong's stepping onto the moon's surface was 62% ("Hoso tenbo").

Yutaka Suzuki, a researcher at NHK during that time, analyzed data from questionnaire surveys and insisted that the entirety of the events related to Apollo 11 was more suitable for television broadcasting than for any other media, such as radio, newspapers, or weekly magazines (Suzuki 27).

Moreover, Masaaki Segawa, who was the chief producer of the Apollo 11 television programming at NHK, recalled that a live translation from English to Japanese was an essential part of this broadcasting and that he planned to show it for the following three reasons:

To emphasize the history of civilization
To provide real-time reporting
To offer a scientific point of view (Segawa 9)

We can easily confirm these three points that Segawa emphasized if we examine the first scene of Apollo 11's moon landing. In the background as the main title and credits are being shown, we can see that announcer, Tsuneji Tsukagoshi, and commentator, Murano, are talking and we can hear their voices. Moreover, we can also hear live English conversations taking place between Apollo 11's crewmembers and the commander of NASA in Houston. At the same time, we can see the television camera filming two men at the left side of the frame. These characteristics of an opening scene reinforce the atmosphere of live broadcasting, not recorded footage, and the sense that

the television studio is receiving new information every minute.
Then, Tsukagoshi starts talking to the television audience:

Now, the day that a human being lands on the moon has arrived. What makes this moon trip different from the previous adventures? The fact that men just like us are now working on the moon, which is 380 thousands kilometers far from the earth. We are able to see their workings in detail through televisions and radios. [……..] This moon trip can be considered as being extremely significant for us, humankind. And, this can be regarded as the beginning of the age of space discovery.

We can recognize two points in this introductory narration. One is the power of real-time reporting and other is the perspective on the history of civilization. This program invited scholars from the field of astronomy to emphasize the need for a scientific point of view.
It must be noted that the very moment at which the lunar module landed could not be shown live because the modulewas flying on the back side of the moon,and it could not transmit radio waves to the earth. Therefore, television audiences all over the world could only hear the voices of the astronauts and the commander at NASA. As a result, the NBC and CBS networks in the US constructed studio sets so that the moon landing could be simulated with actors (Allen 145-146). But, NHK in Japan did not do this, and showing a primitive form of computer-generated imagery (CGI) to its Japanese audience instead. This was a historical moment, because the imaginations of television viewers throughout the world were united even without their seeing the real visual images of the moon landing itself.
With the help of broadcasting satellites and a global system of television networks, the Apollo 11 media event in 1969 enabled people to feel as if they were experiencing the moment in real-time—that the whole world was connected with the moon—as they sat in their living rooms. In other words, the people watching the live television broadcast were able to share a sense of “unity” with audiences around the world. This sense of unity did not occur with the photograph *Earthrise* or the film of *Powers of Ten*.
It is possible that this study of the Apollo 11 media event in Japan will be expanded into a larger international joint research project that will compare the characteristics of each country’s treatment of Apollo 11 in its media.

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Ⅲ. A socio-cultural study of the discourses of *mono-zukuri* in the manufacturing of launch vehicles in Japan

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Abstract

The space industry encompasses a variety of economic activities, including the manufacturing of satellites, rockets, and other products. These complex products are manufactured under socially multilayered supply chains involving numerous companies in Japan. In recent years, the manufacturing process has often been discussed in terms of *mono-zukuri*, a term associated with traditional handicrafts. This paper will examine the contexts in which the word is used and contexts that have socio-cultural implications.

Keywords: Space industry, supply chain, *Mono-zukuri*

1. Introduction

The space industry encompasses a range of economic activities including the manufacturing of products that will eventually go into space in the Earth's orbit. Thus, it is an industry that utilizes outer space for commercial reasons.

In Japan, the Basic Plan on National Space Policy was established to plan Japanese development and utilization of outer space. Enacted in 2008, its purpose, according to Article 24 of the Basic Space Law, is to promote integrated and systematic measures for

the development and utilization of outer space.

The suppliers of products to the space industry are often large companies, with many small and medium-sized companies also manufacturing machinery and parts. These complex products are manufactured by socially multilayered supply chains between many companies.

Some machinery and parts are manufactured in small factories, called *machi-kouba* in Japanese, that do subcontract work. The manufacturing process is not a mechanical activity which could be described in a manual, but rather a complex, elaborate, and socially and economically mediated activity. The workers often referred to as *syokunin*, meaning "craftsmen," must be able to exercise appropriate behaviors in their work, such as adjustment to change, communication, and management of knowledge.

In recent years, their work has come to be frequently discussed in the context of *mono-zukuri*, which literally means to manufacture and produce things. The recent uses of this word are not necessarily traditional. This paper will examine the social contexts in which the word is used as well as its connotations.

2. Division of labor in the manufacturing of launch vehicles

The Japanese rocket H2A is an active expendable launch system operated by Mitsubishi Heavy Industries (MHI) for the Japan Aerospace Exploration Agency (JAXA).

The production of H2A involves several large Japanese enterprises.[2] NEC produces the inertial guidance computer; Kawasaki Heavy Industries, Ltd., the fairing and payload attachment fitting; Japan Aviation Electronics Industry Ltd., the inertia sensor unit; Mitsubishi Precision Co., Ltd., the electronic component package and rate gyro package; Mitsubishi Space Software Co., Ltd., the guidance program; IHI Corporation, the LE-5B turbopump and LE-7A turbopump; IHI Aerospace Co., Ltd., the solid rocket booster, pyrotechnic composition, and reaction control system; and Mitsubishi Heavy Industries, Ltd., the coordination and total fabrication of the rocket engine and LE-7A and LE-5B engine.

The rocket parts are custom-made from a range of materials that must be processed with high machining and positioning accuracy. Considering that only around two H2A rockets a year are launched and the amount of production is significant, manufacturing is assumed to be costly, with low production.

These large enterprises are associated with numerous small and medium-sized

[2] "Space industry in Japan" December 18, 2014
(http://aerospacebiz.jaxa.jp/jp/spaceindustry/company/h-iia.html)

enterprises (SMEs) through procurement and supply chains of hierarchically structured subcontractor networks. There, we can see a microcosm of industrial structure through the domestic division of labor.

Most Japanese people are not employed by larger enterprises but by small and medium-sized enterprises, SMEs.[3] Many economists point it out that Japanese procurement-and-supply-chain have a vertical structure. The well-known role of Japanese SMEs' agglomerations is the formation of hierarchical and subordinate subcontractor networks. The pyramid-like hierarchical structure of inter-firm networks is formed.

At a glance, rocket production also uses this procurement-and-supply-chain system. As an example, we will examine MHI's Nagoya Aerospace Systems Works, where the manufacture of aerospace instruments and appliances, the repair and manufacture of fighters and helicopters, and the assembly of planes and rockets are carried out. This facility and MHI Nagoya Guidance & Propulsion Systems Works are important bases for MHI's aerospace businesses. According to public materials from MHI's Nagoya Aerospace Systems Works, we can confirm procurement and supply relationships with SMEs, which are concentrated in the city district of Nagoya and the peripheral area.

In recent years, Japan has increasingly recognized the importance of SMEs, inter-firm networks, and industrial agglomerations, because of the impact of globalization on Japanese leading industries. It has come to be regarded that some traditional and high technology can be accumulated in the fields of Japanese *mono-zukuri*, concretely, *machi-kouba* of many SMEs. This consciousness of technology has driven Japan to differentiate itself from rising economies, particular its neighboring countries.

3. The field of *mono-zukuri* in *machi-kouba*

Takahiro Fujimoto has defined *mono-zukuri* as the duplication of design data into an object.[4] He has also called it the "art, science and craft of making things." I assume the notion of *mono-zukuri* as duplication of a design depends on a point of view of data processing in computer. If approached as a kind of planning model, it locates the organization and significance of human action in underlying plans.[5]

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[3] Roberson, James M. 1998. Manufacturing Men: Working Class Masculinities in Japan. Hitotsubashi journal of social studies, 30(1), pp.45-59.

[4] Fujimoto, Takahiro. 2004. Nihon no mono-zukuri no tetsugaku [Monozukuri Philosophy of Japan]. Nihon Keizaishimbunsya, Tokyo. (in Japanese)

[5] Suchman, L. 1987. Plans and situated actions: The Problem of Human-Machine Communication. Cambridge University Press, New York.

At least, in the context of *mono-zukuri* in *machi-kouba*, we need to pose the converse question of how an object will affect a worker rather than how a worker as subject to an object. In other words, it is a question of de-subjectification. The human participant is an active and perfomative being as well as a passive being.

We can understand this from the writings of Tomohiro Koseki.[6] He is a well-known labor writer who has worked as a skilled machinist in Tokyo for over forty years. He has published many books describing the life and work of factory workers in small factories very vividly and in depth. These publications are an excellent collection of labor history documents in post-war Japan.

According to Koseki, factory workers use a special language for metal processing. For example, *Kezuru*, "shave, plane, sharpen;" *Hatsuru*, "shave little by little;" *Hiku*, "saw, grind, mill;" *Kiru*, "cut;" *Hezuru*, "scrape the outer surface;" *Kisagu*, "shave off;" *Momu*, "make a hole;" *Eguru*, "hollow;" *Sarau*, "clear;" *Nameru*, "to smooth;" and *Mushiru,* "movement as if to pull the feathers off a chicken."

Moreover, workers tend to regard metal as a living thing. This is reflected in expressions such as "the metal cries" and "the metal is glad."

Expressions change, depending on products made, tools used, and work procedures. The materials affect workers, and individual workers making full use of their skills make adjustments between materials and means of production, and colleagues. In that sense, the process of *mono-zukuri* is not a simple duplication.

An interesting metalwork method, metal spinning, or *hera-shibori*, is used for some Japanese rocket parts manufactured in some small town factories, and demonstrates the centrality of *mono-zukuri*. Materials subject to metal spinning are iron, copper, aluminum, and other metal sheets. An iron *hera*, or spatula with circular head and a handle about 1.0–1.5 meters long, is applied to the piece in progress to mold it into shape.

Hera-shibori is used to manufacture both buckets for daily life and space rocket parts. It is a metal sheet-processing technique requiring precision manual work. Rocket nose cones and parabolic antennas, which are made with precision machinery, are often made by metal spinning. It is said that finished products boast higher degrees of precision than those made by state-of-the-art processing machines in terms of their fine details of processing.

A Japanese H2A rocket is like a solid cluster of precision parts, filled with

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[6] Koseki, Tomohiro. 2000. Iki na senbanko [Trendy turner]. Iwanami modern library. (in Japanese), Koseki, Tomohiro. 2002. Mono-zukuri no jidai: machi-kouba no chosen [Era of manufacturing: challenge of the town factory]. NHK library, Tokyo. (in Japanese)

state-of-the-art technology. Its nose cone is manufactured by metal spinning. Since these parts require a high degree of precision but are not made in large numbers, metal spinning, applied by a *syokunin* or craftsman, one item at a time, is best suited for their production.

Tomohiro Koseki noted that workers engaged in *mono-zukuri* are often considered as *syokunin*. The *syokunin* is a skilled manual worker who makes items, tools, or even machines such as the handmade devices.

Formerly, their work was considered simple manual labor not requiring a high degree of skill or expertise, nor specific years of experience. Their works were often ruthlessly labeled "3K," for the first letter of the three words *kitsui* ("harsh") *kitanai* ("dirty"), and *kiken* ("dangerous") in Japanese.

However, factory workers tend to identify themselves as *syokunin*, and are also identified as such from the outside. Therefore the former positioning has shifted. The Japanese traditional word *syokunin*, used in the context of *mono-zukuri*, now has socially positive connotations.

4. Discourses of *mono-zukuri*

Again, I will discuss the term *mono-zukuri*. The word *mono-zukuri* simply means to produce something. It is always written in hiragana or katakana, which are Japanese characters. According to Kojien, one of the authoritative dictionaries of Japan, the meanings of this word are the following: 1. To cultivate, farm, or a farmer; 2. Events to celebrate the little New Year. Originally, the word was related to agriculture.

The word *mono-zukuri* has special connotations. The meaning of *mono* in Japanese ranges from visible and touchable materials to general events – in other words, anything that can be perceived and recognized as an object. Its meaning also extends to invisible and spiritual beings, as the words *mono-no-ke* or *tsuki-mono* indicate.

The word of mono would be compared to the word of *mana*, which is found in Austronesian languages and indicates magical power. While relying on Levi-Staruss's view, Komatsu points out that the word of *mono* and the word of *mana* are mutually interchangeable concepts.

In any case, the concept encompassed by *mono* is comprehensive and ambiguous.[7] In that sense, the word differs from the word "thing" in English, which also has a variety of

[7] Komatsu, Kazuhiko. 1994. Hyorei shinko ron: yokai kenkyu no kokoromi [An essay on the worship for spirit possession: Challenge for the study of yokai]. Kodansya gakujutsu bunko, Tokyo. (in Japanese)

meanings: an inanimate object, an action, event, thought, or utterance, but basically means something to be visible.

Of course, we are careful not to simply see the word of *mono-zukuri* in modern Japanese society from a religious perspective. But, as Koseki has written, it is clear that people engaged in *mono-zukuri* do not consider *mono* simply as material thing.

It is necessary for us to see that its former usage is clearly different from the current one. Its usage has extended to encompass production and manufacturing in general in a modern factory. Although the word which seems to be somewhat antiquated has been frequently used in newspapers, magazines, and reports, it spread to more general use in the second half of the 1990s.

A search on the full-text database system for the Minutes of the Diet[8] showed the word had clearly emerged in the policy discussion in the plenary session of the House of Representatives on the March 12, 1992. At this time, it was placed on the agenda to amend the part of Dentoteki kogehin sangyo no shinko ni kansuru horitsu, the Act on the Promotion of Traditional Craft Industries. This law had been enacted as a law for the promotion of Japanese traditional crafts industry on May 25, 1974. Sanji Muto, a member of the House of Representatives, spoke as follows.

From this point of view, the merits were proposed in order to achieve the following. To convey the “mono-zukuri no kokoro”, spirit of manufacturing, for posterity. Its spirit is traditional to Japanese culture. As a unique culture that has been nurtured in the history and culture of the region, the traditional craft industry should be reactivated and strengthened. The industry is the face of the region.

It can be seen that *mono-zukuri* refers to Japanese traditional crafts from the translated quotation above.

However, the situation changed. In 1998, the Japanese Prime Minister’s Office set up a *mono-zukuri kondankai*, a consultative council on *mono-zukuri*, and enacted *Mono-zukuri kiban gijutsu shinko kihon ho,* the Basic Act on the Promotion of Core Manufacturing Technology, on March 19, 1999. The preface of the basic act is as follows.[9]

By way of supporting the development of the manufacturing industry, which is Japan's

[8] The full-text database system for the Minutes of the Diet (http://kokkai.ndl.go.jp/)
[9] Japanese Law Translation, December 18, 2014.(http://www.japaneselawtranslation.go.jp/?re=01)

fundamental industry, Mono-zukuri kiban gijutsu, core-manufacturing technology, has contributed to the development of all areas of the national economy such as to the expansion of production, promotion of trade, creation of new industries, and increase in employment; and has contributed to improving the lives of the citizenry. In addition, workers engaged in operations related to core manufacturing technology have played an important role in maintaining and improving the level of technology in their capacity as supporters of such technology.

We believe that the economic and social role of such core manufacturing technology and workers who engage in it will continue to be an important element in the foundation of the existence of the State in the future.

Recently, however, due to changes in the employment structure, changes in competitive conditions resulting from factors such as the progress of industrialization overseas and other diverse and structural changes in the economy, the share of the manufacturing industry in Japan's gross domestic product has fallen, and concerns about a decline in the industry have grown, and the smooth succession of core manufacturing technology is becoming difficult.

In order to address such a situation and maintain the sound development of Japan" national economy through the development of the manufacturing industry, which is a fundamental to the State, the active promotion of core manufacturing technology is indispensable, while the social respect for skills related to core manufacturing technology must be enhanced.

We hereby establish this Act to drive forward measures for the promotion of core manufacturing technology in a comprehensive and organized manner.

It is said that the purpose of the act was to reverse the trend of de-industrialization and the hollowing out experienced by Japan after the Japanese financial bubble in the 1990s by reaffirming Japan's strengths in manufacturing.

Here, I would like to highlight the usage in recent days of the word *mono-zukuri*; nevertheless there are already two other words for manufacturing and production: *seisan,* 生産, and *seizo*, 製造, written in Chinese characters, and s*eisan* and *seizo* are used for all types of modern manufacturing and production. Now the word *mono-zukuri* has been used to describe technology and processes integrating development, production, and procurement.

Then, the word is always connected with intangible qualities such as Japanese traditional craftsmanship and connotes the manual dexterity of Japanese craftsmen. The modern manufacturing is apologized by this word. Perhaps its word written in

Japanese original characters will give many of Japanese people a familiar and old-fashioned feeling. They are convinced of the Japanese industrial strength that made Japan an economic powerhouse in the 1970s and 1980s.

5. Conclusion

The manufacture of a rocket is based on a social division of labor. While it may change, it remains deeply connected to conventional Japanese social and economic structure.
On the other hand, rocket production with state-of-the art technology is often discussed with stereotyped sayings and expressions from both traditional technology and advanced technology. To emphasize *mono-zukuri* in Japan suggests the strength of the Japanese manufacturing industry, especially SMEs, which have been overlooked as unimportant.
Certainly, it is a fact that some SMEs have a high level of technology and international competitiveness, and have supported Japanese society and its economy. And, the skilled workers called *syokunin* in some of the SMEs do fine work.
Under the situation, it tends to be believed that only the *syokunin* is capable of producing a highly accurate product.
The head of Kitajimashibori Works, a company familiar with *hera-shibori,* echoed this sentiment in a report.[10]

A special feature of the processing of hera-shibori *is that only one metal modal is necessary Thus, it is not more expensive than the press work, and the products are manufactured using a quick and easy method. This is a good point. However, this processing reduces mass productivity because of manual procedures. Since the work is done by hand, it has the advantage of being suitable for small-lot production. So, we are selective in which method we use: Press work is used to manufacture simple items, the* hera-shibori *is used for complex items and small quantities, for example, the parabolic antenna and nose cone of a fuel tank of a rocket and an aircraft. An accuracy in dimensions of more than five-hundred is often required. Press work is not easy because of their size. The answer to the question of whether highly precise and fast processing is possible is not Yes or No. Numerical control machining is possible to shorten machining time. But, it takes a long time to make a program. Further, only* syokunin *with skills in*

[10] Iida Fumiaki et al. 2008. Keep Craftsmanship! Japanese Small Factories' Potentials: Aerospace, Journal of the Japan Society for Precision Engineering, 74(6), pp. 571-575. (in Japanese) This citation is what is summarized by the author.

hera-shibori *can do so.*

The head believes only the *syokunin* are capable of producing a highly accurate product. But, we can read the other important aspect. It is a fact that the company selectively employs a specific technology. Rather than of whether technically possible, its employment will be considered to be largely dependent on economic factors of cost. This suggests the following: if the manufacturing of launch vehicles is under a different situation from the current, for example, the product is under mass production, the absolute necessity of the technology with a focus on such handwork may not be ensured. In conclusion, it can be said that the discourses of *mono-zukuri* assume to keep the current economical and social situation in Japan, and will justify the presence of somebody who expresses in their language, or that there is a sense of nationalism hidden in the discourses.

Ⅳ. Anthropology of "First Contact"

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Abstract

This study considers human contact with extraterrestrial intelligence, the so-called "first contact" in science fiction, from the perspective of anthropology and communication theory. Science fiction has performed various thought experiments regarding whether and how mutual understanding is realized in such human–alien interaction circumstances. First contact can be classified into two categories: the scaffold for understanding based on rationality and objective truth, or on embodiment and internal understanding. Finally, we discuss the existence of another layer that we call the "stance of understanding," namely, the belief that "they must be trying to communicate."

Keywords: First Contact, Science Fiction, SETI, Cultural Relativism,
Stance of Understanding

1."First contact" and the Philosophy of Communication

First contact refers to the first encounter between different groups or individuals. Generally, it is a concept in cultural anthropology, which implies the contact between two different cultural groups. In science fiction (SF), it is a major theme exploring meetings between humans and extraterrestrial intelligence (ETI). In 1945, Murray Leinster wrote the novel *First Contact*, which described an encounter between two spaceships, one human and one alien, in the Crab Nebula. This novel established the "first contact theme" in SF.

This study explores mutual understanding between human beings and others, using descriptions of first contact that appear in SF as thought experiments. It is not an

outrageous idea to cite ideas from SF in the human sciences that treat communications or social interactions. For example, the philosopher Ludwig Wittgenstein's *Philosophical Investigations* [11] contained a metaphor of a Martian.

"I see a picture; it represents an old man walking up a steep path leaning on a stick — How? Might it not have looked just the same if he had been sliding downhill in that position? Perhaps a Martian would describe the picture so. I don't need to explain why *we* don't describe it so."

Anthropologist Gregory Bateson also used the example of a Martian in *Mind and Nature* [12]. In a class that he taught at the California School of Fine Arts, he brought paper bags. From one of them, he took out a freshly cooked crab and presented the following challenge to the class:

"I want you to produce arguments which will convince me that this object is the remains of a living thing. You may imagine, if you will, that you are Martians and that on Mars you are familiar with living things, being indeed yourselves alive. But, of course, you have never seen crabs or lobsters."

Thus, Bateson introduced the students to questions concerning life, entropy, and regularity. Takeshi Ohba [13], a leading Japanese ethicist, cited SF writer Yasutaka Tsutsui's short story *Worst Contact* [14] (a parody of "first contact"), to discuss the basis of communication. In this story, an Earthian lives in close contact with an alien named Kelala from the Mag-mag star for one week, to test how well each comprehends the other. Every time the Earthian thinks that he understands Kelala, he is betrayed, and he ultimately becomes neurotic. In these examples, the Martian, or alien, represents others with whom one can never associate. This is probably because these fictional aliens lack certain abilities possessed by humans. But, which ability do they lack? This is the question I address in this study.

Masaki Yamada, a famous Japanese SF writer, stated that "the possibility of science

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[11] Wittgenstein, L. *Philosophical Investigations*. Blackwell Publishing 1953, p.54.
[12] Bateson, G. *Mind and Nature: A Necessary Unity*, Wildwood House 1979, p.6.
[13] Ohba, T. *Who Are the Others?: Ethics of Self-Organizing System*. Keiso-shobo, 1989, p.46. (in Japanese).
[14] Tsutsui, Y. Worst Contact, *Space Hygienic Exhibition*, Shincho-sha, 1982. (in Japanese)

fiction consists in the imagination of the matters which *cannot* be imagined" [15]. Hence, philosophers have used the example of an alien in discussing communication. In high-energy physics, some characteristics of material that do not exist in ordinary conditions can be seen in the ultimate state. Similarly, cumbersome "everydayness" in communication can be unveiled only when we consider an extreme example, such as first contact with an alien.

2. Is ETI Understandable?

Here, we focus on the problem of mutual understanding. Is an alien or ETI understandable? In fact, the answer is beyond us because no one has yet met an alien. Nevertheless, it is worth considering this problem as a basis of communication.

One possibility is that understanding will be accomplished using rationality, such as represented by mathematics. For example, the "Arecibo message" was sent to the M13 star cluster in 1974, from the Arecibo Observatory in Puerto Rico. This message consisted of 1,676 (=23 × 73, a product of two prime numbers) bits. On drawing, a 23 × 73 rectangle (Fig. 1) appeared. The authors of this message thought that if the aliens who received it were intelligent, they could perform prime factorization. This trial message was based on the idea that mathematical truth holds throughout the universe.

Fig. 1. The Arecibo message.

A similar idea is that mutual understanding can be attained based on physical laws. A message plate (Fig. 2) was placed in the Pioneer 10 spacecraft in 1972, which was the first human-built object to leave the Solar System. The upper-left figure of the plate shows a schematic representation of the hyperfine transition of hydrogen, which represents a wavelength of 21 cm, as the unit of length.

"Similarity of body" might also be a basis for understanding ETI. According to this idea, even without using mathematics or physics, if an alien's body is similar to a human body (i.e., the alien appears "humanoid"), understanding becomes possible. However, why should body similarity result in

[15] Yamada, M. *Hunting the God*, S-F Magagine May 1974, 1974. (in Japanse)

understanding? This is actually a difficult problem to solve. The idea that a common basis for communication exists, such as mathematical truth, physics, or the body, corresponds to "anti-relativism" in cultural anthropology.

Alternatively, in some SF, the alien is incomprehensible. One example is the novel *Solaris* [16] by Stanislaw Lem. Solaris is the name of a planet, and its oceanic surface has some kind of intelligence. However, every attempt by human researchers to communicate with it ends in failure. Tsutsui's *Worst Contact*, mentioned above, is another good work, albeit slapstick, that depicts unintelligibility. This perspective corresponds to "relativism" in cultural anthropology.

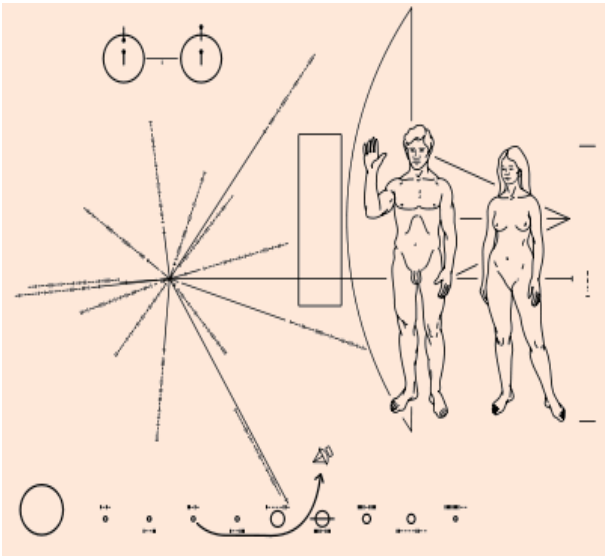

Fig. 2. The Pioneer message.

If the Search for Extra-Terrestrial Intelligence (SETI) succeeds, cultural anthropologists will be called on to discuss the understandability of intelligence. They should prepare themselves for this by considering the problem of relativism.

3. Stance of Understanding

SF portrays many kinds of aliens. Some are friendly, such as Steven Spielberg's character E.T., whereas others are hostile: Fred Saberhagen's *Berserker* book series [17] provides a typical example of hostile aliens. However, even hostile aliens can have a common basis for understanding, that is, "we are hostile toward each other." Therefore, hostility is said to be "one kind of understanding." I call this the "Tom and Jerry paradox" because the cartoon characters Tom and Jerry are always fighting in a friendly manner. Yet, a common basis, which we can call a "stance of understanding," still remains between them. We can use philosopher Donald Davidson's "principle of charity" [18] to try to understand others, that is, "We make maximum sense of the words and thoughts of

[16] Lem, S. *Solaris*, 1961, MON, Warker.
[17] Saberhagen, F. *Berserker* , 1967, Ballantine.
[18] Davidson, D. A Nice Derangement of Epitaphs. LePore, E. (ed.) *Truth and Interpretation: Perspectives on the Philosophy of Donald Davidson*. Blackwell, Oxford. 1986, pp.433-446.

others when we interpret in a way that optimises agreement" to try to understand others. The aliens described in *Solaris* or *Worst Contact* discard this stance from the onset.

Thus, we find two layers of mutual understanding (Table 1). On the lower layer, an effort to understand the other party exists, even if the relationship is friendly, such as that seen in *E.T.*, or hostile, such as that in the *Berserker* series or in *Tom and Jerry*. On the upper layer, the existence of an "intentional stance of understanding" itself becomes a subject of discussion, such as in *Solaris* or *Worst Contact*. To use a philosophical term, it can be called the "transcendental layer," because the basis of communication itself is questioned here.

Then, our problem is whether such an "intentional stance of understanding" that mankind probably has, emerges naturally in ETI or not. Let us examine this question by considering the nature of life. One principle attribute of the living body is "self-replication." Therefore, any living body must be "similar to others" in this sense. Given such a condition, in which one is surrounded by many "similar others," the intentional stance of understanding might emerge naturally. If this supposition is applicable to aliens, they might also have such a stance, and first contact with them could be achieved successfully.

Table. 1. Two layers of mutual understanding

Intentional stance of understanding exists		Intentional stance of understanding does not exist
Friendly	Hostile	n.a.
E.T.	*Berserker*, *Tom and Jerry*	*Solaris*, *Worst Contact*

Ⅴ. The Humanistic Approach to Space Exploration: A Cultural Anthropological Look at Space Tourism

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Abstract

This paper examines private space flights from the viewpoint of "tourism anthropology," a subfield of cultural anthropology. One difference that a private space flight has from national or scientific projects is that it is inseparable from the tourism industry. Advertisements for these private space flights use the same phrases as those used by "exploration tours" to the Amazon rainforest or Antarctica. The phenomenon of tourism today is closely related to globalization. Exploration of the Amazon or Antarctica by ordinary tourists has been enabled by the development of transportation and communication technologies in the process of globalization. This shows that private space flights are categorized as similar to or the extension of sightseeing tours on the ground. In other words, this is "space tourism."

We may reasonably consider space tours to be an extension of these exploration tours. Thus, they would be a tool that provides an old experience or one that is a projection of the image on the ground. This raises another serious problem. When people begin to consume the place called "space," an industrial system that supports this consumption may develop; however, we cannot expect other possibilities of space activities or scientific results to develop. In so-called "exploration tours," tourists would simply reproduce their own image, but completely ignoring reality of the space.

Keywords: Space Anthropology, *Lebenswelt (Life world)*, Tourism, Sample, Perspective

1. Introduction

Many people, not only researchers in related fields, will agree that the advance of humanity into space has brought significant changes in all aspects of our thoughts, values, lives, and society. The aim of this paper is to consider this issue as a new possibility for human culture and examine it from an anthropological point of view. The final purpose of my study is to consider the following problems.

1. Will space tourism promote expansion into space and the exploitation of space by human beings?
2. Will space tourism result in change to the recognition of human beings' universe? And/or can space tourism bring the creation of the new worldview to human beings?

The topic we treat here is the problem of "tourism." The drastic development of transportation technology in the 20th century is not just a result of the development of scientific knowledge. It is people's "desire" for mobility in the capitalistic market that drove the restless improvement of the technology. The breakthrough in the cost problem of the technical development is not just a matter of scientific knowledge but of cost-effectiveness, which depends on "demand."

A typical example is "tourism." It is a subject in which economy, culture, and society come into play, and hence has been an important topic in recent anthropology.

However, what kind of influence space tourism has on further future space activities has not yet been sufficiently examined. In general, it may be expected that space tourism would promote the exploitation of space and expansion of human beings into space. Since not much data is available on this subject, I have attempted to consider space tourism with reference to previous studies on tourism from the domains of Cultural Anthropology and Sociology. Here can be found two research questions on space tourism.

The concept of "space tourism" today has the potential to promote the development of new technologies such as "space elevator" and "space hotels." In this paper I discuss the social and cultural problems of the concept of "space tourism," which may come to have a large influence on future space activities, from an anthropological point of view.

2. Separation of Space and "*Lebenswelt*"

The concept "space" has been, without doubt, the domain of scientists from the beginning of the modern era. The separation of science and religion can be dated from the establishment of modern science and folk or theological cosmologies. Cultural

science, however, established its foundation as an objective discipline by a positivist approach to the "world," as distinct from the concept of "space (or cosmos)." The "world" here, however, should be considered as *Lebenswelt* (life world), namely the world of perceptual experiences in one's life.

Concerning *Lebenswelt*, Edmund Husserl argues that "in whatever way we may be conscious of the world as universal horizon, as coherent universe of existing objects, we, each 'I-the-man' and all of us together, belong to the world as living with one another in the world; and the world is our world, valid for our consciousness as existing precisely through this 'living together.' We, as living in wakeful world-consciousness, are constantly active on the basis of our passive having of the world" [Husserl 1936/70:108–109].

Here, I emphasize the separation of the "cosmos" and "*Lebenswelt*" during the process on the foundation of modern scientific researches, which were continuous in the folk/religious cosmology. In ancient times, "cosmos" meant "the state of order" that developed from the "initial state of chaos," forming part of a philosophical or religious cosmology.

Ancient cosmology is connected to contemporary astronomy and astrophysics via the modern scientific theory of the cosmological structure. However, there is a fundamental gap between ancient cosmology and modern science. Namely, in modern science the "state of order" is not an a priori premise but something to be elucidated a posteriori.

"Space" has become, therefore, an "unknown area" for scientists. It is a field that imparts rich scientific knowledge; however, it is no longer an obvious thing that can be experienced directly by human beings. Modern cultural science, on the other hand, has been attempting positive study of the "*Lebenswelt*," namely the empirical/inductive search for a universal law by reducing everything to a fact, in order to establish their foundation as a "science." It can be considered a pseudoscientific approach, whose point of view fails to capture the concept of "space."

3. Globalization: Space Returning to "*Lebenswelt*"

Today, we are facing an historic turning point in "globalization" as a consequence of the advance of modernization, in particular the overwhelming market economy. We sometimes interpret the English word "globalization" as "terrestrialization" or "worldization." But it is not that our "*Lebenswelt*" has expanded to a terrestrial scale, but rather "forced to expand." On the other hand, the rapid expansion of our "*Lebenswelt*" is no longer obvious nor is it familiar to everyone.

It is the premise of this paper that "space" is again becoming the subject of cultural science in today's situation, as described above. Our "*Lebenswelt*" is no longer separated from "space," when we consider globalization. Throughout the 20th century space has been becoming a place of human activities. It began as a place to express national prestige, but the economic aspects, the political aspects directly related to military action, and public acceptance are obtaining more and more influence on space activities.

The important point here is the fact that the direction of the development of space technologies today is not only a significant factor influencing globalization but also lies along the same line as the social and cultural movements that led to the globalization.

4. Sociological and Cultural Anthropological Approach on Tourism

Let us examine space trips from the viewpoint of "tourism anthropology," a subfield of cultural anthropology. One difference that private space flights have from national or scientific projects is that they are inseparable from the tourism industry. Advertisements for private space flights tend to use the same phrases as "exploration tours" to the Amazon rainforest or Antarctica. This shows that private space flights are categorized as similar to or the extension of sightseeing tours on the ground, and hence they are "space tourism."

We should note that tourism is a modern phenomenon. The concept of tourism for recreation or entertainment by the general public began in the 19th century along with a drastic change in lifestyle due to the development of transportation and the Industrial Revolution.

Thus, on beginning the examination of space tourism, I would like to introduce some definitions of tourism from sociological studies.

McKean, who is a pioneer of tourism studies, presented a typical example of the definition of "tourism." He states tourism is "a profound, widely human desire to know 'others'* with the reciprocal possibility that we may come to know ourselves … a quest or an odyssey to see, and perhaps to understand, the whole inhabited earth" [McKean1977].

McKean treated tourism as a subject in which economy, culture, and society come into play, and hence has been an important topic in recent anthropology and sociology.

In addition, it may be said that the definitions of MacCannell and Middleton are representative.

"Tourism is a primary ground for the production of new cultural forms on a global base. In the name of tourism, capital and modernized peoples have been deployed to the most

remote regions of the world. Tourism is not just an aggregate of merely commercial activities; it is also an ideological framing of history, nature, and tradition; a framing that has the power to reshape culture and nature to its own needs" [MacCannell, D. 1992].

Middleton argues that "although travel and tourism is invariably identified as an 'industry,' it is best understood as a total market … [which] reflects the cumulative demand and consumption patterns of visitors for a very wide range of travel-related products" [Middleton, 1998].

The drastic development of transportation technology in the 20th century is not just a result of the development of scientific knowledge. It is people's "desire" for mobility in the capitalistic market that drove the restless improvement of this technology. The breakthrough in the cost problem of technical development is not just a matter of scientific knowledge but of cost-effectiveness, which depends on "demand." As McKean wrote, tourism is "a profound, widely human desire to know 'others' with the reciprocal possibility that we may come to know ourselves … a quest or an odyssey to see, and perhaps to understand, the whole inhabited earth" [McKean, ibid]. However, until recent times space had not become an object of tourism. In a consideration of space tourism, Urry, a well-known researcher on tourism, examined the characteristics of space tourism. He argues that the study of tourism is about "how and why for short periods people leave their normal place of work and residence. It is about consuming goods and services that are in some sense unnecessary. They are consumed because they supposedly generate pleasurable experiences that are different from everyday life" [Urry 1990].

According to Urry, a trip first heads outside the field of residence and labor, and the stay there is short and temporary. There is a clear intention that the tourist will return "home" after a relatively short period of time. Namely, a tour should return "home" at the end. It does not continue on to a long stay or emigration.

Besides which, one can find a perspective to the object of the tour. Various places are chosen as the object of this perspective, because people strongly expect the pleasure of finding measures or meanings that are different from those of their daily lives. These expectations are produced and supported by films, TV programs, magazines, and other media. They produce and enhance the perspective.

The selection of "places to see" in a typical guidebook comes from the perspective of the media. And perspectives are produced by the activities of the media that are different from the scientific knowledge of space.

Such perspectives of the tourism are reproduced. They are directed to scenes different

from tourists' daily experience. And if they are captured, understood, and reproduced via pictures, postcards, films, and models, also in space tours the tourists capture and reproduce those scenes that have been already captured and understood in the films, etc. This changes our recognition of space.

Furthermore, perspectives are constructed through symbols, and tourism is nothing but a collection of the symbols. For tourism, the image of the destination must be systematically produced and supplied. If a tourist reads a guidebook, takes a space flight, goes to a place shown in the book and takes a similar picture, his experience there is just a confirmation or consumption of the images and symbols he had already received before he started. It is a kind of pseudo-event.

Thus, it is possible that all we will obtain from a space tour is the confirmation of the images and consumption of the symbols of space that have already been constructed. Therefore, we cannot expect changes in our cosmology, views on the world, history, and nations.

The phenomenon of tourism today is closely related to globalization. The exploration of the Amazon or Antarctica by ordinary tourists has been enabled by the development of transportation and communication technologies, namely those same products that enable globalization. The space tour we see now lies in the extension of these exploration tours. It will probably be a tool that provides a "new experience" that projects the images on the ground. This invokes another serious problem.

When people simply consume the place called "space," an industrial system supporting it may develop, but given that, perhaps we would not be able expect that other space activities or scientific results would be possible scientific results. In so-called "exploration tours," the tourists just reproduce their own image, ignoring knowledge brought by the exploration or the reality in the destination.

I may demonstrate with the following diagrams the argument that the above-mentioned tourism relates to space tourism.

Diagram1. Separation of Space and "*Lebenswelt*" : Before Space Tourism

- Pre-modern

Cosmology. View of the world

(Integrated inhabited world and Space)

- Modern

Separation of "*Levenswelt*" and Space

Levenswelt;

the world of perceptual experiences in one's life

(cf **Husserl**)

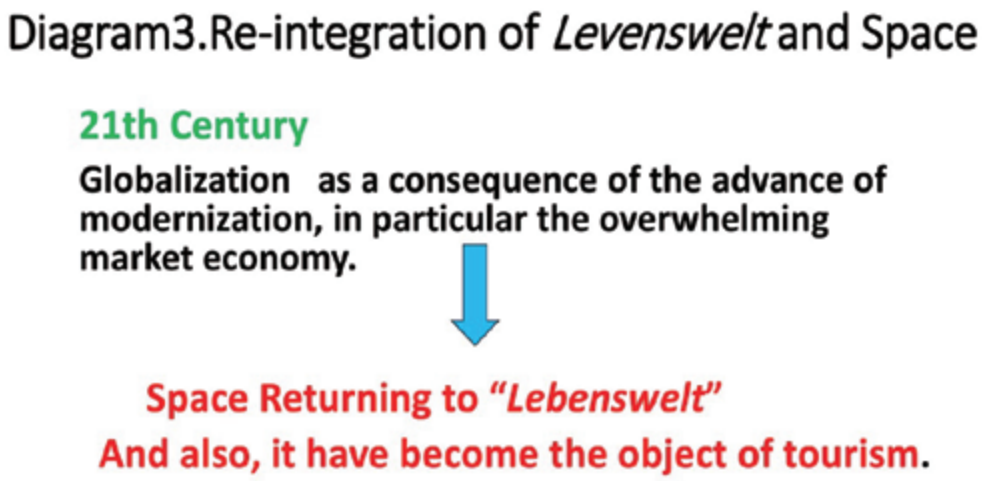
Husserl Edmund, *Die Krisis der europäischen Wissenschaften und die transzendentale Phänomenologie* Hrsg v Elisabeth Stöker,3 Aufl Meiner, Hamburg 1936/70

Diagram2.
Separation of "*Levenswelt*" and Cosmos

Levenswelt: The object of Humanities.

Cosmos

Space: The object of Science



5. Space Tourism

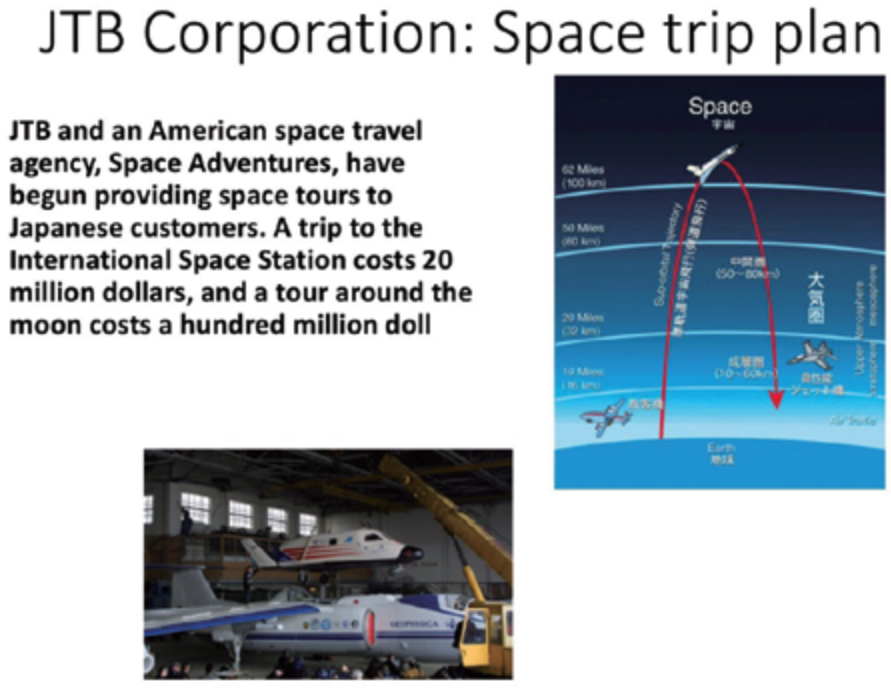
Today, our "*Lebenswelt*" is closely related to space, even for those who are not astronauts nor involved directly in space activities. Namely, space is no longer an "unknown space" separated from people's lives.

The approach of cultural studies may be useful as we consider relations between ordinary people and space such as space tourism, as well as future problems such as resource mining in, and emigration to space.

Recent technological improvements have raised the possibility of space flights for ordinary citizens, thus invoking the emergence of new businesses. Various projects for space travel are ongoing on a private basis. Furthermore, some are considering concrete plans for the construction of space elevators or space hotels.

fig.1

fig.2



Now, let us examine the space flights from the viewpoint of “tourism anthropology,” a sub-field of cultural anthropology. One difference of private space flights from national or scientific projects is that they are inseparable from the tourism industry. Advertisements for space flights use the same phrases as “exploration tours” to the Amazon rainforest or Antarctica. This shows that private space flights are categorized as similar to or the extension of sightseeing tours on the ground, and hence they are “space tourism.” So are private space flights a new experiment with scientific knowledge or only a repetition of the existing image of industrialized “esoteric tours” in the marketing system?

I would like to emphasize that tourism is a modern phenomenon. Tourism for recreation or entertainment by the general public began in the 19th century with a drastic change in lifestyle due to the development of transportation and the Industrial Revolution.

Here, I use the discussion by Urry, a well-known researcher on tourism, to examine the characteristics of space tourism. According to Urry, a trip first heads outside the field of residence and labor, and the stay there is short and temporary. There is a clear intention that the tourist returns “home” after a relatively short period of time. Namely, a tour should return “home” at the end. It does not continue on to a long stay or emigration.

Besides, one can find a perspective to the object of the tour. Various places are chosen as the object of perspective in a tour, because people strongly expect the pleasure of finding measures or meanings that are different from those in their daily lives. Such expectations are produced and supported by films, TV programs, magazines, and other media. They produce and enhance the perspective.

The selection of “places to see” in a typical guidebook comes from perspective of the media. And the perspectives are produced by the activities of the media that are different from the scientific knowledge on space. Such perspectives of the tourism are reproduced. They are directed to the scenes different from the daily experience.

And if they are captured, understood, and reproduced via pictures, postcards, films, and models, also in the space tours the tourists capture and reproduce those scenes that have been already captured and understood in films, etc.

Furthermore, the perspectives are constructed through symbols, and tourism is nothing but a collection of symbols.

For the tourism, the image of the destination must be systematically produced and supplied. If a tourist reads a guidebook, takes a space flight, goes to the place shown in the book and takes a similar picture, her/his experience there is just a confirmation or

consumption of the images and symbols she/he had already obtained before beginning. It is a kind of pseudo-event.

Thus, it is possible that all we will obtain from space tourism is just confirmation of the images and consumption of the symbols about space that have been constructed on Earth. Therefore, we cannot expect changes in our cosmology, views on the world, history, and nations.

6. Conclusions

In this paper, I point out that, in future space activities, the approach of cultural sciences is important, as social and cultural influences are becoming increasingly significant and also that space activities may bring significant changes in contemporary understanding of society and culture. In the discussion of space tourism, however, I pointed out the possible problem that, as space is industrialized, we may no longer be able to count on new ideas nor scientific development.

Here, I would like to ask again the following questions on space tourism.

1. Will space tourism promote the expansion of human beings into space and the exploitation of space?
2. Will space tourism result in change to the idea of the universe of human beings? And/or can space tourism bring about the creation of a new worldview for human beings?

The phenomenon of tourism today is closely related to globalization. The exploration of the Amazon or Antarctica by ordinary tourists has been enabled by the development of transportation and communication technologies, which are the products that enable globalization.

The space tour we see now lies in the extension of these exploration tours. It will probably be a tool that provides a “new experience” that projects images onto the Earth. This would create another serious problem. When people come to only consume the place called “space,” an industrial system supporting this may develop, but perhaps we cannot expect the other possibilities of space activities or scientific results. In so-called “exploration tours,” the tourists just reproduce their own image, ignoring knowledge brought by exploration or reality in the destination.

In this paper, I point out that, in future space activities, the approach of cultural sciences is important as social and cultural influences are becoming increasingly significant and also that space activities may bring significant changes in contemporary understanding of society and culture.

In the discussion on space tourism, however, I am concerned with the possible problem that, as space is industrialized, we may no longer be able to be sure of new ideas or scientific development. Lastly, the future direction of this study will take into consideration methods of overcoming the limits of modern tourism.
Concerning applying a theory into practice, training facilitators of space tourism equipped with both nature scientific and humanistic knowledge.

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VI. Life in extraterrestrial space: An anthropological consideration on astronauts' everyday experiences

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Abstract

Since the completion of the International Space Station (ISS) in 2000, over 80 astronauts have experienced months of life in extraterrestrial space. Based on an analysis of texts mainly written by three Japanese ISS astronauts (Wakata, Noguchi, and Furukawa), this paper examines the meanings of their daily experiences in the ISS from three perspectives: psychological, physical, and ontological. These perspectives were chosen based on the following:

1) Psychological studies show that long-duration astronauts showed an increased concern for universalism than short-term flight astronauts (Suedfeld et al., 2010).

2) Physical transformations in the ISS, such as space adaptation syndrome (SAS), decreased muscle strength, and "moon face" are commonly experienced. As a physician-astronaut, Furukawa scientifically and subjectively describes these changes, being surprised by the rapid adaptation of the human body to a microgravity environment.

3) The basic orienting system (Gibson 1966) formed around a vertical axis defined by gravity will be temporarily dysfunctional in the ISS, but within a month or so astronauts get accustomed to a microgravity environment, and feel free to move around inside the ISS. This process may be seen as a reconstruction of interrelated structure between things and the body, which Heidegger once called "familiarity with the world" as an ontological basis of human beings.

Overall, this paper suggests that an extraterrestrial culture is generated early on in an ISS environment, forming new ontological relationships between human beings and the

extraterrestrial nature.

Keywords: extraterrestrial space, astronauts, International Space Station

Introduction: Space as a Site of Everyday Life

Since the launch of the International Space Station (ISS) in 2000, there is always human presence in extraterrestrial space. As of 2013, there were 89 astronauts who had experienced life in the ISS, and each one typically spent six months in extraterrestrial space. Most of these astronauts are American or Russian men.

As there is always a group of people living in this "place," this extraterrestrial space is also a site where anthropological inquiry should be conducted. Astronauts' daily experiences can be described and understood in an anthropological sense, as one variant of human culture.

Unfortunately, this "field" is too far for anthropologists to visit and conduct fieldwork. For now, we, basically, need to rely on the astronauts' own narratives and writings, like armchair anthropologists in the 19th century who never visited the field partly because of no affordable transportation. This paper might be recognized as an example of the 21st century armchair anthropology of extraterrestrial space.

In this paper, I describe and analyze how the extraterrestrial life is lived by astronauts, and the changes that occur through astronauts' lives in extraterrestrial space. Using the texts written or told by astronauts, I attempt to read these texts "over the shoulders of those to whom they properly belong" (Geertz 1973: 452).

The meanings and changes in extraterrestrial space are examined from three perspectives: psychological, physical, and ontological.

1. Psychological Changes

Canadian social psychologist Peter Suedfeld and other researchers (Suedfeld et al., 2010: 1411) have analyzed the content of 125 "astronaut autobiographies, interviews, and oral histories." They scored these sources for references to values and described how the psychological changes concerning their value change occurred before and after the spaceflight.

As shown in Table 1, many astronauts place more values on "universalism" and "spirituality" after the spaceflight. Moreover, compared to the short-duration astronauts, the long-duration astronauts (six months or longer) place much higher values on

universalism[19] (Table 2).

Suedfeld et al., (2010: 1431) propose that this is because long-duration astronauts "had more leisure time to contemplate," but this seems like a very simplistic view. The ethnographic details of these psychological changes are yet to be described in a scientific way. More qualitative, intensive research on astronauts' change in values is required.

Table 1. Value Changes in Three Flight Phases (Suedfeld et al., 2010: 1428, 1430)

Rank in Astronaut Hierarchy	*Rank in Pan-cultural Norms*	***Value***	Preflight	In-flight	Postflight
			M%	*M%*	*M%*
1	6	**Achievement**	32.9	26.8	24.7
2	7	**Enjoyment**	9.3	17.7	10.7
3	2.5	**Self-direction**	11.5	6.0	7.3
4	1	**Benevolence**	10.0	5.9	6.6
5	9	**Stimulation**	9.9	8.7	5.5
6	5	**Universalism**	3.9	8.8	12.5
7	2.5	**Security**	7.0	7.8	7.2
8	10	**Conformity**	5.8	6.3	6.8
9	4	**Power**	5.1	5.5	9.4
10	Unranked	**Spirituality**	2.8	5.0	6.8
11	8	**Tradition**	1.8	1.6	2.6

Table 2. Duration Differences (Suedfeld et al., 2010: 1429)

Value	short / long *	Mean %
Enjoyment	short	14.0
	long	8.3
Universalism	short	6.1
	long	9.0
Security	short	6.2
	long	8.9
Spirituality	short	3.6
	long	1.8

* short: 2 weeks or fewer (n=65), long: 6 months or more (n=60)

[19] 'Universalism' here refers to "protecting the environment, a world of beauty, wisdom, and a world at peace, etc." (Suedfeld et al., 2010: 1418).

2. Physical Changes

It is well known that various physical changes occur in extraterrestrial space. Legs become thinner and palms become firmer as you grasp things when you move around. These changes appear within several months.

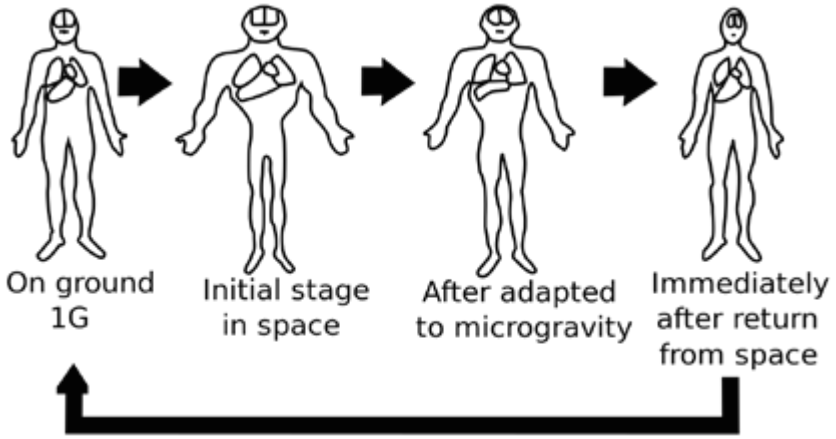
Satoshi Furukawa, a Japanese ISS astronaut and also a medical doctor explained:

"Observing physical changes that happened to my own body, I felt that human body is so well made. It can adapt itself to the different environments. In extraterrestrial space, the body adapts physically suitable for space, and on the earth, it changes suitable for the earth. Physical functions not used become weak. And functions that are used often become strong" (Furukawa 2012: 131).

As a physician-astronaut, Furukawa emphasized the human body's latent capacity to adapt to different gravity environments (see Fig. 1).

Over the course of human evolution, humans have survived not by transforming our bodies like other animals, but by utilizing technologies and science to adapt to various environments. However, in the microgravity environment, this strategy seems no longer effective because we have found no technological solution to create gravity.

Fig.1. Adaptation of Body in Space
(http://commons.wikimedia.org/wiki/File:Space_body_fluid.svg)



However, we might overcome this hardship, again technologically, by transforming our own bodies. For example, in the near future, emigrants to another planet might transform their bodies genetically to adapt to the different gravity environment. This would raise social and ethical issues similar to the controversy over the transhumanism movement, which seeks to go beyond human physical and mental limitations by means of science and technology.

3. Ontological Changes

On Earth, terrestrial animals maintain their orientation by the "basic orienting system" (Gibson 1966, see Fig. 2). In the ISS, this system does not work correctly for humans; instead, a feeling of disorientation takes over. This so-called "space motion sickness," is a major symptom of SAS. As the Japanese ISS astronaut Noguchi explained:

"It is hard to dismiss the unconscious feeling that things on the table don't move. At the beginning, we put things on the table carelessly, and lost lots of things. The most missing object was a spoon" (Noguchi and Oe 2012: 82).

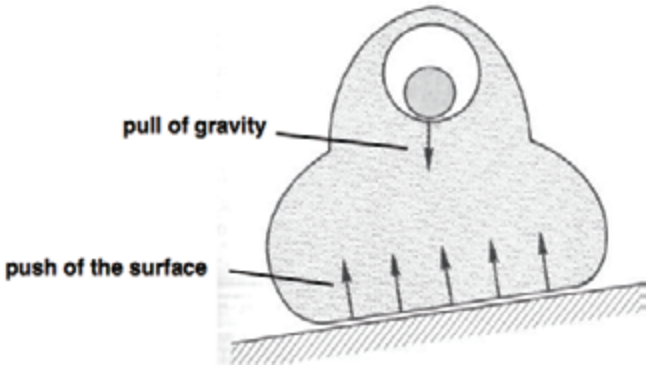


Fig.2. The Basic Orienting System (Gibson 1966: 63)

But then astronauts gradually accustomed themselves to the microgravity environment and became adept at moving and handling things. Thus, how can they properly move and interact with items in the ISS?

As you can see in the videos of astronauts in ISS,[20] they seem in complete control of their body movement. The way they move around and grasp the hook or

[20] See www.nasa.gov/mission_pages/station/main/suni_iss_tour.html.

handle on the wall looks quite regulated. They look and feel comfortable at "home" in a microgravity environment. How do they improve and accustom themselves to this environment? The following episodes discuss this question.

Episode one

In the ISS, the positions of tools and equipment are predetermined, so that the relationships between things do not change. Besides, the wall with the lighting is called a "ceiling," and the opposite side of a ceiling is called a "floor," and the floor everywhere is painted blue. "In the ISS, creating an earth-like regularity makes spatial recognition easier" (Wakata 2011: 15).

Episode two

In a microgravity environment, you feel the floor under your feet and the ceiling above your head regardless of positions. "In the ISS, as you rotate your body, the sensation itself turns upside down. It is just like a famous drawing that looks two faces or a vase (Rubin's vase)" (Furukawa 2012: 138).

Episode three

Noguchi (Noguchi and Oe 2012: 85-86) said, "(In the ISS) clothes don't stick to the skin. They float. After returning to the ground, what started to annoy me were my clothes. It was like they were sticking to my body. I didn't like that sensation."

These episodes show that in the ISS, "non-terrestrial" interactions with things are repeatedly conducted. Through trials and errors, the astronauts become accustomed to and familiar with the environment and feel at "home." This process reminds me of the German philosopher Heidegger's ontology.

Heidegger (1985: 202) once said, "Dasein [human beings] exhibits itself as a being which is in its world but at the same time is by virtue of the world in which it is." This means that humanity is partly a result of the environment, and human beings do not exist as they do now without the terrestrial world. Therefore, according to Heidegger, in the extraterrestrial world, humanity would exist differently. Humans will invent new types of movements and instruments in extraterrestrial space, thus creating their own "space culture."

4. Conclusion

As discussed above, human beings have successfully adapted to extraterrestrial space, and may create a specific culture there. Anthropological inquiry into humanity in extraterrestrial space will tell us how far our humanity can expand, what our humanity is here on Earth, and how our humanity is intertwined on Earth.

However, our knowledge in this field remains very limited and dispersed among different disciplines. To proceed with research on humanity in space, we need a more holistic, anthropological approach toward extraterrestrial human experiences. I hope that in the near future an anthropologist will become an astronaut, or vice versa, and bring us more detailed wisdom on humanity in outer space. I am sure that fieldwork in space will increase and improve our comprehension of humanity, because understanding it in the context of outer space is key to understanding humanity here on Earth.

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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 be possible if one observe 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 out 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 evolutional 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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