

Section One

INERT MATTER

Consequentialism and Commercial Space Exploration

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The authors investigated the relevance of consequentialism in commercial space exploration as well as in the actively developing space market. The authors conclude that space expansion and colonization of space objects will lead to a revision of the foundational consequentialism provisions. Consequentialism, formed during the history of terrestrial civilization, loses its effectiveness under conditions of space commercialization. The basics of planetary thinking are different from those of cosmic thinking. Therefore, considering the meaning of the terms “cosmic expansion” and “colonization of the cosmos” through the existing theory of consequentialism faces serious contradictions. There is a range of problems that are not explored in modern philosophy and ethics due to the lack of an empirical basis for philosophical analysis.

Keywords: consequentialism, commercial space exploration, space commercialization, “New Space” ecosystem, space market, moral rightness

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Introduction

In the last decade, Commercial Space Exploration has been actively proceeding from the field of theoretical research to practice. The introduction of NASA's Commercial Orbital Transportation Services (COTS) program has become a new milestone in the relationships between public funding of space programs and the opportunities of private investments into space exploration. Clelia Iacomino's book is one of the latest large-scale studies of the evolving role of private actors in space exploration (Iacomino, 2019). Iacomino offered a comprehensive overview of current space exploration in terms of geopolitical and commercial aspects.

New advances in space exploration raise the urgency of problems that have not previously been explored or are inadequately explored by science. One of these problems is the ethics of space exploration commercialization.

In the present article, the authors will consider the relevance of the maxim "the end justifies the means" in space exploration. This maxim as well as the Ovid phrase "The result justifies the deed" correspond to the class of normative ethical theories combined by the term "consequentialism." The term was first used by Gertrude Anscombe, a British analytic philosopher in 1958.

Commercial Space Exploration: present state and prospects for development

More than 60 years have passed since the launch of the first artificial Earth satellite. Sputnik-1, made in the USSR, was launched into orbit on October 4, 1957. For more than 50 years, the space flights and space exploration have been regarded as programs that can only be financed by highly developed nations. For this reason, achievements in space exploration directly depended on the economic development of the state. For example, after the collapse of the USSR, its cosmic potential was distributed in unequal proportions among the Russian Federation, Ukraine and Kazakhstan. Each of the three states has different ways of financing space exploration. In Ukraine and Kazakhstan, government funding for space programs has virtually ceased. As a consequence, these states have lost their leadership in space exploration. In the Russian Federation, public funding for the space industry is still ongoing. It has fallen far short of funding for state space programs in the US, China, the European Union, India and Japan. We take into account not only the share of public funding, but also the effectiveness of space programs, as well as their impact on the development of the scientific potential of the state. However, the very fact of financing allows the Russian Federation to remain among the states that are united by the term "space power".

At present, governments and heads of the state institutions specializing in space exploration are developing programs that stimulate the involvement of commercial actors in public programs. The European Space Policy Institute and the Italian Space Agency conducted a study on potential contributions of commercial actors to space exploration. The general objective of the study was to understand potential ways to foster successful contributions of commercial actors to achieve European strategic space exploration objectives. The authors of

the study concluded that despite the efforts made by the states, the profitability of the space industry is not obvious to private investors. The space industry is still not regarded by private investors and investment funds as an attractive asset in terms of profitability.

To increase the attractiveness of the space services market, Clelia Iacomino and Silvia Ciccarelli suggested the following steps (Iacomino & Ciccarelli, 2018):

1. Creation of solid partnerships: the public sector should not have a strong control of the partnerships. States should look for investor partners who are ready to develop their research programs including commercial space exploration.
2. Establishment of tax and investments incentives: to improve the business case of entrepreneurs and support the start of a new industry, the space agencies are encouraging new businesses to invest in creating new markets in space exploration, providing tax breaks.
3. Creation of a portfolio with multiple partners: a diverse portfolio of partners and investing in diverse solutions, should create competition which drives “performance up and costs down”.

The experience of the USA showed that leadership in space exploration, which is maintained solely through public funding, could be erroneous. Since 1984, the share of public funding has gradually decreased in space telecommunications, commercial space transportation, remote sensing, etc., while the share of participation of non-state enterprises has increased rapidly. A legal and regulatory framework has been modified to stimulate space commercialization. The stages of space law development are discussed in the research of Valentyn Halunko (Halunko, 2019), Larysa Soroka (Soroka & Kurkova, 2019), etc. Larysa Soroka and Kseniia Kurkova explored the specifics of the legal regulation of the use and development of artificial intelligence for the space area (Soroka & Kurkova, 2019).

As a result of changing the legal framework and attracting private investors to the space market, the US did not lose its leadership in space exploration, but rather secured it. Private investment along with government funding have significantly reduced the risk of business projects in the space industry. The quality and effectiveness of space exploration programs have increased.

In 2018, Springer published an eloquent book *The Rise of Private Actors in the Space Sector*. Alessandra Vernile, the author of the book, explores a broad set of topics that reveal the role of private actors in space exploration (Vernile, 2018). The book covers the following topics: “Innovative Public Procurement and Support Schemes,” “New Target Markets for Private Actors,” etc. In the “Selected Success Stories,” Vernile provides examples of successful private actors in space exploration (Vernile, 2018).

The current level of competition, which has developed on the space market, allows us to state the following fact. Private space companies have been able to compete with entire states in launching spacecraft, transporting cargo to orbital stations, and exploring space objects. The issue of mining on space objects, the creation of space settlements and the intensive development of the space tourism market are on the agenda.

In the 21st century, the creation of non-governmental commercial organizations specializing in the field of commercial space exploration, is regarded as an ordinary activity. They are established as parts of the universities around projects funded by private investors. For example, Astropreneurship & Space Industry Club based on the MIT community (Astropreneurship, 2019).

Large-scale research in the field of commercial space exploration, as well as the practical results achieved, led to the formation of a new paradigm called “New Space” ecosystem. The articles of Deganit Paikowsky’s (Paikowsky, 2017), Clelia Iacomino (Iacomino & Ciccarelli, 2018) et al. reveal its key meanings and the opportunities it offers in the space sector. The “New Space” ecosystem is a new vision for commercial space exploration. It is the formation of a cosmic worldview, in which the near space with all the wealth of its resources and capabilities, becomes a part of the global economy and the sustainable development of the society.

The “New Space” ecosystem offers the following ways for commercial space exploration (Iacomino & Ciccarelli, 2018):

1. Innovative public procurement and support schemes, which significantly expand the role of commercial actors in space exploration.
2. Attracting new entrants in the space sector. First of all, these are companies working in the domain of Information and communications technology, artificial intelligence, etc. that are expanding their research in space markets. They offer innovative business models and new solutions to space commercialization.
3. Innovative industrial approaches based on new processes, methods, and industrial organization for the development and production of space systems or launchers.
4. Disruptive market solutions, which significantly reduce commercial space exploration prices, increase labor productivity, provide new types of services, etc.
5. Substantial private investment from different sources and involving different funding mechanisms. For instance, these are private fortunes, venture capital firms, business angels, private equity companies, or banks, etc.
6. Involvement of an increasing number of space-faring nations investing in the acquisition of turnkey space capabilities or even in the development of a domestic space industrial base. This expands the space markets and makes it more competitive.

The analysis of the research and advances in commercial space exploration allows us to draw the following conclusions:

1. In fact, the space market has already been created. It is currently undergoing continuous development that will integrate the resources and capabilities of the near space into the global economy over the next decade.
2. A new paradigm, denoted by the term “New Space” ecosystem, is at the heart of the created space market. The “New Space” ecosystem is a step towards the formation of cosmic thinking, in which outer space, with its resources and capabilities, is considered as a sphere of human activities.
3. Space market regulates space law, which is constantly evolving. The space law develops within the bounds of international law. In essence, the space market is integrated into the international legal field and is governed by its laws.
4. Space commercialization updates ethics issues. The link between law and ethics remains relevant in the space market. The study “The Revival of the Notion of Arete in Contemporary Philosophy” proves the continuity of the founding provisions of ancient and modern civilizations (Bazaluk, 2019). In fact, the continuity of cultural history, on the basis of which planetary thinking is formed, becomes apparent. The inclusion of the near space in the activities of terrestrial civilization must be accompanied not only by changes in the regulatory and legal framework, but also by a rethinking of the laws of ethics.

Consider moral challenges of commercial space exploration.

Moral challenges of commercial space exploration

Jai Galliot conducted comprehensive and unifying analysis concerning the rise of private space exploration, with a view toward developing policy that may influence real-world decision making (Galliot, 2015). He investigated the plethora of questions demanding serious attention — privatisation and commercialisation, the impact on the environment, health futures, risk assessment, responsibility and governance.

From our point of view, there are several key moral challenges in commercial space exploration.

The foremost moral challenge, which at first transformed space exploration into a closed club of superstates, is due to the fact that space technologies and space exploration have always had a dual purpose since their inception. On the one hand, they expanded the presence of man throughout the universe and made it possible for man to use the resources of outer space for the civilization development. On the other hand, space programs have been considered as a part of the national security strategy. They were used for military purposes: to defend and attack the enemy.

The “New Space” ecosystem reduces the relevance of this moral challenge. The evolving space market, which integrates into global international and economic relations, offers new solutions to this moral challenge for its participants. On the one hand, the space market provides its participants with a number of benefits that greatly expand the scope of their activities and, accordingly, opportunities. The “New Space” ecosystem is an opportunity for private actors and less-developed states to become involved in new high technologies and their use for commercial space exploration. This is an opportunity to join the emerging cosmic thinking. The cumulative potential of new entrants to the space market forces us to reconsider the existing ethical standards applied in contemporary international relations. The continuous increase in the number of space market participants reduces frontier tensions and decreases the ability to use space technologies for military purposes. On the other hand, if the benefits received by space market participants are not governed by strict ethical standards, they can lead to a distortion of the balance between the loci of civilization. On the contrary, it will increase the frontier power and, accordingly, increase the likelihood of regional wars (Bazaluk & Svrydenko, 2017). Commercial space exploration is always a new discovery, the results of which cannot be predicted by planetary thinking. For example, the discovery of new types of matter, energy and information in the process of space exploration can lead to monopolization of the market and even to the superiority of a space corporation over any other that is limited to activities on a planetary scale.

When analyzing the “New Space” ecosystem, Deganit Paikowsky comes to the following conclusion. For a long time, space exploration has been driven mainly by three reasons: national security and military considerations; economic growth, prosperity, development, and benefit to society; and / or the aspiration to sustain and upgrade international status (Paikowsky, 2017). The “New Space” ecosystem paradigm is based solely on the desire to profit. Considering space as an investment project and as an opportunity “to profit” is the second key moral challenge. How ethical is it to make money from space exploration? For a long time, space exploration has been considered as a purely supreme value. Outer space and overcoming planetary scales have been seen as a challenge to terrestrial civilization. Space walks have been transformed from a dream into a goal. Ultimately, this goal led to the integration of the potential of civilization, the mobilization of political, economic and scientific resources of states that were previously at odds with one another.

However, the era of space exploration poetry has passed. The exploration of space and its resources has become a daily occurrence that requires completely different approaches. The editors of *The Ethics of Space Exploration* have attempted to determine a robust and theoretically informed approach to the ethical dimension of discussions on space and society (The Ethics, 2016). The book presents research on normative ethics, ethical issues in Solar System exploration, etc. The book contributes significantly to the understanding of issues of value, which repeatedly emerges in interdisciplinary discussions on space and society.

The second moral challenge makes us ponder over the consequences of space commercialization. In fact, space exploration changes from the supreme value, that unites the potential of terrestrial civilization, into a new qualitative state — the space market. Will commercial space exploration not lead to the split of civilization? What is a new supreme value that is able to unite civilization in the face of competition with commercial space exploration?

Consider the relevance of a particular class of normative ethical theories in commercial space exploration. How ethical is the maxim “the end justifies the means” in commercial space exploration? We believe that the answer to this question will be a definite contribution to the comprehension of a new supreme value capable of unifying terrestrial civilization in terms of commercial space exploration.

Best or right is whatever makes the world best in the future

Consequentialism about the moral rightness of acts states the following. “Whether an act is morally right depends only on the consequences of that act or of something related to that act, such as the motive behind the act or a general rule requiring acts of the same kind.” Or otherwise, “What is best or right is whatever makes the world best in the future, because we cannot change the past, so worrying about the past is no more useful than crying over spilled milk” (Sinnott-Armstrong, 2019).

Consider two examples.

Elon Musk in his article “Making Humans a Multi-Planetary Species” expressed his vision of the future of humanity. According to Musk, human civilization should “become a space-bearing civilization and a multi-planetary species” (Musk, 2017). Russian astronaut and explorer Sergey Krichevsky views terrestrial civilization as cosmic humanity. He argues that the evolution of human civilization will lead to the creation of cosmic humanity (Krichevsky, 2017). Oleg Bazaluk states that the appearance of humanity is a natural phenomenon, which is conditioned by the philosophy of the Cosmos (Bazaluk & Kharchenko, 2018). Thus, human expansion of space is regarded not only as an obvious phenomenon, but also as a natural process of human evolution. Colonization of space objects is expected to become a common practice in the short term. We are currently observing the formation of a sequence of actions that, at the first stage, will lead to the colonization of Mars. The first colony on Mars is expected to be built by 2030 (Musk, 2017).

Consider to what extent the cosmic expansion and colonization of space objects are consistent with the moral rightness of acts. Consequentialism about the moral rightness of acts has been established and operates on a planetary scale. “Best or right is whatever makes the world best in the future” implies, above all, human activities on Earth as a space object. The thesis “makes the world best” is an exclusively human vision of the world, limited by its current level of development. In addition, we do not have a unified and well-established basis for planetary worldview in the scale of terrestrial civilization. It is pluralistic. Earth-scale consequentialism is effective because Earth as a cosmic object is the medium of birth and

development of human civilization. Human has the right to regard the environment of their birth and existence as “Homo Nooeconomicus” as a Human Image for the Noospheric Epoch” (Smirnov & Odintsova, 2019). However, how ethical is the expansion of consequentialism theory to spaces that are not the birthplace and formation of human civilization? Does consequentialism apply to space objects that do not have a history of human presence?

Musk, Krichevsky, Bazaluk, and many other researchers regard space expansion as a natural process for the evolution of human civilization. However, is this not equivalent to acknowledging that aggression is an ontological characteristic of humans? After all, expansion is primarily aggression. On the scale of Earth, expansion is associated primarily with the terms “war”, “violence”, “coercion”, “restriction of rights and freedoms”, etc. What will change when we consider the ethics of “space expansion”?

We have every right to compare commercial space exploration with the discovery and development of America by Christopher Columbus and the Europeans. The consequences of colonization of America for its indigenous peoples are well known. The exploration of Mars that Elon Musk is so eager for is tantamount to “conquering America” by terrestrial civilization. Currently, the fact of the presence of complex biological organisms on Mars is not reliably established. However, scientists are inclined to believe that Mars has the simplest biological organisms. In 2018, Princeton University Press published the book *Life on Mars: What to Know before We Go* by David A. Weintraub. David A. Weintraub is Professor of Astronomy at Vanderbilt University. His research essentially precedes the maxim “The end justifies the means.” An ethical problem arises: how far is humanity willing to go to satisfy their desire to colonize Mars? If biological life is indeed to be found on Mars, then colonization of Mars will, at best, lead to its transformation and, at worst, to death. There are a sufficient number of examples like this in world history.

It is possible to extend the consideration of the problem of “Mars exploration”. For example, we can assume the existence of civilizations that are beyond earthly civilization in terms of development. Such a conclusion follows, for example, from the new paradigm of the Universe proposed by Bernardo Kastrup (Kastrup, 2018). Suppose these highly developed civilizations would be the observers of the “colonization” of Mars by modern man. What conclusions can they come to when observing the devastating effects of Mars colonization by man? How will the ethics of a human colonizer correspond to the ethics of the behavior of highly developed space civilizations?

Space expansion formulates a problem that has not previously been faced by humans. Suppose, in 2030, the first colony will be really built on Mars. Will consequentialism remain relevant to it? The first colonizers will face at least the following problems:

1. Moral rightness and wrongness of actions is determined by the history of human development on Earth. To what extent can the history of human development on Earth and the consequences of consequentialism, formed on its basis, be projected on the ethics of Mars colonizers?
2. What can the colonizers of Mars mean by the phrase “makes the world best in the future”? Primarily, the first colonizers of Mars will be aware of the degree of risk of their presence on a new planet and the inability to return to Earth. Will this not cause the extension of consequentialism? Secondly, few of the colonizers of Mars will consider their future on Mars. For most of them, the experience of colonization will be a bright but short-lived event of their lives. Again, will this initial setting not change the foundations of consequentialism? Finally, thirdly, man will colonize a planet that lacks complex biological organisms. The present planetary thinking does

not imply the ethics of the attitude towards the simplest ones. Something, which man cannot visually perceive, is mostly beyond their thinking. This means that, in essence, the colonization of Mars does not imply the ethics of attitude toward the indigenous Martian life. A priori, man will act on Mars as an aggressor.

3. How can you understand the phrase “makes the world best” when you live in a colony surrounded by life-threatening space? What does “the world” mean? Is it the colony or the surface of Mars? How ethical is the assumption that an alien from another planet — a colonizer — can make Mars better? At its best, they can make their stay on Mars better. However, this “better” for Martian evolution will be comparable to the “better” for the indigenous people of America after its colonization by Europeans.

Consider the second example. Commercial Space Exploration is not only the development of the space tourism and space travel market. This is, first and foremost, the use of mineral resources that are part of the structure of space objects. When we consider the use of mineral resources on a planetary scale, we are guided by consequentialism. The moral rightness and wrongness of actions is determined by the stereotypes existing on the Earth’s scale about what “makes the world the best in the future” (O’Connor, 2016). Current ethics laws strike a balance between utilitarian views on the use of planet resources and awareness of the effects of environmental disasters on human life. Moreover, this equilibrium is not stable. It is constantly regulated under the influence of continuous rethinking of the connections between the tangible, living and rational matter, which results in the human understanding of the philosophy of the Cosmos (Bazaluk & Kharchenko, 2018). The basis of this understanding is formed by the experience of human activities on a planetary scale.

Commercial space exploration updates the problem of transferring the ethics of extraction and use of mineral resources in Earth conditions to other space objects. The question is how effective is consequentialism in organizing the extraction of mineral resources on Mars? If consequentialism on Earth establishes specific boundaries that limit human intervention in the ecosystem of the planet, are there such boundaries on Mars? Is there a need to create such boundaries on a planet that lacks reasonable matter?

Extraction of minerals on space objects of various forms actualizes another problem. The fact of the absence or presence of biological life at this site is significant, but not determining. Man is far from understanding the cosmic processes. Suppose cosmic expansion opens up the possibility for man to extract mineral resources on the planet, which is guaranteed to have no biological evolution. It is basically impossible there. However, the extraction of mineral resources is always an interference with the geological evolution of a space object. Human intervention in its geological evolution raises a problem of danger for the space object. Moreover, it is followed by another problem. If human intervention in the geological evolution of a space object leads to its collapse, how much will the destruction of the cosmic object affect the cosmic processes? Man does not know the answer to the question: how much can geological evolution change the evolution of the Universe?

The examples we considered, allow us to formulate the ultimate question of our study. How applicable are the maxim “The end justifies the means” and consequentialism itself in commercial space exploration?

Overall, the present study will at least result in the revision of consequentialism in commercial space exploration. The history of culture, that laid the foundations for it, limits its influence solely to the scale of Earth. This means that under conditions of space expansion, consequentialism loses its cogency and cannot be used as an effective theory. Space expansion

and colonization of space objects present completely new history of terrestrial civilization that may lay entirely new groundwork for the moral rightness of acts.

Conclusions

The main conclusion that can be drawn from the present findings is that we approached another important question. Does a person get more rights and freedom in commercial space exploration? This question is not accidental, because in the course of the study we found that the basis of consequentialism in space exploration is not as convincing and obvious as in the conditions of terrestrial civilization. Consequentialism in space expansion and colonization of space objects will at least be reconsidered. Commercial space exploration is a new page in the world history. It will lead to a change of planetary thinking into cosmic, or to a division of thinking into planetary and cosmic ones.

The performed analysis provided evidence for the fact that the effectiveness of using consequentialism in commercial space exploration is not obvious. The experience of planetary evolution, which laid the foundation for modern consequentialism, essentially rendered useless in space exploration. In the course of commercial space exploration, it is necessary, at least, to gain experience and provide answers for the following questions:

1. What is meant by the term “the world” in cosmic thinking?
2. What is the meaning of the phrase “makes the world best in the future” for the colonizers of space objects?
3. How relevant is the pursuit of commercial space exploration and space expansion to the moral rightness and/or wrongness of acts.

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