

Project Report

Ethics and the Potential Conflicts between Astrobiology, Planetary Protection, and Commercial Use of Space

Erik Persson

Center of Theological Inquiry, 50 Stockton Street, Princeton, NJ 08540, USA; erik.persson@fil.lu.se;
Tel.: +1-609-937-4670

Academic Editor: Palmiro Poltronieri

Received: 8 May 2017; Accepted: 25 May 2017; Published: 27 May 2017

Abstract: A high standard of planetary protection is important for astrobiology, though the risk for contamination can never be zero. It is therefore important to find a balance. If extraterrestrial life has a moral standing in its own right, it will also affect what we have to do to protect it. The questions of how far we need to go to protect extraterrestrial life will be even more acute and complicated when the time comes to use habitable worlds for commercial purposes. There will also be conflicts between those who want to set a world aside for more research and those who want to give the green light for development. I believe it is important to be proactive in relation to these issues. The aim of my project is therefore to identify, elucidate, and if possible, suggest solutions to potential conflicts between astrobiology, planetary protection, and commercial use of space.

1. Project Description

The project is a continuation of some of my previous work on ethical issues in connection with astrobiology, planetary protection, and commercial use of space.

Planetary protection is a technical and legal term with a very specific content. It deals with how to avoid biological contamination of other worlds (forward contamination) and of Earth (back contamination), in connection with space exploration. In order to make the project manageable and in order to focus on problems that specifically occur in space (rather than on Earth), the project will focus exclusively on forward contamination. I will also limit my investigation to deal with planetary protection as a decision under uncertainty, that is, as long as we do not know whether a world is inhabited or not. This is a limitation that seems to be implied in discussions and decisions about planetary protection in the space community, even though it is not explicitly stated. Once we know that a world is or is not inhabited, the situation and the considerations that need to be made will be very different and it will make sense to start talking about “extraterrestrial environmental protection” rather than “planetary protection”.

Planetary protection in the form of avoiding forward contamination is very important for astrobiology. When sending unmanned as well as manned missions to other worlds, it is vital to avoid contamination of that world. It is therefore easy to believe that there are no conflicts between astrobiology and planetary protection. This is not necessarily true, however. We know that total sterilization of humans and machines is impossible. We can obviously never completely sterilize humans. If we did, the humans would die too. We can go a bit further with machines but, essentially, the same is true for them. The electronics in a rover is usually more sensitive than at least some Earth microbes. We also know now that what kills some bacteria will cause others to flourish. This means that we need to find a balance between our efforts to find life and our efforts to protect it.

Another potential source of conflict between astrobiology and planetary protection has to do with the moral status of extraterrestrial life. So far, planetary protection is mainly about protecting the science, that is, it is important for astrobiology to avoid contamination of extraterrestrial habitable

worlds in order to avoid the destruction of any life on that world before it can be discovered, and to ensure that any life that is discovered on that world really is extraterrestrial and not of Earth origin. If extraterrestrial life has moral standing in its own right, this might not be enough. In that case, there will be moral obligations that demand a higher degree of protection than is motivated by the value of the extraterrestrial life as study objects for science. It might also imply moral restrictions for what we can do to these life forms that will be in direct conflict with their use as study objects.

In 2012, I published an article on the moral status of different types of extraterrestrial life [1]. This paper was followed by a book chapter [2] in which I identified some philosophical questions in relation to astrobiology. Among the questions I raised was the question of how to treat extraterrestrial life and whether we have any moral obligations regarding non-inhabited worlds. In this project, I will follow up on another aspect of these papers by throwing more light on how the moral status of different life forms squares with the guidelines for planetary protection. This will by necessity include some discussion about different scenarios regarding what kind of life we might encounter in connection with different mission types (ranging from Mars to interstellar missions of the “Breakthrough” type).

The question of the moral standing of extraterrestrial life and its implications for planetary protection is not only relevant in relation to scientific exploration. It is in fact even more relevant in connection with the commercial use of other worlds (since it can be easily imagined that commercial use will be of a more intrusive character than scientific exploration).

Commercialization of space is no longer a futuristic fantasy. It happens as we speak. National Aeronautics and Space Administration (NASA) is already using commercial contractors to send payloads to the International Space Station. There are several private companies building everything from parts of instruments to whole satellites. The U.S. Department of Commerce has opened an office of space commercialization and the U.S. Federal Aviation Administration has opened an office for commercial space transportation. Several companies plan to send tourists to space. Virgin Galactic has already sold over 500 tickets. So called Space Ports for commercial space flight are popping up all over the world (e.g., Space Port America, Space Port Sweden, and Abu Dhabi Space Port). Private companies have already started planning for mining projects on asteroids, and so on and so forth. The increased utilization and commercialization of space has obvious economic and legal implications, but it also has deeply human and ethical implications. Since there are not yet any commercial activities on any extraterrestrial body, we still have a chance to be proactive.

The third node in this investigation is the relation between astrobiology and the commercial use of space. There will surely be many opportunities for constructive cooperation, but we can be equally certain that there will also be conflicts.

In 2014, I published a paper [3] in which I discussed the issue of how to strike the balance between science, planetary protection, and commercial use of another world. Basically, I predicted that when the time comes to actually exploit the resources on other worlds or establish it as a tourist destination, we will see conflicts between those who think that we have looked for life long enough on the world in question without finding any and that it is now time to give the green light for development, and those who think that there is still a chance that there might be life we have yet to discover and that we should not risk compromising the survival and evolution of that life, and thereby also the chance to study it, by large scale human interventions. In the paper, I suggested that we start discussing where to strike the balance now while we can keep our minds cool, and not postpone the discussion until the developers wait impatiently on the launch pad.

In another book chapter [4], I discussed another ethical aspect of space commercialization, namely the implications for the civil rights of space settlers in space colonies governed by private corporations (in line with e.g., the East India companies, the Virginia Company, etc. during the colonial era on the Earth). This is not strictly speaking about astrobiology, but it indicates the wide spectrum of ethical issues in connection with the commercial use of space.

The point is that ethics have a very important role to play in analyzing these implications, and in particular in analyzing, elucidating, and if possible, suggesting solutions to the conflicts between

science, planetary protection, and commercial use of space. I believe it is important to be proactive and not wait until the positions of different interest groups have already been locked down. Considering that things are moving very fast and that we do not know when the first finding of extraterrestrial life will be announced, it is important to start this process as soon as possible.

On our own planet, ethical considerations about how we affect the environment have usually come *ex post facto*, that is, after the Earth environment has already been affected, sometimes in an irreversible way. The ethical theories that have been developed in order to guide human interactions with the environment on our own planet are also very abstract, even though they are often classified as “applied ethics”. In addition, they have not always managed to find their way into actual decision-making. In space, we still have a chance to do just that. We can, in principle, learn from our mistakes on our own planet and we still have time (though we do not know how much time) to turn the relatively abstract and general ethical theories developed to guide our interactions with living systems on our own planet into concrete and practically implementable guidelines that can be applied on future encounters with living systems in space, and above all, to do it before the damage is done. An overarching aim of this project is thus to take the next step and not just present abstract ethical theories, but to try to work out the specific implications of the theories for the specific problems at hand.

2. Concrete Tasks

The project will proceed in the form of two concrete tasks:

- (1) Identifying potential conflicts between astrobiology, planetary protection, and commercial use of space, as well as formulating proper ethical questions around these potential conflicts. The questions can be found in three focus points:
 - A. The intersection of astrobiology and planetary protection.
 - B. The intersection between astrobiology and commercial use of space.
 - C. The intersection between planetary protection and commercial use of space.
- (2) Suggesting constructive solutions to the problems identified in (1).

3. Publication Plan

The results of the project will be documented and disseminated in the form of four research papers. They will be presented at international conferences in both philosophy and astrobiology, and published in international peer-reviewed philosophical and astrobiology journals.

Acknowledgments: The author wishes to thank Margaret Race, Jacques Arnould and David Dunér for supporting the application and William Storrar at the Center of Theological Inquiry for accepting to host the project as part of the research program “Inquiry on the Societal Implications of Astrobiology”. The project is funded by NASA grant NNX14AR81G.

Conflicts of Interest: The author declares no conflict of interest.

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