Why Go to Space? The Academic Philosophy of Space Travel

By Gordon Arthur

Abstract

While there has been extensive popular writing and broadcasting about the reasons for going, or not going to space, the academic philosophy of human endeavour in space is still in its infancy. This article explores some of this early work by Florence Hetzler, who proposed a methodology for space philosophy, Gonzalo Munévar, who has done the most extensive work in the field and who discusses numerous aspects of space philosophy, and Walter Peeters, who argues it is time for a reunion between science and philosophy, which separated about 350 years ago. It offers an assessment of where we are and some suggestions on how we might develop this field.

Introduction

While there has been much popular writing and broadcasting about the reasons for going, or not going to space,[1] the academic philosophy of human endeavour in space is still in its infancy. This article explores some of this early work and offers an assessment of where we are and some suggestions on how we might develop this field.

The Development of Space Philosophy

Methodology: Florence Hetzler

After witnessing the inaugural launch of the Space Shuttle Columbia in 1981, Florence Hetzler saw the need for philosophical reflection on the meaning of human space travel.[2] She felt that humanity is, in a real sense, the sum of human experiences, and that space travel had expanded that experience, which needed further analysis. She offered the challenge, "Scientists are comfortable with space. Are philosophers?"[3] Her answer was that apparently, they were not. In response to this challenge, Hetzler suggested that taking a holistic view covering multiple spheres of knowledge using imagery and analogy would be a helpful approach, and she suggested that a Cultural Council at NASA should be part of the solution.[4] While NASA did not set up this council, and while other philosophers have taken slightly different lines, incorporating multiple fields of knowledge

[1] For example, books ranging from Carl Sagan's *Cosmos* (New York: Random House, 1980) and Isaac Asimov's *Foundation and Earth* (London: Grafton Books, 1986) to Buzz Aldrin's *Mission to Mars: My Vision for Space Exploration* (Washington, DC: National Geographic Society, 2013); TV shows and films such as the *Star Trek* and *Star Wars* franchises. I am indebted to Bob Krone for drawing my attention to some of these titles.

[2] Florence Hetzler, "Man and Space," *Dialectics and Humanism* 2 (1982): 51-64.

[3] Hetzler, "Man and Space," 56.

[4] Hetzler, "Man and Space," 64.

but not directly imagery and analogy, the questions she raised have been fruitful for further work.

Evolving the Theory: Gonzalo Munévar

Gonzalo Munévar is one of the few philosophers to have taken up this challenge. In "A Philosopher Looks at Space Exploration,"[5] Munévar begins by addressing the standard objections to space exploration, and he argues that these philosophical approaches are inadequate. Social critics argue that there are other, more pressing priorities on Earth; ideological critics argue that space exploration is an unwise extension of big science and technology that could have harmful effects.

Space enthusiasts tend to point to the advantages of satellites, which can provide economic benefits through locating resources as well as monitoring the environment and therefore saving lives by forewarning us about extreme weather events. Space exploration, they argue, "contributes greatly to the reduction of human misery, the improvement of human life, and the preservation of the environment,"[6] and it will continue to do so in many other ways. In the putative Golden Age of space exploration (1962-76), there were claims that for every dollar spent in space, there was a return of seven dollars, although this scenario clearly did not continue into the Space Shuttle period, due to the shuttle's high operating expenses. Munévar outlines this case as follows:

SATELLITES:
- WEATHER:
  - save lives
  - help agriculture
  - help transportation
- SEA:
  - find resources
  - tell us about environmental impact
- LAND:
  - find resources
  - tell us about environmental impact
- COMMUNICATIONS:
  - help commerce
  - make our lives easier

[5] Gonzalo Munévar, "A Philosopher Looks at Space Exploration," in *Evolution and the Naked Truth: A Darwinian Approach to Philosophy* (Aldershot: Ashgate, 1998), 169-79. While I agree with much of what Munévar says in this chapter, I take sharp issue with some of his assumptions, in particular his assertions that truth is defined by evolutionary success and that relativism is unavoidable. See Gonzalo Munévar, "Evolution and the Naked Truth," in *Evolution and the Naked Truth*, 3-22.

[6] Munévar, "A Philosopher Looks," 170.

SPINOFFS:
NEW TECHNOLOGIES
NEW TECHNOLOGICAL OPPORTUNITIES[7]

However, the critics are not impressed. Ideological critics retort that the case for space exploration is a delusion: "it offers more growth and technology to stop the mess caused by growth and technology."[8] If we change our attitudes and stop fouling the environment, space technology will be unnecessary. Similarly, social critics question the obvious payoffs of missions to Saturn, Uranus, and Pluto, and they wonder why we do not focus our effort directly in the fields in which space technology is producing spin-offs.[9]

Munévar's solution to this is to make a philosophical case for the serendipity of scientific exploration. The first part of this argument is that there is a strong connection between scientific change and serendipity. He begins by asserting that scientific views are instruments for interacting with the universe. He rejects the traditional view that scientific knowledge is objective, pointing out that perspective and worldview have a significant effect on how we view and interact with the world around us. For example, if a stone falls from a moving object, an observer on the ground will see its motion as a parabola, while an observer on the moving object will see it fall in a straight line. Both will be right from their own perspectives, but neither view can be called objective. Different views of the universe lead to different assumptions and vice versa. Thus, we must take a dynamic view of the universe, rather than a static view, and thus we can focus on transformations in science and their consequences, which gives us a new point of attack.[10]

It follows from this that our viewpoints determine, or at least influence, the problems and opportunities of which we are aware. Thus, new viewpoints may make us aware of new opportunities and new dangers. Consequently, we can also develop new solutions and new technologies to address these opportunities. Einstein began his career by thinking about how the universe would look if one were travelling on a light ray, a question that had no obvious practical application. However, it led him to develop the theory of relativity, which in turn led to the development of quantum theory.[11] These theories indirectly led to the development of lasers, which now have medical applications in microsurgery that could not have been foreseen at the time. Munévar argues that it would have been almost impossible for a surgeon to have developed a medical laser if it required turning the science of the day upside down. Thus, Munévar concludes, "serendipity is the natural (practically inevitable) result of change."[12] However, it seems to

[7] Munévar, "A Philosopher Looks," 171-72.
[8] Munévar, "A Philosopher Looks," 172.
[9] Munévar, "A Philosopher Looks," 172.
[10] Munévar, "A Philosopher Looks," 173-75.
[11] Munévar correctly points out that Einstein never fully accepted quantum theory, at least in the form espoused by Niels Bohr and Werner Heisenberg.
[12] Munévar, "A Philosopher Looks," 176.

me that this last claim is too strong. Scientific change may lead to serendipity, and on numerous occasions it has, but in my judgement, Munévar has not made the case that it must lead to serendipity.

The second part of Munévar's argument is that scientific exploration leads to scientific change. This is far more straightforward than the first part. Scientific exploration leads to new knowledge and new ideas, which have new consequences, and thus refinements of theory and new applications will follow. Thus, combining the two stages:

1. Scientific exploration leads to scientific change.
2. Scientific change leads [may lead] to serendipity.

therefore:

3. Scientific exploration leads [may lead] to serendipity.

This undermines the social critics' claim that spinoffs are achievable without space exploration, as transformations in science are often prerequisites for improvements in technology (i.e., theory normally precedes application). The argument also works against the ideological objection, as we will always interact with and transform the Earth, so the question is not whether we will do so, but how and how wisely. While wisdom is not synonymous with knowledge, and our knowledge will never be complete, we need knowledge to make wise and informed choices. Depriving ourselves of a potentially vast sum of knowledge may be depriving ourselves of the chance to act wisely, and therefore not proceeding with space exploration may be irresponsible. Space exploration may therefore be "not a false panacea but an important means to a cleaner and better future."[13]

In "Humankind and Outer Space,"[14] Munévar discusses the relative merits of manned and unmanned space exploration. He begins with 1979 Nobel Physics Laureate Steven Weinberg's scathing critique of manned spaceflight: according to Weinberg, it has no scientific merit and putting humans in space serves no useful purpose.[15] Munévar expresses sympathy with this viewpoint: "Manned exploration has indeed been detrimental to space science. And in the short run it will continue to be so";[16] however, he adds that in the long term, the benefits will outweigh the costs.

Some argue that we can achieve more in space with machines than with humans. Humans need air, water, food, and protection from the environment. This requires larger rockets, heavier payloads, and more reliable equipment. Machines need none of these, and they can go much further at substantially lower costs. On the other hand, humans

[13] Munévar, "A Philosopher Looks," 179.

[14] Gonzalo Munévar, "Humankind and Outer Space," *International Journal of Technology, Knowledge & Society* 4, no. 5 (2008): 17-25.

[15] Munévar, "Humankind and Outer Space," 17.

[16] Note, however, that Munévar was writing during the Space Shuttle era. The shuttle is the most expensive way of getting to space yet devised. See Munévar, "Humankind and Outer Space," 21-22.

can do some things much better than machines can. Machines do not have manual dexterity and they cannot (currently) fix satellites. However, machines can go where humans cannot, and in some contexts (e.g., space telescopes) the presence of humans would be detrimental (by causing vibrations). In addition, probes can already travel throughout (and beyond) the solar system, while it is highly unlikely that humans will be able to travel beyond Mars for a very long time.[17]

Proponents of unmanned space exploration tend to focus on two approaches: teleoperators and robotics. Teleoperators control remote devices via radio signals, which allows human input into the behaviour of satellites, rovers, robots, etc. However, they also have significant problems. The first is that the further away the spacecraft is, the more difficult it is to control. Radio signals are limited by the speed of light, so while commands can get to the Moon in about a second and a half, it takes four to twenty minutes to get them to Mars, depending on the relative positions of the Earth and Mars, and for the outer planets, it would take hours. Even a three-second delay can have serious consequences, as any car driver knows. Consequently, extra measures are necessary.[18]

One option is to attempt to anticipate problems by, for example, providing detailed topographical maps derived from satellite images. The rover would stop if it encountered anything unexpected and seek further instructions from its operator. One consequence of this is that the vehicle would need to move very slowly, even in known terrain. In unknown terrain, this could be a significant challenge. Another significant challenge is that operators must work off tube. Even if they have 3D images, they will not be able to see as well as humans on site, and they will not get correcting feedback from their other senses, which will impair their ability to assess situations accurately. Humans on the ground would likely perform better, even if low gravity were to prove a confounding factor by impairing human performance. In addition, machines are rarely as dexterous as humans when doing detailed work, so a combination of on-site humans and machines is likely to be the best solution here.[19]

Those who favour robotics argue for the virtues of intelligent machines, which, they point out, are already better than humans at performing certain relevant tasks (e.g., predicting the locations of mineral deposits). However, it does not necessarily follow that because such programs work well on Earth, they will also work well on the Moon and Mars, where conditions are radically different. In addition, such programs do not have the flexibility of humans, and there is no sign that artificial intelligence is making significant progress in addressing this.[20]

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[17] Munévar, "Humankind and Outer Space," 17-18.

[18] Munévar, "Humankind and Outer Space," 18.

[19] Munévar, "Humankind and Outer Space," 18-19.

[20] Munévar, "Humankind and Outer Space," 19-20. Munévar does not discuss whether this barrier can be overcome in principle, and such a discussion is also beyond the scope of this paper. My suspicion is that it cannot.

Another concern of the opponents of human spaceflight is the cost. Munévar calculates that we could run between 400 and 500 interplanetary missions for the cost of building the International Space Station (ISS; about $130 billion by 2008).[21] It is undeniable that the shuttle programme and the ISS took resources away from other projects. Opponents point out that the cost of a failed unmanned mission is much lower than the cost of a failed manned mission, and that machines have travelled tens of thousands of times further and gathered more knowledge than human space explorers.[22] However, these objections are mitigated to some extent by the greatly reduced costs of more recent rockets.

Munévar then makes his case for the value of permanent human settlement in space. He states that while it would be profligate to fly to Paris simply to sit in a street-side café while sipping brandy or coffee and watching people go by, if we needed to be in Paris for other reasons, it would be perfectly reasonable to do that as well. The same argument can apply to space: if there are good reasons to have a permanent presence in space, it would make sense to perform other experiments that would otherwise be uneconomic, and this might lead to a new flowering of science. A human presence in space allows for repairs to space telescopes (most notably, Hubble) and it allows for the construction of telescopes that are too large to launch from Earth in one piece. It allows the placement of telescopes in locations that would be difficult to access directly (e.g., the far side of the Moon) and which could shield them from interference from the Earth or extend the baseline of measurements in interferometry. It would allow for the mining of resources and the construction of goods in space, without the costs and complications of launching them from Earth (e.g., strong vibrations). Thus, human settlement in space will be useful in the long term, even though the benefits will take time to materialise.[23]

Munévar states that the urge to explore space must go hand in hand with scientific exploration, as this is likely to be a prerequisite for setting up successful colonies in space. However, a significant human presence in space would likely increase the quantity and quality of research by orders of magnitude, and it would also likely revolutionise the concept and range of space science. Terraforming planets like Mars and Venus may eventually become possible, although we should learn all we can about the existing environments before attempting to change them. Ultimately, humanity will have to leave Earth if it is to survive, as this planet will eventually become uninhabitable through natural processes or as a result of human activity. However, none of this will be possible without human activity in space.[24]

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[21] Munévar gives several examples of consequences of this, but since they are thirteen years old, I have not included them.

[22] Munévar, "Humankind and Outer Space," 20-21.

[23] Munévar, "Humankind and Outer Space," 22-23.

[24] Munévar, "Humankind and Outer Space," 24-25.

In "Space Exploration and Human Survival,"[25] Munévar explores why survival in general and human survival in particular is of value. While this may seem self-evident to many, some philosophers challenge it, as do some who oppose big science on ideological grounds. Wendell Berry, for example, argues that abundance will produce bad character, as good character requires the discipline of finitude.[26]

In philosophy, questioning a value is frequently a demand to identify a more basic value from which it follows: P will bring about Q, and Q is a good thing. However, P can be similarly questioned, so we must continue this process until we arrive at a value that is good in itself. For example, we work to get paid. Money allows us to buy food and clothes, pay the rent/mortgage, etc. Doing such things makes us happy, and happiness is a complete and self-sufficient value.[27] Happiness, in this context, means a happy life as a whole, and the happiness of society is more important than the happiness of an individual. Munévar adds that "there seems to be a clear connection between human happiness and human survival."[28]

Munévar rejects the existence of absolute values,[29] and he therefore feels no need to show that human survival is an absolute value, but he attempts to show that space exploration is in the interests of humanity. By pointing out that space exploration may save humanity from the dangers posed by asteroids or the expansion of the sun, he offers strong reasons for pursuing it. However, his rejection of absolute values forces him to conclude that the only basis for convincing members of another society to adopt your views is to convince them that your approach works better for you than theirs does for them, or better, that your customs will work better for them too. Thus, it is necessary for

[25] Gonzalo Munévar, "Space Exploration and Human Survival," *Space Policy* 30 (2014): 197-201. doi.org/10.1016/j.spacepol.2014.10.002. Munévar subsequently wrote a book chapter on Gerard O'Neill's proposal for building space colonies: "Space Colonies and Their Critics," in *The Ethics of Space Exploration. Space and Society*, ed. James S. J. Schwartz and Tony Milligan (Cham, Switzerland: Springer, 2016), 31-45, but there is so much overlap in substance between "Space Colonies and Their Critics" and "Space Exploration and Human Survival" that I have omitted the former from this paper.

[26] Munévar, "Space Exploration and Human Survival," 197, citing Berry's contributions to Stewart Brand, ed. *Space Colonies* (New York: Penguin Books, 1977), 36-37 and 82-85.

[27] Munévar, "Space Exploration and Human Survival," 197-98, citing Book 1 Chapter 7 of Aristotle's *Nicomachean Ethics*, 2nd ed., trans. Terence Irwin (Indianapolis: Hackett, 2000).

[28] Munévar, "Space Exploration and Human Survival," 198.

[29] It is not difficult to find flaws in the case for relativism. The most obvious one is that its central claim is that there are no absolutes [in field P]. However, this statement is also a proposition: it is either always true or always false, and therefore it is an absolute statement. We might therefore expand it into the statement, it is absolutely true that there are no absolutes. This is self-contradictory and therefore necessarily false. Furthermore, one might observe that a complete and self-sufficient value, such as human happiness, certainly looks like an absolute value. Nevertheless, relativism persists in several different versions. For a much fuller discussion of these issues, see "Relativism," in the Stanford Encyclopedia of Philosophy, September 11, 2015, plato.stanford.edu/entries/relativism.

him to show that human survival is in the interests of humanity to establish that space exploration is also in the interests of humanity.[30]

Human survival clearly does not always override other values. Humans sometimes endanger themselves to save others (e.g., a mother protecting her child), and there is general recognition that humans can disregard their own safety for a higher purpose. Munévar suspects that this higher purpose "is somehow involved with making life better for those that remain, or even to make sure that others do remain."[31] Ultimately, it may concern the well-being of all humanity in the future as well as the present and the past. However, some find "humanity" too nebulous a concept. Nevertheless, our actions do affect those who come after us, whether we intend this or not. Humanity is not a super-organism, but it is more than the sum of its parts:

> An advanced scientific and literary society, for example, builds libraries, universities, and laboratories, which enable an individual to educate himself for a style of life that would not exist without those institutions. The choices and opportunities open to him are not those that he could have without the benefit of the past efforts of generations that brought about the world into which he was born.[32]

In a primitive society, one cannot choose to become a scientist or a critic of technology, as a primitive society has not developed these fields. However, in most societies we have some degree of choice, and our choices necessarily influence and change these societies. In technological societies, space exploration is a viable choice. The consequences of our choices are likely to outlive us and affect our children and grandchildren. Thus, our choices to go to space or not to go to space may have consequences that last for generations.[33]

Munévar correctly states that survival of the species is not a value simply because it accords with evolution: evolution has no goals, and most of the species that have ever lived are now extinct. Survival is of value to us because without it, our other aspirations are moot, and it is also in the nature of humans to care about their descendants.[34] Nevertheless, some philosophers argue that since future generations are not yet born, they have no rights, as they have no existence in any meaningful sense. However, adopting this position would, in Munévar's opinion (and mine), absolve us of responsibility for ozone depletion and for attempting to predict and deflect asteroids that may impact the Earth. Even if we do have such obligations, this does not mean we will

[30] Munévar, "Space Exploration and Human Survival," 198.
[31] Munévar, "Space Exploration and Human Survival," 199.
[32] Munévar, "Space Exploration and Human Survival," 199.
[33] Munévar, "Space Exploration and Human Survival," 199.
[34] See Gonzalo Munévar, "The Morality of Rational Ants," in *Evolution and the Naked Truth*, 131-47. Munévar draws on the work of Peter Singer, E. O. Wilson, and Charles Darwin.

always serve the best interests of humanity (many will not), but we should at least take account of the interests of humanity.[35]

Ideological critics, however, may not be impressed by this argument, and they may doubt the link between space exploration and survival. Their concern is that while scientific approaches may save us from catastrophes at some point in the future, they will certainly degrade the environment now and disturb the natural balance, possibly to the point of making an extinction event more likely. Munévar suggests that these critics favour two possible approaches. One is to reduce human load on the environment by reducing the population. This would likely require coercion, and it would result in widespread misery, which is likely to be too high a price to pay for an approach that might not succeed. The other is promoting better respect for the Earth rather than the idea that we can always leave if things get too difficult. Living in space is at best a promise at this stage: can we really bet our entire future on it? Exercising more moral responsibility and treating the Earth with more respect will lead to a better world. Space exploration, however, will continue to disrupt the natural environment, as it has in the past.[36]

In response, Munévar points out that disruptions to the natural balance have happened in the past and will happen in the future, with or without human activity:

> A very early and rather important disruption of natural balance took place when life was born and changed the chemistry of the planet. Another crucial and massive disruption of balance came when the oxygen liberated by life "poisoned" the atmosphere and the oceans. And this was followed by the adaptation of life to oxygen, with the subsequent destruction of the cozy arrangements between early life and the environment. Disruptions of similar magnitude were brought about by the appearance of complex organisms, by the formation of an ozone layer, which made the land available to life … and then by the return of vertebrates to the water, which led to whales and dolphins.[37]

Thus, the natural balance to which ideological critics refer is an illusion. In addition, all living things, not just humans, alter their environment. The issue is not whether we should alter our environment (we have no choice), but how we should do so wisely. Furthermore, eventually, natural changes in the environment will make the Earth uninhabitable, whatever we do or do not do. Scientific endeavour in general and space exploration in particular offers no certainty that we will gain the knowledge necessary to mitigate them. However, without them, we will have no choice to make.[38]

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[35] Munévar, "Space Exploration and Human Survival," 199-200.
[36] Munévar, "Space Exploration and Human Survival," 200.
[37] Munévar, "Space Exploration and Human Survival," 200.
[38] Munévar, "Space Exploration and Human Survival," 200-01.

Re-Forging the Link Between Space Science and Philosophy: Walter Peeters

In "Space Science as a Cradle for Philosophers,"[39] Walter Peeters notes that for 350 years, there has been a divide between science and philosophy, and he wonders whether the time has come to merge the two disciplines again.

Peeters notes that many astronauts and cosmonauts have commented that from space, no borders are visible; just one beautiful planet. The experience of being in space has caused significant philosophical shifts in many people, in some cases causing strong religious devotion.[40] Konstantin Tsiolkovsky famously noted that "the Earth is the cradle of mankind, but one cannot remain in the cradle forever,"[41] a thought that subsequently developed into an essay entitled "Is There a God?" Due to the official atheism of the Soviet Union, it was never published.[42]

Carl Sagan, in his later works, developed a concept of cohabitation between science and religion: "Because science is inseparable from the rest of human endeavor, it cannot be discussed without making contact, sometimes head on, with a number of social, political, religious and philosophical issues."[43] Hermann Oberth concentrated on the political aspects of space He was highly critical of communist materialism, which he believed could not account for such things as the human soul.[44] Thus, Peeters has taken up Hetzler's challenge to adopt a multidisciplinary approach to space philosophy.

Jesco von Puttkamer, a disciple of Wernher von Braun and a strong supporter of Mars missions, was an early advocate of avoiding contamination of Mars. This led to concerns about traces of primitive life in meteorites and questions over the propriety or otherwise of suppressing and contaminating it. It also raised questions over whether such lifeforms have rights.[45] Chris McKay proposed a three-point approach to address this concern:

1. Preservationism: Humans should not exercise their technological capabilities to alter the Earth and, by extension, the cosmos.
2. Wise stewardship, or utilitarianism: Humans can use, control, and change natural systems, but they must do so wisely and to maximize long-term human benefit.

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[39] Walter Peeters "Space Science as a Cradle for Philosophers," *Astropolitics* 10 (2012): 27-38.

[40] Most notably James Irwin and Charlie Duke.

[41] Peeters, "Space Science," 29, citing Konstantin E. Tsiolkovsky, *The Investigation of Space by Means of Reactive Devices* [Planeta Yest' kolybel' rasuma, no nel' zia vechno zhit' v kolybeli] (Moscow: Academy of Sciences of the Soviet Union, 1954).

[42] Peeters, "Space Science," 28-29.

[43] Peeters, "Space Science," 31, citing Carl Sagan, *Cosmos* (New York: Random House, 1980), Chapter 7, xiv.

[44] Peeters, "Space Science," 32.

[45] Peeters, "Space Science," 33.

3. Intrinsic worth: Human use is not the ultimate value, and living systems have intrinsic worth independent of human utility.[46]

This has obvious implications for terraforming. McKay's prescription is that we should not attempt this if a planet shows any signs of life, but if it does not, we may recreate a biosphere that may teach us more about how the Earth works.[47]

Peeters states that ancient philosophers raised concerns about the philosophical dimensions of space exploration. He adds that Socrates stated that "Man must rise above the Earth—to the top of the atmosphere and beyond—for only then will he fully understand the world in which he lives."[48] While this quotation is often attributed to Socrates, there is no direct evidence that he actually said it.[49] Whether the quote is genuine or not, it raises an interesting point: humanity may have to go higher to understand itself more deeply. For centuries, this relationship was ignored, but in times past, science and philosophy were taught by the same person.[50] However, roughly 350 years ago, the two fields split under the influence of Descartes, Locke, and Newton, among others. This separation allowed both fields to flourish, but they went in different directions. Some would suggest that it is time for a reunion:[51]

> Today this schism, this tremendous gap between the spiritual world and the material world of science, causes great concern to many people, particularly also to scientists. With everything in the physical sciences, specifically in subatomic physics as well as cosmology, becoming, by necessity, more statistical, there is a feeling that certain concepts from the spiritual side may have to be taken into consideration.[52]

Since space exploration has a clear philosophical dimension, it brings together the two fields and begins to close the schism.

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[46] Peeters, "Space Science," 33, citing P. McKay and M. Marinova, "The Physics, Biology and Environmental Ethics of Making Mars Habitable," *Astrobiology* 1, no. 1 (2001): 89-109.

[47] Peeters, "Space Science," 32-33.

[48] Peeters, "Space Science," 33.

[49] In addition, Peeters has inadvertently wandered into a philosophical minefield. If Socrates left any writing, none of it has survived: all we know about Socrates is what his student Plato wrote about him. Furthermore, while Socrates appears in many of Plato's dialogues, it is not always clear whether Plato is reporting what Socrates actually thought, using Socrates as a spokesman for his own views, or using Socrates as a vehicle to explore ideas to see where they lead. However, in *Phaedo* 109, Plato does report Socrates as expressing broadly similar views.

[50] For example, physics was once known as natural philosophy.

[51] Peeters, "Space Science," 33.

[52] Peeters, "Space Science," 33, citing J. von Puttkamer, "Foreword," in P. Harris, ed., *Living and Working in Space* (Chichester, UK: Ellis Horwood, 1992).

The German Aerospace Centre has brought together space scientists and philosophers to examine the technical, scientific, and ethical aspects of human spaceflight in a programme called *Saphir*. It has concluded that manned spaceflight has a cultural dimension, which changes humanity's self-image and idea of the human place in the universe. Thus, spaceflight is not purely about financial costs and benefits: politics has also played its part in promoting space exploration. There have been several workshops on *Man and Cosmos* in Europe, and they have engaged with the work of Pierre Teilhard de Chardin,[53] who tried to bring physics and theology together. In Teilhard de Chardin's view, humanity must continually expand its horizons, despite ongoing criticism.[54]

Finally, Peeters notes that many of the innovators in space exploration have been mavericks, who have acted on their personal values to remedy what they saw as deficiencies in the organisations for which they worked. Peeters describes them as Space Ronins, after the freelance Samurai in seventeenth-century Japan after the feudal system collapsed. Peeters wants to encourage this trend. He notes that Apollo 11 Command Module Pilot Michael Collins suggested that if future missions included "a poet, a priest and a philosopher we might get a better idea of what we saw."[55] This suggests a need to involve a wider range of disciplines in future space exploration plans.[56]

Discussion

Hetzler, as an early writer on the philosophy of space travel, was right to focus on methodology. While the details of her proposal go beyond the scope of this paper, and subsequent writers have in general gone in different directions, she raises two important principles. First, it is important to approach space exploration from multiple perspectives. This is always good practice in philosophy, as no viewpoint is above criticism, and no viewpoint can give an exhaustive view of a subject. Hetzler proposes noetic, spiritual, and emotional viewpoints as initial options,[57] while Peeters agrees with spiritual inputs and adds scientific inputs, but there are no doubt many other possible lines of approach, both philosophical and non-philosophical. Second, conventional modes of philosophy may not be adequate to deal with space exploration, and imagery and analogy may be necessary supplements to argumentation. However, this suggestion does not seem to have received much attention so far.

Munévar, by contrast, gets into the thick of the argument and tries to make his case. Both social and ideological critics can offer strong arguments against space exploration, but like Munévar, I do not believe they are ultimately successful. I would certainly agree

[53] In particular, *L'avenir de l'homme* [The Future of Mankind] (Paris: Editions du Seuil, 1959).
[54] Peeters, "Space Science," 34-35.
[55] Peeters, "Space Science," 36, citing P. Billins, *One Great Leap: Apollo 11 Remembered* (New Plymouth, New Zealand: Zenith, 2009), 55.
[56] Peeters, "Space Science," 35-36. Cf. Hetzler, "Man and Space," 64.
[57] Hetzler, "Man and Space," 58.

with Munévar that a dynamic view of space exploration is necessary, but I am not convinced by his case that serendipity is the natural result of change. Change can be for the worse, and it does not always lead to clear benefits. For example, technicians at Chernobyl attempted

> to determine whether, in the event of a loss of station power, the slowing turbine could provide enough electrical power to operate the emergency equipment and the core cooling water circulating pumps, until the diesel emergency power supply became operative. The aim of this test was to determine whether cooling of the core could continue to be ensured in the event of a loss of power.[58]

Due to a lack of communication, certain safety protocols were not followed, and this, combined with design flaws in the reactor, led to a large explosion at 01:23 local time on Saturday, April 26, 1986. It is far from clear that there were any happy accidents in the resulting carnage, or that anything useful was learned from it (with the possible exception of "don't shut down the safety systems while experimenting on nuclear reactors"). There is clearly a case that scientific exploration can and does lead to serendipity, but it needs to be strengthened considerably if it is to meet the objections of critics. However, attempting this would be beyond the scope of this paper.

It seems to me that the dilemma Munévar sees between promoting respect for the Earth and exploring space may be false. This need not be an either-or situation; it may well be possible to do both. While living permanently in space may currently be science fiction, if it leads to the development of resources from and in space, there will be less need to mine the relevant resources on Earth. This should reduce the overall impact of space travel on the environment. Whether it can become a net positive remains to be seen.

Peeters, by contrast, wants a rapprochement between philosophy and science. I wonder if this is a realistic aspiration. There is certainly room for closer links between science and philosophy, and scientists certainly make philosophical assumptions routinely, but it seems to me that the disciplines have diverged to such an extent that a reunion may not be practical. Furthermore, it is not entirely clear that philosophers and scientists are asking the same sorts of questions. This point becomes even sharper when Peeters discusses Pierre Teilhard de Chardin, who attempted to harmonise physics and theology. Scientists tend to ask *how* questions. Theologians and, to a lesser extent, philosophers, tend to address *why* questions. Thus, for example, it would be a mistake to take the creation accounts in Genesis 1 and 2 as scientific documents, as they are intended to explore the roots of human spirituality as much as they are accounts of how life on

[58] OECD Nuclear Energy Agency, *Chernobyl: Assessment of Radiological and Health Impact. 2002 Update of Chernobyl: Ten Years On*, Chapter 1, www.oecd-nea.org/rp/chernobyl/c01.html.

Earth came to be. Furthermore, Teilhard de Chardin's work was not always well received by either scientists or theologians, so his views are not really in the mainstream of either discipline.

Moving forward, there is scope for more work on developing the methodology of space philosophy. In the humanities, methodologies are not always explicit, as they are in the physical and social sciences, and in some cases, they evolve as a project proceeds, but there is merit in making the necessary assumptions explicit and having a clear methodology at the outset.

There is also merit in broadening those with inputs to space philosophy beyond academic philosophers, although their input is an essential component of this field. Scientists, poets, philosophers, and theologians can all make contributions, which may lead to a richer field of study.

The case that exploration leads to serendipity, to discoveries that benefit humanity, needs to be strengthened or supplemented. There is a strong argument that it may lead to beneficial side-effects, but it is still vulnerable to counterarguments like the events at Chernobyl.

Finally, we need to be clear what sort of questions we are asking, as they will affect the kind of answers we get. This may become more complicated if contributions are coming from multiple disciplines, but failure to do this is likely to lead to confusion.

Conclusion

The philosophy of space exploration is largely an undeveloped field. There is plenty of scope for development. The philosophers who have written on space exploration to date have laid a solid foundation, however. They have explored a possible methodology, begun to develop arguments in its favour, and explored its relationship to similar academic disciplines. It now falls to others to develop this field and to construct better and stronger arguments in favour of space exploration.

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About the Author: Gordon Arthur is Dean of Space Philosophy and Theory at Kepler Space Institute (KSI). He has taught courses in both philosophy and governance at KSI. He has published books in theology and journal articles in both philosophy and theology. He

is Associate Editor of the *Journal of Space Philosophy*. This article was written partly for this journal and partly as source material for the KSI 500: Philosophical Foundations course.

Editor's Notes: Our Associate Editor of this Journal, and Department Dean for the Kepler Space Institute, takes us into the complex arena of merging Space science and philosophy. That is one of the purposes of this Journal of Space Philosophy. In spite of a very long history of humans thinking about Space, and a much shorter one of humans experiencing Space, there remains today, in 2021, both super advocates and those who cannot answer the "Why to Space?" question. That distinction has probably existed with every societal movement in history. We, in Kepler Space Institute are in full agreement with our overview answer of: "To improve, and very likely insure survival, of humanity." I want to tell readers that the professional formatting and editing of each of these Journals since Fall 2012 has been the sole achievement of Dr. Gordon Arthur. ***Bob Krone.***