Exploring the ethics of commercial space exploration in the 21st century

Is the pursuit of space exploration through commercial organisations advantageous to humanity?

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The benefits of space exploration go far beyond humankind's shared desire to discover and explore new worlds. While playing an important role in engaging the public's eyes, space exploration also directly inspires the generations of today and tomorrow to pursue many space science disciplines. The interdisciplinary nature and international corporation innate to this field means that space exploration can no longer revolve solely around a country's pride in its technological superiority, much as how it was during the great space race of the 20th century. Rather space exploration is a field in which measurable benefit to humanity is essential to sustainable political and economic support.

Space exploration for the most part, is regarded as a benefit to humans from around the world because it has left us with inventions that we couldn't imagine our world without, improving our standards of living. Whether it be directly or indirectly, it is space exploration that we have to thank for: solar panels, satellites and the communications they provide us (wireless mobile internet and GPS navigation, for example), memory foam, freeze-dried foods, air purifiers, the sole design and materials of modern sneakers, water filtration systems, wireless headphones, medical CAT scanners, the HACCP food safety standards (used in food manufacture in over 150 countries), cochlear implants (hearing aids), infrared thermometers, the miniaturization of cameras in our smartphones (NASA-developed CMOS active pixel sensors), scratch-resistant lenses, prosthetics and artificial limbs, adjustable smoke detectors, and advancements in embedded technology (paving the way for the internet of things, IoT). [2]

The influence space exploration has had on our lives is truly incomprehensible. However, it has been almost 50 years since the last human walked on the Moon and there has been little progress in sending humans beyond Low Earth Orbit (LEO) since then . For some time, the commercialisation of space has been inevitable but mainly focussed on organisations manufacturing and taking satellites to orbit to provide services of communications, imaging broadcasting, and GPS [3]. However, the likes of private companies such as SpaceX, Boeing, Blue Origin, and Virgin Galactic, to name a few, are now pioneering the frontier of a new space race – they are increasingly looking to settle humans in space and to harvest resources from planetary/inter-planetary bodies.
These companies are generating a significant amount of interest from the public and investors such as NASA, which frequents the outsourcing of satellite delivery to SpaceX and, more recently, transporting astronauts affordably to the ISS.

While private commercialisation is concerned primarily on profit such to maintain a sustainable business model, some may argue that commercialisation speeds innovative progress of space technology and drives down the cost through the introduction of a competitive market. As well as economics, controversy arises over the ethics of the commercialisation of space exploration.

The ethical question to explore: 'Is the pursuit of space exploration through commercial organisations advantageous to humanity?'

This is a diverse topic governed by the ethics of colonising space, exploiting resources of Earth in order to achieve exploration goals, introducing new life and bio-contaminants indigenous to Earth to other worlds, exploiting the resources of other terrestrial bodies for profit/human progress, and the exacerbation of unequal opportunities in a global community where wealth inequality is increasing and poses a significant moral dilemma. Furthermore, there is a substantial barrier to humanity's settlement of space; energy.

Extracting, manufacturing, and transporting vast amounts of material as well as the burning of fossil fuels will be inevitable for any permanent fixture and settlement to take place. NASA and their private industry collaborations have the goal of getting the next humans to the Moon and of establishing an orbital lunar base. A moon base would act as a 'catalyst' to reduce the dependence on Earth's resources; fuel could be produced on the Moon via electrolysis and, with the lack of a dense atmosphere and a weaker gravitational field, launching to other worlds like Mars from the Moon is very attractive.

The ethics of space exploration, much as any high-expense endeavour today, does not escape the debate over humanity's responsibility to conserve Earth, its people, and its ecology. In the 21st century, the role of 'the billionaire' is under heavy scrutiny and the public's desire for new action on issues of wealth inequality, climate change, and global health development mean that philanthropic focuses are being encouraged (a notable example being Bill Gates & Warren Buffet's Giving Pledge Scheme [4]).

Exploiting space's resources and providing space tourism would be highly profitable and will aid economic prosperity for humanity in providing new technologies and more abundant materials. However, the vast assets of major CEOs who are currently focussing on space exploration put them at advantage over the many smaller companies venturing into the space business. There is potential for a monopoly to dominate the entire space tourism/resource mining field.

As Sir Tony Atkinson once said, "If we are concerned about equality of opportunity tomorrow, we need to be concerned about inequality of outcome today" [5]. One may therefore suggest that it is more important to focus on creating equal opportunities and saving planet Earth rather than settling on new planets, especially if that could exacerbate wealth inequality. Although, as mentioned previously, space exploration has historically benefited humanity and helped improve the quality of living for most - through numerous advancements in manufacture techniques, medical care, electronics, and consumer technology - the global inequality of opportunity is the consequence of global inequality in health, wealth, education, and the many other dimensions that matter for our lives. It would be reasonable to argue that the expenditure of vast sums of money on space exploration does not help the present outcomes of people living in the poorest parts of the world.
It can, however, be argued that a responsible approach to commercial space exploration, with legislation comparable to a model like the Antarctic Treaty [6], would ensure commitments to sustainability. Exploration in this way would have greater odds of improving humanity's outcome in the long term. Scarce resources could be obtained from space reducing the dependence on mining and harming Earth, a benefit to nations in all stages of development.

While the commercialisation of space exploration currently revolves around the personal interests of entrepreneurs, the same can be said for any commercial endeavour – there is no rule or obligation in place to decide where people are allowed to spend their money so long as it is within the law. In fact, that decision is regarded to be one's own freedom and right in most parts of the world.

The safety of commercial space exploration, being an entirely new infrastructure with a high-risk endeavour, is not certain. There is a lot that can go wrong and a company transporting and accommodating consumers in space is entirely responsible for the safety of its passengers. This, however, has been inherent to all new products and services - it did not stop the production of the motor vehicle and airplane, and nor should it have! The cost of space exploration will be an extreme barrier to most of the world's population, with only the richest able to afford such travel; this luxury raises an ethical dilemma. A big motive behind space settlement is to improve the odds for humanity's survival. If humans remain habitant on only a single body (Earth), humanity may face demise in the face of any potential mass extinction event.t. Having a population on the Moon or on Mars would act as a back-up for any eventual catastrophe. If only the richest part of the population could take this opportunity, it infringes on morality.

Considering the three main philosophical approaches to ethics

During the initial stages, space exploration organisations are primarily concerned on research and development, innovating to manufacture an affordable, safe, and more efficient infrastructure. However, many of the arguments outlined so far look more distant into the timeline of space exploration.
To help achieve some coherency in answering "Is the pursuit of space exploration through commercial organisations advantageous to humanity?", we will outline some considerations with regard to the ethical frameworks of deontology, consequentialism, and virtue ethics.

Deontology

A deontological viewpoint assesses the rightness or wrongness of an action according to whether it is consistent with a ruleset for a given community [7].

Some deontological views may argue that humans were born to Earth and that it is our duty to put our best efforts into protecting and conserving its resources – the large expenditure in cost, resources, and fuel required to get to space would have a detrimental impact on Earth. Perhaps it may be argued that if humans were meant to habit another planet, we would see life out in our universe already, and its absence is a sign that Earth is the best place for humanity. Many faiths over the world consider humans to be at one with Earth and its nature. Giving up on Earth in pursuit of new land is then perhaps viewed as neglect.

Conversely, some deontological views may argue that humans should take any action necessary to prolong the survival of our race and other lifeforms on Earth. If humans and other lifeforms became multi-planetary, it can be viewed as the next evolutionary step in our progression. Having life habitant elsewhere improves the odds for survival into the future and increases the resource supply. A mining infrastructure in space would significantly increase the supply of resources to humanity. Some of our most cherished devices are dependent upon rare-earth elements and non-renewable metallic deposits, which have a limited supply in the Earth's crust. Not to mention that some resources are only sourced from a few places in the world, where there is a lack of control over the safety standards for workers. For example, cobalt, an essential component to many batteries, is mainly mined in the Democratic Republic of the Congo, where it is estimated a third of the miners are in the informal sector, including 25,000 children who experience extremely exploitative and dangerous conditions for as little income as $2 a day [8]. Many of the materials required for smartphones, renewable energy infrastructure, computers and medical instruments are dependent on such limited deposits, with unethical sources. In order for humanity to sustain the increasing standards of living that stem from the 'seeds of technology', and combat regional inequality, new abundant supplies of the depleting reserves must be discovered. Space mining offers this opportunity, and thus with an increased supply and resource security, material costs would be driven down. Ultimately, this could improve humanity's standards of living as manufacturing becomes globally more affordable.

Consequentialism

Consequentialist ethics relies on the justification of decisions based on the advantages of the overall outcomes ('the ends justify the means' [7]). A subcategory of this approach is utilitarianism, which puts absolute value in maximising the advantageous outcome and hence the value is judged by the overall result regardless of the means of facilitation.

The consequentialist debate is vast as there are so many pros and cons arising from the matter of not only commercialising space but also exploring space in the first place, the requirements of getting there, and the side effects it imposes on our Earth.

Some of the main views we have outlined can be condensed to:

- The favour for commercial space exploration for economic endeavours: profit and proliferation of the industry. The introduction of a new competitive market drives down the cost to reach space which is a benefit to everyone.
- The favour of commercial space exploration for enhancing innovation, advancement of scientific research, and technology which improves the outcome on quality of life for humanity.
- The favour of space exploration to increase human knowledge and inspire future generations.
- The favour of space exploration to increase the outcome of survival of humans – and other life forms on Earth.

A utilitarianism argument may strongly favour these arguments despite the initial cost on Earth's resources because, in the long-run, Earth and its populations of species would benefit from exploiting other planetary bodies.

- The rejection of commercial space exploration due to the potential for exacerbation of today's inequalities, from wealth to opportunity. A space business will be dominated by the super wealthy and become a market only available to the richest consumers in the world. Space exploration has a potential for huge profit from resource extraction and tourism but only the most developed nations in the world will be able to exploit this.
- The rejection of commercial space exploration due to the high expenditure of necessary resources, money, fuel, and time. Energy production and use is the primary hurdle in the journey of settling space, and mining and other resource utilization endeavours to produce such energy would have a detrimental impact on Earth and so could result in more harm than anticipated long-term benefits.
- The rejection of space exploration on grounds of contaminating other terrestrial bodies with biomatter from Earth. This hinders efforts to find pre-existing evidence of life beyond earth and puts any potential alien organism at risk of extinction.

A utilitarianism argument may consider that these disadvantages far outweigh any benefits and thus to protect and conserve Earth and its lifeforms, commercial space exploration is not an overall benefit to humanity - it should not be pursued.

Virtue Ethics

Ethical systems based on virtue weigh outcomes based on the role of a person's or group's character in making the decision [7]. Virtue ethics dictates that personal adherence to virtuous qualities should be at the forefront of decisions.

Virtue ethics may oppose commercial space exploration in several key ways:

- Space exploration is currently dominated by the money and desires of billionaire CEOs – for example in the big tech industry. The rejection of huge commercial endeavours by billionaires in general on grounds of moral obligations to participate in more philanthropic projects instead.
- As outlined before, the vast potential for capitalizing on a highly profitable market could exacerbate the global wealth divide as well as increase the inequality of opportunity in society.
- It may be argued that despite the benefit for long-term prosperity, improved quality of life, new technology and reduced dependence on Earth's resources, the initial hurdle and resource exploitation from Earth is not righteous. Similarly, the climate change crisis needs to be addressed and harming Earth in the short run for long-term improvement is not saving the Earth of today.

Conversely, the opposite argument may be applied to virtue ethics here, that long-term good can come from space exploration and ultimately it is a good endeavour to improve the chance of survival for Earth's environment and lifeforms.

Conclusion

The most extreme sides to this case arise from the utilitarian and virtue standpoints, which put absolute weight upon either the end outcome or the initial endeavour. It is, however, important to take both approaches into consideration with the more objective consequentialist approach to debating, because collaboratively they help to identify the diverse views and approaches shared by humans around the world. Diversity in views, cultures, and backgrounds is inherent to humanity and, in a field that is so dependent on global collaboration, it is vital to consider all the effects that a complex industry such as space commercialisation will have. The debate over whether commercial space exploration is a benefit is extremely complex and there is no single right or wrong answer at this current, very early stage in this industry's timeline. Humans have still not landed on another terrestrial body since 1972 and so settlement of other worlds may still be a long time away.
In a rapidly changing climate, it is important to create a global agreement on legislation to cover commercial and governmental space endeavours so that they are pursued in the most sustainable manner possible.

References

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