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I will now handover to Daniel. I understand there are sovereignty, military, intelligence questions alongside the commercial exploitation of space. How do we handle this, Daniel?

Daniel Andler

Outer space is a mess, and a dangerous one. How has it come to this? And what can we do about it?

Half a century ago (in 1967 to be precise), the UN Committee on the Peaceful Uses of Outer Space produced the Outer Space Treaty, followed by four more conventions, the last of which was the Moon Agreement in 1979. The so-called Five Treatises were supposed to shield us from the potential threats stemming from human activity in outer space.

That was then. In 1967, Elon Musk wasn't born, and he was 8 years old when the Moon Treaty went into effect. Musk's businesses Space X and Starlink, and his Mars-oriented vision are of course part of the present quandary. But they are also emblematic of the technological explosion of the last few decades. This explosion has in turn has given birth to some Gargantuan projects —some outer space-based, some not— which raise concerns, whether they have the slimmest chance of succeeding or not. Reality has caught up with distant possibilities, and the Treatises aren't equipped to deal with the present plight, where actors have multiplied in number and variety, with many countries, non-state actors and private businesses challenging the historical space powers; and where commercial and vastly expanded military interests compete with scientific ones. Consider some of the issues we have to face today:

1. How to administer the Lower Earth Orbit, which is something of a Wild West. We have the debris problem, which presents us with a threat that we don't know how to stave off, due to both technical and legal problems. We have a cluttering problem, with fleets of satellites competing for orbits, and no accepted principles of priority.
2. How to regulate the military and security systems located in space, in the absence of a universally accepted *jus bello* that applies to outer space. Hybrid attacks are a major concern: in order for the separation principle according to which legitimate military operations should not jeopardize civil services, it is essential that military and civil systems should be kept separate. But this 'reverse distinction principle' is massively violated, as illustrated by dual-use satellites.

3. What leeway should be granted to outer space tourism. Does technical and economic feasibility justify the expenditure in economic and human resources, the damage, actual and potential, to the outer space environment?
4. What legal framework to impose on mining for metals and water and construction on the Moon, on Mars, on neighboring asteroids. This splits into several interconnected problems:
   a/ Ownership: the recent Artemis accords grant ownership of resources extracted from non-Earth bodies to the extracting agencies; but this —despite claims to the contrary— runs counter the Outer Space Treaty clause according to which spatial bodies are the property of humanity and of no country or private agent;
   b/ Jurisdiction: what institution is in charge of implementing extant regulations and imposing sanctions on violations?
   c/ Mining activities, in particular the construction of massive permanent structures that they require, cannot fail to affect the environment, as it does on Earth; given both our less than stellar record in terrestrial mining and the deep uncertainties regarding outer space environments, how much restraint should be exercised, and how should we proceed?
   d/ Should we proceed at all? Indeed, engaging in full-scale mining in a given area, we foreclose future options for use of the area.
   e/ Damages are unavoidable: to what degree should they be regarded as acceptable? how can they be mitigated and compensated?
5. What sense to be made of the goal of 'terraforming' Mars —of making it inhabitable by a human population? Is it remotely feasible, and if so at what cost? If it is both technically feasible and cost-effective, is it legitimate? Is Mars as such owed some kind of respect? Many people, whether for religious, metaphysical or more broadly philosophical reasons, recoil at the thought of humans settling Mars as some of their forefathers have settled the West. Should their reluctance be brushed aside, be it for the sake of saving humanity from our own bankrupt planet? Should microbial life turn out to exist, is it owed respect? And how should we countenance the prospect of imposing life on Mars on a human population? Given that even under the most optimistic scenarios, many people will remain on Earth while some will settle on Mars, on what basis should the division be made, and should we tolerate an inequality of a totally new kind between two sets of humans, the Earth and the Mars dwellers?
6. What to think about the even more distant prospect of travel to distant planets. Space travelers would spend their entire lifetime on a spaceship; and they would require the enhancements which make it physically and psychically bearable. Are these options we should offer to some of our fellow human beings?

A mere update of the Five Treaties might help us deal with some of these issues. But clearly not with all of them. We intuitively feel that what is required is a keen ethical perspective. But what kind, or rather, what stage of ethics is called for? In many areas of applied ethics, such as those concerning the environment, business, or again AI or genetic engineering, ethics is mostly taken at a crystallized stage, where the norms of good and bad, the rules of acceptable and unacceptable behavior are already settled, and where what you might call an 'Ethics Brigade''s job is to identify areas where these principles are, or are at risk of being ignored,

neglected or deliberately violated and to uphold them. Legislation such as the Five Treatises is precisely aimed at systematizing the duties of the Ethics Brigade in charge of outer space.

Space governance at the present juncture needs something more drastic. It calls for what I propose to call 'fluid ethics', or ethics in the making, whose purpose is to identify ethical issues not covered by agreed-upon principles of good and evil and to initiate a deliberation in which nothing is left off the table, all relevant factors, including the uncertainties and risks, are considered with due diligence; a deliberation in which all stakeholders take part; a deliberation which proceeds under a methodology which has been discussed rather than pre-imposed; a deliberation which aims for a clear decision about the here and now, given that no demand — not even the demand for resources for space activities— can be regarded as non-negotiable, and that a balance is all we can aim for. Once reached, the decision obligates all parties because they took part in the decision and they have an understanding of its rationale.

This may sound either banal and hence otiose, or idealistic and unconnected to down-to-Earth, or perhaps down-to-Mars issues which are the bread and butter of professional experts in international relations, politics, diplomacy, economics, military affairs, technology. These experts obviously have a seat at the table and should keep it. But I fear that on their own they will not help us out of the predicaments I listed a moment ago, any more than they have up to now, for at least two reasons: first, they rely on a crystallized ethics which does not have the necessary conceptual and moral resources; second, they keep the public out, at the local and the global scale. Let me illustrate both points. Crystallized ethics says that outer space activities should benefit mankind. And mankind is indeed the main stakeholder here, for several reasons. One is that mankind itself is faced with at least one existential threat, *viz.* climate change, or maybe several. Another is that a disaster in space, whether caused by the Kessler effect or by a sabotage by rogue non-state actors or a military flare-up, could lead to unheard-of damage to humankind. Finally, some influential people believe on the other hand that terraforming is the way, possibly the only way, to salvation. Therefore mankind, the main stakeholder, should have a seat at the table. But how does one bring mankind to the table? An important first step is to involve the public, in the global sense. But that by itself won't make mankind the sort of stakeholder which the usual methodology of crystallized ethics, as practiced in say genetic engineering or AI, knows how to implicate. What is called for is a collective reflection at a more fundamental level, perhaps akin to what the thinkers of the Enlightenment achieved in the 18th century. This kind of deliberation could lead us, for example, to turn away resolutely and unanimously from mining projects because they are too dangerous to the environment, or from the terraforming project before it consumes too much of our resources and diverts us from more immediate concerns. But this could only emerge from the deliberation I am recommending, and which could lead to a different decision.

So let me simply conclude by urging that fluid ethics both advances a shared understanding of the issues and their interconnectedness and keeps the search for collective wisdom open, as it crucially needs to be, by making ample room for public and global involvement. But then, where and how should the enterprise of fluid ethics of outer space be conducted? Should it be distributed over many venues? Does it require an independent Outer Space Authority? My hunch is that both may be needed, but I must leave it at that.

Patrick Nicolet

Thank you, Professor Andler, for this description and for drawing our attention to the fact that, as we have seen with the first rocket, from an engineering standpoint we could never test a rocket before launching it, so it was an engineering challenge. You are telling us that it is the same from an ethical standpoint, where it is not just one area of human activity we must address. Indeed, by projecting ourselves into space, we project the whole of humanity. Thus, the complexity of the ethical challenge is on a broad scale. I like your notion of fluid ethics; I just need to understand how this will work. You asked for a governance body, and you are certainly right, that is a fundamental and complex question we should address from the very beginning. As I understand, we do not have the framework right now, but those questions are important, so thank you very much for this inspiring contribution.