Open Science and Commercial Secrets

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1. Introduction

The potential commercial context of future space exploration, in particular commercial exploitation of resources on celestial bodies, has the distinct possibility of putting scientific discoveries about space into private hands. What if, as an example, a space mining company found a dinosaur bone on the Lunar surface? Such a discovery would fundamentally change our understanding of natural history, but it would also likely be of great monetary value to the discovering company, leading to questions of which interest, science or profit, should prevail.

The fact that profit is a driver of scientific exploration is not new, and is easily illustrated by terrestrial instances such as pharmaceutical companies having active research programs in areas of rich biodiversity. The ensuing issues raised in such cases have played out in courts in disputes around patents and trade secrets. Discoveries in space, though, occur within a distinct legal framework that embraces a heightened concern with information sharing among states and operators alike. This brief commentary will discuss this framework in both legal and ethical terms and evaluate its ability to mediate between science and commerce. Specifically, this paper will suggest that though there are strong ethical justifications for balancing these interests, at the moment there is a legal imbalance that disfavors the sharing of information that has both scientific and commercial value.

This paper will proceed by first discussing the role of information sharing in the space law regime and give examples of open science initiatives from civil space actors to support this regime. It will then turn to a more general discussion of the nature of scientific data when discovered or held in the commercial context. Finally, it will discuss the extent to which the legal framework for space balances these competing interests, and whether it is possible to have robust commercial space exploration coupled with open science.

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2. A Dinosaur Bone on Moon

Several years ago, after a long day at the United Nations Committee on the Peaceful Uses of Outer Space (UNCOPUOS) Legal Subcommittee (LSC), a number of other space law and policy professionals took a refreshing beverage on the banks of the Danube. The author was having a conversation with one of the lawyers from one of the now defunct space resources companies, and the author posed the question, "what if your company finds a dinosaur bone on the Moon?" Without hesitation, the space resources lawyer responded that such a discovery would be used to bring value to the company.

A dinosaur bone on the moon sounds like the beginnings of a fantastical sci-fi adventure, but engaging in sci-fi speculation is not the purpose here. Rather, such an idea is put forward because it presents a clear case in which a discovery would have dramatic effects on our understanding of the world, specifically the fields of geology, biology, paleontology, and a variety of space science disciplines. It would be no exaggeration to call such a discovery a paradigm shift in human knowledge. However, in this scenario, it would be discovered and exploited by a private company, meaning the full meaning of such a discovery and its value to the sciences might not be realized as the commercial actor would seek to maximize profit from that discovery.

A gut instinct of many is that such a discovery should be used for "the benefit of all [hu]mankind" in accordance with general space law. At the same time, simply because a discovery occurs within the context of a private company is not necessarily incompatible with our understanding of scientific discovery and innovation. These values are thought of as public goods, but are as likely to come from private industry as they are from public institutions. For instance, patent law is often seen as a way to foster innovation by rewarding inventors for their work by giving them monopoly rights over their invention for a set length of time. While a dinosaur bone on the Moon is not an invention, scientific discovery is a critical part of innovation and fostering economic development. In the terrestrial sphere, private companies engage in this type of activity regularly and this is not seen as illegitimate. Indeed, it is often seen as beneficial to society by driving forward both science and the economy.

Yet, from a space perspective there seems to be a difference in how we think about these things. This is due to the unique way in which the global commons of space is structured through international law. It is a place for military and commercial activities, but the primary driving ethic of space law is one of cooperation and information sharing. The Outer Space Treaty mentions the norm of "international cooperation" more than any other in the treaty, and it promotes a variety of types of information sharing to facilitate such cooperation. A salient example in this context is found in Article X, which states:

> In order to promote international co-operation in the peaceful exploration and use of outer space, States Parties to the Treaty

> conducting activities in outer space, including the Moon and other celestial bodies, agree to inform the Secretary-General of the United Nations as well as the public and the international scientific community, to the greatest extent feasible and practicable, of the nature, conduct, locations and results of such activities.

In Article X, information sharing is done specifically in support of international cooperation and requires states to provide information not just on their space activities but on the results of those activities. The reference to the international scientific community implies that results of scientific discoveries should be shared. This comports with the sentiments of the normative content found in Article I referring to the sharing of benefits and the encouragement of cooperation in scientific research.

It must be recognized that this emphasis on information sharing is usually articulated within the bounds of softer language that one might call best efforts obligations. For instance, "to the greatest extent feasible" gives a state party a significant amount of leeway in determining how, when, and what to share about its activities. This is confirmed by the language of the benefits sharing declaration, which makes clear that states have a right to choose the nature of their international cooperation and with whom to engage in such cooperation. Nevertheless, the idea that space science should be shared can be seen in numerous programs run by space agencies of states that make their data open. For example, both the Landsat and Copernicus programs distribute their data through open access portals, and there are a number of sources for open astronomy data such as that collected by the new James Webb Telescope. Further, all states that have engaged in sample return missions from space have pursued programs that allow researchers globally to access samples for scientific research. So while the legal obligation may be a soft one, there seems to be at least some normative push towards the sharing of scientific information, and in the case of the discovery of a dinosaur bone on the Moon, one might argue that the normative content is heightened because of the transformative effect the discovery would have on human knowledge. Regardless, this raises a question of where the line should be drawn between scientific discovery that can be exploited for commercial gain and scientific discovery that should be made available for the benefit of all.

3. Secrets and Openness

This question becomes prominent in the space domain because of the domain's emphasis on transparency. While transparency is an underlying ethic for space activities, as noted above it has only been operationalized as hard obligations in a few places, such as registration of spacecraft. At the same time commercial activities often rely on restrictions in information to maintain competitive advantage in the commercial market.

The example of patents as a tool for innovation has already been raised. Interestingly, patents do indeed create transparency in scientific knowledge. A patent is available for new inventions or processes, and the patent gives the inventor (or the owner of the patent rights) monopoly rights over the use of that invention or process for a set amount of time, usually twenty years. In exchange, the owner files public information on the invention or process that would allow someone skilled in the trade to make the invention or use the process. Thus there is transparency in the new knowledge, but it is linked to a use restriction that gives the original innovator an advantage in the commercial market that is limited by time.

Of course, the discovery of a dinosaur bone on the Moon would not qualify for a patent as it is neither an invention or a process. It is a natural item that contains scientific data and information. A patent would not be a protection available to a company for such a discovery. A company might however use trade secrets to keep such scientific information secret. A company could keep the finding of a new resource as a trade secret giving it the ability to exploit the resource for commercial purposes. In the dinosaur bone case, the company might seek to hide the information in order to lay claim to other fossils found. This in turn, might result in the destruction of the geologic context of the bones as the company sought to extract as much value as possible. Other resources with scientific value are certainly imaginable. Trade secrets are a form of intellectual property and are enforceable against individuals that breach these secrets. So for instance, if another entity were also to make such a discovery and publicize it, then the first astro-paleontologist would not be able to make a claim for a violated trade secret. On the other hand, if a company employee leaked the information, the company would have a right of action against that employee.

But this leads to a secondary question, clearly an asset like a dinosaur bone does not retain value as a secret. Its value is based on its rarity which must be known. But this raises the question of openness as it relates to the stewardship of that scientific information. Because once this information becomes public, it is open in the sense that it is known. However with such a discovery to what extent should pure scientific investigation be given access. If it goes to the highest bidder you could end up with a Jurassic Moon Park scenario, where a random billionaire buys the bone with the intent of resurrecting the lunar lizards to make a space park to go with the thriving lunar tourism market. More likely, though the scientific research might either just be kept behind closed doors or languish as the bone sits in a trophy case.

Importantly, this is not to indicate that this is the necessary outcome of commercial stewardship of the data. There are, of course, robust arguments that commercial enterprise is the most efficient way to steward valuable information, but there are also robust counter arguments that suggest that such a scientific discovery should somehow be held in trust for humankind as a whole. But regardless of which side of this economic discourse one sits, the

notion of openness should impact the decision making surrounding the dinosaur bone. This also gives no indication of which governance mechanisms would best be suited for managing this resource to maximize scientific gain.

4. Protecting Science

Before the such a discovery, it would be down right shocking for any legislature to adopt a law regulating the scientific openness of a Lunar-fossil. More generalized space resource laws have already been seen to be adopted that can apply to such resources. So for instance, The US space resources law declares space resources to be "abiotic," so we know that the law would not apply to dinosaur bones on the Moon, but the law is silent on how biotic resources would be treated differently. At the end of the day though, such generalized legislation will likely not be prepared to cope with the pressures placed on it by unique scientific resources.

With this lack of legislation, one place to start would be a discourse between industry and the stakeholders in the scientific community. From there some principles could be developed that an industry participant might agree to concerning the openness of scientific information. Of course, to get such a set of principles completed there would be a need for the industry to see value in complying with them. Whether that decision be an ethical one or a question of cost-return, an industry participant must buy into the narrative of compliance and determine if it fits their business model.

Of course, from here we have the oft told tale of how there is potential for these principles to get escalated up the hierarchical stack of governance on their way to form law. This is not a complete answer to the issue, but it creates a node for normative growth from an ethical stance adopted through a discourse.

There may also be room for state action either at the domestic level or the international level through law, regulation, or policy. This would still likely need to come from dialogue with stakeholders. Most states would be unlikely to take drastic action that would damage the nascent industry, but it would be reasonable for there to be some cooperation between industry and a national space agency.

A recent analogue is the discussion around dark and quiet skies, in which the astronomy community has raised concerns about the increasing population of satellites in low Earth orbit, which has resulted in a dialogue concerning these issues, but has not yet resulted in a consensus on how to balance science and industry in this context. Since this is a pressing issue, it stands to reason that any consensus surrounding the private discovery of a dinosaur bone on the Moon (or more to the point other scientifically valuable lessons) is well into the future.

5. Conclusion

The unique environment of space and the structural ethic of information sharing requires that there be some acknowledgement of the need for openness in scientific discoveries in the space environment. At the same time, for commercial operators to want to engage in such exploitation, they will want assurances that they can derive value from their efforts. Space presents a new sphere for balancing between open and closed information in pursuit of societal value and private economic activity. The context of space as transparent may place the thumb on the scales in favor of transparency, but that can not be an absolute value. However, as the case of a dinosaur bone on the Moon illustrates, neither can we adopt commercial advancement as an absolute value. Their will be a need to balance these values, and states, industry, and civil society will need to work together to shape the future of commercial transparency in space.