Inclusion and Environmental Protection in Space

Tony Milligan

A push for inclusion has been one of the most striking features of space programs in recent years, with a diverse range of agents going up to the International Space Station. NASA has been promoting the recognition of the early, but hidden, role of black scientists such as Katherine Johnson within its programs of the 1960s (Johnson was celebrated in the 2016 film Hidden Figures).[1] Beyond this, private sector activities are emerging with some built-in elements of inclusion. In 2021, Wally Funk finally could make it into space on a private sector Blue Origin suborbital flight, 60 years after being part of the privately trained female Mercury 13 group. These women were not part of the official NASA program, and they never made it into space, despite public criticism and the advantages of sending women in the cramped capsules given their generally smaller size. The women had what Margaret Weitekamp has referred to as "right stuff, wrong sex."[2]

In the United States' case, contemporary inclusion has extended to Indigenous peoples. The first Indigenous astronaut, John Herrington of the Chickasaw Nation, flew on the Shuttle STS-113 mission in 2002, a decade after Mae Jemison became the first black woman to do so as part of mission STS-47. Both Herrington and Jemison flew on the Endeavour, a shuttle named after the ship of British explorer Captain James Cook. Colonial nomenclature and imagery of this sort have always been part of space programs—comfortably in the past, but

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awkwardly now. Talk of colonizing space still raises unsettling questions about our off-planet activities as a possible continuation of a disreputable past.[3] Such talk also raises concerns that projects may end badly, with space becoming a final frontier for territorial disputes, and for inequalities that we no longer tolerate on Earth, but cannot easily curtail elsewhere.[4] As a counterbalance, actual institutional practices hold out the tempting prospect that space programs will promote inclusion and recognition for historically disadvantaged groups, perhaps even at an accelerated pace. NASA already supports a range of initiatives such as DSET, the NASA-Navajo Drought Severity Tool used by the Navajo to monitor and report water precipitation.[5] NASA also supports the extensive and growing Native Skywatchers initiative, put together initially by the Ojibwe and Lakota and geared to remember and revitalize Indigenous astronomy. More symbolically, Navajo (Diné) names have been used for objects of interest encountered by the Perseverance Rover on Mars.[6] This process is not exactly complete inclusion, but it builds hope that activities in space will be of benefit to all on Earth.

Rationales for Inclusion

There are multiple rationales for inclusion of this sort. For those in charge of space programs, inclusion is not only the right thing to do, but also a way to sustain legitimacy in the face of continual struggles over funding. Inclusion is not merely functional, but it also plays a useful role. Programs in space yield important results and valuable outcomes, but the feedthrough time tends to be longer than the tenure of political administrations. Stable funding and realistic goal-setting benefit from a sense of the longer-term legitimacy that exclusion can undermine. This is especially true under circumstances where exclusionary practices are assumed to map onto partisan divisions. Exclusionary programs may then be seen as little more than an extension of partisan politics, and good candidates for defunding when other (often larger) budgetary commitments are much harder to change. Exclusionary practices can also be associated with narratives suggesting some broader institutional failure to move with the times. Inclusion, by contrast, gives credence to the idea that space programs are up-to-date, ultimately about humanity, and good candidates for bipartisan and multipartisan agreement about funding. On the Indigenous side, inclusion in space programs offers something important: a place within one of the great transformative processes of the present century. If Indigenous peoples are not included, not only in space programs but also within communications, robotics, and in the extensive rolling out of advanced technologies, they risk being

figuratively nowhere. These communities would be superfluous with respect to the technological society now emerging. Here, I appeal to a concept from political philosopher Hannah Arendt and her explanation of exactly what it was that the Nazis attempted to do to Jews even before actual extermination. The Nazis tried to render them superfluous, a people with no role or place in the world being built.[7] This does not mean that routine forms of exclusion from technological change are morally equivalent to the Holocaust. But it does suggest that there is an ongoing and perhaps familiar existential risk for Indigenous peoples. There are simple, undramatic, and even unintentional ways in which a people may be rendered superfluous. These do not involve the moral horror of Holocaust, but may pass almost unnoticed. Many cohesive Indigenous groups are unlikely to make it into the next century despite widespread hopes for their survival. Smaller groups like the Oroks and the Enets in Siberia, who number in the low hundreds, could survive but face formidable difficulties. In the United States, the Nipmuc of New England are organized for survival, but they remain vulnerable, with under 1,000 enrolled members. At present, the groups least at risk of disappearance because of their size and organization (such as the Navajo, Cherokee, and Lakota) also tend to be the most engaged with programs involving advanced technologies. Whether or not disappearance is avoided in any particular case will depend in part upon having a place within the world that is being made. In our world, human lives are shaped and interconnected, even reconstructed, through technologies which may be socially disruptive or enabling—but are usually both.

Considerations of this sort encourage reflection on a deeper and more distinctive role that Indigenous peoples and other historically excluded communities can play within space programs. The "democratization of space," when meant in a sense that goes beyond the emergence of multiple players in a commercial "New Space" environment, can help to stabilize space programs for generations.[8] The democratization can do so not just by helping to undergird legitimacy, but also by sustainably shaping goals. Almost everything that is done in space will be done by others, by future generations who may have as much interest in our goals as we have in the goals of Francisco Pizzaro or Christopher Columbus. Transitory and idiosyncratic projects that are generated by localized and temporary political conditions are unlikely to be continued. What I will refer to as "space expansion" is vulnerable to future attitudes in multiple ways. Inclusion and democratization may well be among our best options if we want to increase our chances of sharing at least some goals, attitudes, and aspirations with those who come after us. The need for a sense of belonging is a good candidate for

something stable across generations, even if conceptions of belonging change. The need to belong somewhere runs deep within human life. Thinking about space in these terms points to something that we may learn from Indigenous and displaced communities for whom belonging is integral to their ways of seeing and being in the world. Such thought also points toward a way of thinking about the value of space programs that is shaped more by legacies of those subject to colonialism than by its perpetrators. Moreover, it is not escapist, in a world where there is so much that we (or those with greater means) might want to escape from. Thinking about Indigenous ideas of belonging does raise some concerns about cultural appropriation, functionalizing Indigeneity, and the risks of a democratization from above. But any approach to inclusion and democratization will face similar worries.

Skepticism About Space

Fears about escapism recur. The charge has been leveled since the beginnings of spaceflight. Early skeptics of space programs, such as Amitai Etzioni, J. G. Ballard, and in a more qualified way, Arendt, worried that we might be embracing a dangerous technological fantasy in an attempt to run away from our humanity. For Etzioni, "We are using the space race to escape our painful problems on Earth. And they are indeed painful."[9] Similarly, Ballard's Cape Stories, a sequence of tales written across the Apollo era and the early Shuttle years, depict a premature space age in pathological terms, complete with a post-space condition of fuge, a "time sickness" contracted through a failed flight from ourselves.[10] As time runs out and eventually stops, rather than escaping to somewhere else, Ballard's humans end up physically immobilized, on the ground and in mid-air. Attempts to escape were not simply misguided, they would also go badly wrong. Arendt worried about this same combination of escapism and an inevitable failure to escape. We might go into space to transcend our constraints, but we would not find freedom there. Rather, we would only confront a growing dependency upon technologies to keep humans alive. When viewed from the disconnected standpoint of an "observer poised freely in space," Arendt worried that humans might also come to seem insignificant, like so many lab animals running around in mazes.[11] Space technologies might seem to offer a way out of the human condition, but no actual escape could ever be made.

Similar concerns about taking flight from Earthly concerns have resurfaced more recently in the charge that the super wealthy may be preparing an escape route in the face of a worsening climate crisis.[12] Or, at least, that elites may be

hoping that an escape route will somehow emerge from investment in space. This populist idea is far less convincing than the elegant skepticisms of Ballard and Arendt. It lacks their appreciation of space as a lethal environment. With thin atmospheres, surface radiation, and toxic compounds, space is hostile to human life. Rather than soil, the surfaces of other rocky planets, moons, and larger asteroids are covered in regolith: powdered rock and, in the case of Mars, toxic chlorine compounds. Given a chance, regolith gets into space suits, equipment, and the lungs. Even if Mars had an atmosphere, it would still be lethal. In contrast with anywhere in nearby space, the Earth after a global nuclear exchange would be a relatively quick fix.

While no one can actually escape into space, there is nonetheless truth to the idea that the desire to escape from some aspects of life on Earth is one of the main drivers of interest in space. Yet our concern with space can just as readily be thought of as a way of reshaping identities, and not necessarily in the negative sense that worried Arendt. One likely result of space expansion is the emergence of a sense of belonging to a larger region of space than the Earth alone, even if the Earth continues to occupy a special position. This mode of thought has some similarities to aforementioned conceptions of belonging and is built into Indigenous cosmologies. This feature of Indigenous cosmologies is, to an extent, neglected by outsiders because of a residual tendency to think of cosmologies as ecologies with some ecologically useful mythologies about the skies. (This really does border on "functionalizing Indigeneity," rather than encountering storytelling on its own terms). But reflection on such cosmologies as something more than ecologies, and as ways to make sense of what runs deep within our human attitudes to space, may offer more than transitory political interests or economic fashions. The risk of undue influence by the latter is arguably the deeper problem with billionaire-inspired programs. Perhaps we ought to be worried less about absurd levels of wealth and more about the risk posed by transitory or idiosyncratic goals set by a relatively small number of human agents. Our aims in space should draw on our long, broad, and deep human engagement with space, and not upon the personal enthusiasm of any particular group of people—even if they happen to be well-intentioned.

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A classic case of this would be the utopian enthusiasm of Russia's "cosmists" who influenced the early days of the Soviet space program in the hope of establishing a single interconnected universal utopia. A comparable Western example would be the drive in the United States, from the 1970s onwards, to set up O'Neil cylinders, i.e., off-world habitats with artificial gravity and an approximation to small town United States, located inside beautifully engineered hollow tubes. Given the immensity of the project of human expansion into space, it is difficult to be anything other than idiosyncratic in our understanding of what projects will look like, further down the line. But given the risk that idiosyncratic space projects might be abandoned over the course of time, Indigenous inclusion (and engagement with Indigenous cosmologies) can be seen in a different light: as processes that are more likely to enhance space programs if they are part of some larger process of democratization and inclusion capable of shaping our goals in space and of stabilizing projects over multi-generational periods of time.

A Case for Slow Space

As well as being a dangerous escape destination, space does not offer any solutions to the problems of an expanding population in the face of limited resources. What it does offer is a larger context within which those problems can unfold. The strategic resources of space are finite and exhaustible. They sometimes appear plentiful, but only in comparison with those of Earth. A good example is Helium-3 (^{3}He). ^{3}He might be used in relatively clean fusion reactors without some of the problems of our current nuclear fission technologies. It is easier to deal with some ash on the floor of a fusion reactor than with the large volumes of radioactive waste and contaminated power plants involved in nuclear fission. However, the idea of abundant supplies of lunar ^{3}He is a little misleading. On Earth, we are shielded from the solar wind by a protective atmosphere. The moon has no such protection, and so deposits of ^{3}He have built up over billions of years. Yet, ^{3}He density is still measured only in parts per billion, with the result that strip mining would be required to extract it.[13] This extensive and intrusive mining process would conflict with the imperatives of environmental protection if carried out on a scale large enough to run environmentally cleaner fusion reactors on Earth. A far more limited mining process would make a good deal of sense, given the right technologies for use of ^{3}He in space. Like most strategic space resources, the reserves would be exhausted (within a surprisingly short period) by any more systematic mining process for Earth-based energy.

Even the abundant resources of the asteroid belt, which is notoriously rich

in metals, would succumb to ordinary rates of resource extraction, typical since the Industrial Revolution. Exhaustion of main asteroid belt resources could occur within 500 years of mining operations beginning, assuming historically normal levels of exponential growth and expansion of only around 2.5 to 3 percent.[14] Half a millennium may seem like a large period of time, given the pressing environmental problems on Earth, but it is often taken as an appropriate horizon for practical concern about our planet, and about future generations of humans. 500 years approaches the outer limit. Beyond this horizon of half a millennium, the positive or negative impact of our actions becomes mostly unknown, irrespective of our intentions.

However, if we are not worried at all about future generations on a timescale this large, then multi-generational projects such as space expansion will make little sense. This is a major upside of space expansion: its multi-generational character. Thinking about space, and doing so in terms which are both realistic and show a sense of humility, helps to model a way of thinking that humanity cannot now do without. If we are to get through the current combination of environmental crisis and technological bottleneck (i.e., the period during which technology continues to pose civilization level dangers as well as carrying great promise), we can hardly do so without thinking in multi-generational terms, or within time spans that are comprehensible to humans. Tackling the environmental crisis is one such multi-generational project, while expansion into nearby space is another. Yet a kind of humility enters into this picture because neither initiative can be completed by the present generation of humans or by those who will immediately follow. Even if we begin well, almost everything will be done by generations to come. This raises concerns about sustainability and the risks of inter-generational fatigue. Worries that the right kind of sacrifices will not be made to reach the other side of the shore by those generations who will never get there. Yet our best evidence from human history is that we can carry out projects over multi-generational timescales. So, there are at least some grounds for a guarded optimism. But space does add issues of scale and grandeur of an altogether unprecedented and disturbing level. The simple truth is that we do not know how any multi-generational project will turn out. What we do know is that expansion into space is a process that is unlikely to continue forever. This is partly because the accessible resources will not last indefinitely and partly because our reach is not infinite.

Concerns about space resource exhaustion within a reasonable timeframe presuppose this limitation of human reach. While we may be fond of stories in which humanity moves freely among the stars, the logistics of actual human

travel across the vast distances of interstellar space may well prove too challenging. Probes may be sent—even "seeding" technology might be sent—but technologies to warp space to shorten distances, keep humans alive in stasis for decades or centuries, and travel at some significant fraction of the speed of light may or may not emerge. Relying on these uncertainties seems unwise. The solar system may be all that we have, and all that we will ever have. Using resources on the assumption of their ultimate replacement from outside the solar system sounds like a complacency taken too far—especially so when many solar system resources may themselves turn out to be forever beyond the reach of humans. The outer planets of our solar system are so massive compared to the Earth that their gravitational pulls make their surfaces unusable for most human purposes, even if we might harvest materials (such as ^{3}He) from their atmospheres or set up habitats off-world. The line between accessible and inaccessible resources will, no doubt, shift over time. But the line between usable planetary and moon surface and the infirm gaseous outer boundaries of the gas giants may be drawn much closer to home than we might wish, even if home is no longer just the Earth. Ultimately, without interstellar technologies, there is only so much that we can and will ever access and use. State-led or private-sector-led activities will not change the sheer physical limits of our predicament.

Understanding these resource limitations is key to grasping the major environmental dangers in space. These dangers do not arise from a maverick private sector, a bureaucratic state sector, or some imaginary cyberpunk fusion of the two. Rather, the difficulties involve balancing environmental protection over places that we seek to preserve with sustainable systems of extraction in the face of exhaustible resources and the strong likelihood of exponential growth. There is only so much ^{3}He on the moon, and there is only one Moon. There is only one Mars and it makes up a sizable chunk of the remaining usable surface. There are only two major asteroid belts: the belt between Mars and Jupiter, and the larger Kuiper belt much further out, at the outside edge of Neptune's orbit. The nearer belt has less mass than the moon, and a good deal of it is already tied up in an icy Ceres and in the rocky asteroid Vesta. These are celestial bodies with certain kinds of uniqueness and integrity that we would almost certainly want to include within the scope of environmental protection. Yet they are tempting targets for resource extraction for related reasons: they are unique concentrations of resources within an asteroid belt where almost everything else is far apart. Environmental protection must extend beyond the Earth to safeguard what is unique and irreplaceable.

Here, by appealing to the integrity of Ceres and Vesta, I use a specialized

concept which is drawn from environmental work about our own planet, and more specifically from Holmes Rolston's idea that "We are Earthlings. Our integrity is inseparable from Earth integrity."[15] The places of space can also have various kinds of integrity and thinking of them as places may aid an appreciation of their uniqueness.[16] There are also some other ways of framing matters while arriving at the same result: we may think of obligations to protect and safeguard, or (following Alice Gorman) we may speak about "a cultural landscape," and this too will make sense of robust forms of protection.[17] But even robust protection need not involve an attempt to freeze planets in time, in their current state. The solar system is not a quarry, but it is also not a vast museum. Although we might want to preserve localized typical and special areas unchanged, we cannot protect everything and still enjoy the benefits of becoming a civilization that belongs to a larger area than the Earth, such as a second chance to build sustainable forms of life.

What such talk about integrity does mean is that we may have to accept that places as well as life forms can matter in their own right. But if this seems like a step too far and we prefer to think of environmental issues in more anthropocentric terms (e.g., as a matter of preserving cultural heritage for humans), we may still acknowledge the risk of compromising the unique places of the solar system in ways that will deprive all those who come after, even those humans and other beings who live at some point beyond the next half millennium. Either way, getting agreement on what environmental protection might mean, and then making it stick at a policy level, looks far from easy. This is especially so given that our current and modest forms of planetary protection, geared to avoid contaminating sites or bringing anything bad back to Earth, are beginning to look unenforceable under conditions of actual mining.[18] One important ethical goal of any broader set of protective agreements would no doubt be the restriction of extraction and use in the interests of sustainability, shaped by a set of guidelines for use rather than its wholesale prevention. The rapid exhaustion of irreplaceable materials, in the mistaken belief that more will always follow, would have to be avoided. These considerations of environment and sustainability would seem to point in the direction of going slower rather than faster at some point after initial systems are up and running. The protection of what we think worthy of protection may well line up in favor of what we can call "slow space," even if the initial phases of expansion are likely to be rapid.

The Tension Between Fast and Slow

Slow space looks like the most sustainable option, on the assumption that we are going to space and that significant use of space materials as resources is now unavoidable and perhaps also desirable. What makes slow space problematic from the standpoint of inclusion is that a need for greater inclusion suggests that we should rapidly expand the range and pace of our activities in space, rather than look toward some early point at which we can safely slow down. After all, new and dynamic sectors of human activity are better placed to enact higher standards of inclusion and social justice than traditional sectors. Steelmaking and the military are not notorious for top-to-bottom gender equality, nor for that matter is traditional mining. The older the practice, the greater the societal inertia and resistance to change. As an example, within the U.S. military, the "Don't Ask, Don't Tell" policy toward homosexuality was only abandoned at the absurdly late date of 2010. Newer practices and dynamic sectors are not automatically vehicles for social equality, but they do open up opportunities. By analogy, sometimes it is easier to become a better person in a new town, rather than in a place where everyone knows you.

The more rapid the growth and dynamic the change, the more likely opportunities for inclusion will become available. This is likely to remain true beyond the point at which a slowdown in growth might be advisable. There is a tension between the rationales of fast and slow, between environmental concern that points toward a slow space model and inclusion which points toward speeding matters up until problems of inequality and exclusion are no longer a concern (a point in time that looks vanishingly distant). What we get with a more rapid process is more inclusive systems and programs, but a higher likelihood that environmental protections of unique structures and places will successively be overridden. In the face of a series of needs of the moment, everything that we might want to protect may fall.

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This is not, of course, a good reason (or an excuse) to hold back on inclusion or on any manner of program that is likely to advance it. Rather, it is a reminder that social justice of any sort often comes at a price, even if the price is paid further down the line and by others. In this respect, what happens elsewhere, in space, may again be a useful analogue for terrestrial trade-offs. A case in point is

a widespread and understandable reluctance to consider any manner of geoengineering or even dam building on Earth in response to otherwise irreversible climate change, because all such options are far from environmentally ideal. The risk then is that they become forced at a later date, in a far less controlled way, in the least desirable of locations, and at the expense of historically excluded and disadvantaged peoples. The world is not set up in ways which will allow humans to attain everything that we want. At some points choices have to be made, and the eventual price of social justice and of environmental protection has to be paid. In the case of human expansion into space, while we may want to be in control of such matters, part of our vulnerability is a reliance on the willingness of some group of future generations to make the choice and pay that price.

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