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Towards a critical space theory: The instrumental politics of space exploitation

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Abstract

Though a growing number of voices in public discourse are expressing reservations about the new space race and its implications, inherently political questions have remained largely untouched by political theorists: Who is space for and for whose benefit? What are the ideological presumptions and functions of private space exploration? To confront this astro-aporia, we proceed in four parts. First, we develop a typology of two broad positions that predominate in contemporary criticism of space exploration: those who are "space pessimists" and those who are "space neutral"; second, we critique those two positions for relying on an instrumental rationality that cedes too much ground to the logic of instrumentalizing and exploiting that which is deemed non-human nature; third, we examine the linked material and ideological forces fueling the current space race and its enthusiastic supporters; and finally, we formulate a dialectical position that remains critical of space exploitation as it is currently undertaken, but on grounds other than mere utility, thus offering a way to reorient the discussion toward a critical theory of space. From this perspective, space's meaning-making role for

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humanity can be understood as good and should be held in common, rather than being either abandoned or plundered.

Keywords
Space, critical theory, instrumental rationality, capitalism, colonialism

Introduction: who is space for?

The new space race is in full swing—both public agencies, such as NASA, and a burgeoning number of private corporations are promising visions of humanity's near- and long-term future. NASA's Artemis Program is a $93 billion dollar project intended to re-stage the lunar landings of half a century ago (Office of Inspector General, 2021). The aims of the project, however, have been updated for the 21st century: in addition to a dose of diversity in its astronaut pool, the Artemis Program relies on outsourcing larger-than-ever parts of the research and development of rocket and other technologies to private partners in the hopes that it may establish a sustainable human presence on or near the Moon as a stepping stone to lunar, and eventually Martian, habitation and resource extraction (NASA, 2023). At the same time, Elon Musk's SpaceX is developing the Starship, a super heavy-lift launch vehicle with the explicit goal—similar to that of Artemis—of facilitating resource extraction from the Moon, with the colonization of Mars in sight not long afterward (SpaceX, 2023). While Boeing's Starliner capsule may at first appear to have more modest aims shepherding astronauts to the International Space Station, it too has been heralded as a key to extending humanity's exploration into farther reaches of our solar system (Boeing, 2024).

These grand visions of humanity's future are being pursued in the context of a veritable explosion in space flight technology and travel: in 2021, Musk's SpaceX, Jeff Bezos' Blue Origin, and Richard Branson's Virgin Galactic all carried non-astronaut civilians beyond Earth's atmosphere. Just at the end of 2019, former President Donald Trump established the United States Space Force as the newest of the eight US uniformed services. In a similar time frame, smaller private space flight companies have been emerging in quick succession, with successful launches by Astra, Rocket Lab, and others. Of course, these selected developments are the products of only one country's efforts. Globally, the United Nations Office for Outer Space Affairs reports the existence of at least forty-three national space agencies and three regional space agencies as of June 2024 (United Nations Office for Outer Space Affairs, 2024). The gross number of countries with space programs, as well as the number of those with capacities for space launches, the deployment of probes in space, and human spaceflight, will likely continue to increase quickly in the near future.

The new space race is only quickening in pace and, crucially, so too is the need to attend to important political theoretical questions, lest they be left behind on Earth. Or, worse yet, lest the currently entrenched values and goals of the structures and infrastructures fueling the new space race continue to be replicated without critical examination into our increasing forays into space. Who is space for and for whose benefit do we

venture forth into it? What are the ideological presumptions and functions of private space exploration, and how do they interface with the material forces fueling such exploration? Is it possible to navigate a trajectory that seriously engages space's enchantment, benefits to humanity, meaning generation, and even coolness without collapsing into uncritical enthusiasm for the new space race's colonial restaging and instrumental rationality? In this spirit, we argue that the multiple current modes of critiquing the new space race are inadequate to such questions, and instead stake out a dialectical position grounded in political theory which critiques the logic of space exploitation without reducing space's epistemological and ontological worth to merely its utility.

Political theoretical constellations: the problem with the new space race and its critics

Though a growing number of voices in public discourse are addressing the way the new space race is unfolding and its implications, these inherently political questions have been mostly untouched by political theorists.[1] While space is being addressed by international relations, international law, and public policy scholars, approaches that center political theoretic questions have a necessary role to play by bringing to light the embedded value systems, political logics, and ideological landscapes that structure our forays beyond our atmosphere. Varied theoretical tools and investigations all focus attention onto the central questions of politics. For instance, political theory enables us to interrogate the people's affairs (*res publica*) and those public things that concern all of us—and does so in a way that questions the existing frameworks of how we organize society. Moreover, who benefits from our endeavors (*cui bono*) is not only a perennial question of political theory, but one that captures many of the central fissures of space discussions. Understanding the contours or operative concepts of the political landscape of space—political space-scape, perhaps—is however only the first step. The frameworks of analysis that political theorists bring to political questions also enable and at times necessitate making critical and normative arguments about the policies and practices in and around space that affect us all.

In what follows, we develop a political theoretic approach to space politics grounded in the tradition of critical theory, which interrogates the material and ideological conditions of possibility, assumptions, and institutions that animate and give structure to our social world. Theorists like Theodor Adorno, Max Horkheimer, and Herbert Marcuse—often referred to collectively as the Frankfurt School—first developed the critical theoretic framework to generate a critical theory of society and its contradictions, which uncovered the subterranean forces of domination in the 20th century and their interconnected material and ideological premises. Formulating a critical theory of space, or moving toward a "critical space theory," allows us to pose and explore questions such as why the *lingua franca* of space exploration is colonization, why current space exploration is contingent on and to the benefit of multi-billionaires, and why space exploration has come to mean primarily resource extraction and commercialization. Approaches that critically probe and challenge the current presumptions are especially necessary in a time

when the new space race is vaulting entrenched ideas that largely reflect the interests of the already-powerful far beyond Earth's bounds. By focusing our analyses on these material and ideological precursors, we can approach the question of space exploration without taking for granted the assumptions of the current space race. We demonstrate the possibility of a dialectical position with regard to space—one that bypasses a binary choice between continuing space exploration as it currently exists and rejecting space exploration in toto in favor of asking: what might space exploration look like *otherwise*? In this regard, we join a nascent, but growing group of scholars and practitioners attempting to "reclaim space" away from a "decidedly W.E.I.R.D. [Western, Educated, Industrialized, Rich, and Democratic], male, white politically libertarian, and nondisabled" status quo (Schwartz et al., 2023: 2). Doing so opens up possibilities of relating to space and to each other in more just ways.

In order to develop a critical space theory, we follow the lead of Linda Billings (2007: 484) in her call to "delv[e] into the language or rhetoric of spaceflight" as "a productive way of exploring the meanings and motives that are embedded in and conveyed by the ideology and advocacy of spaceflight." For our own critical theoretical purposes, we find public discourse and prominent figures in space debates to be most illuminating of the ideological premises of the new space. To that end, we first develop a typology of two broad positions or camps that predominate in contemporary criticism of space exploration in order to more clearly understand the current landscape of those asking questions about the status quo of the new space race. The first of these two groups we term space pessimists, insofar as they reject any further space exploration on the grounds that development in this arena is ultimately detrimental to humanity. Daniel Deudney (2020), for instance, embraces a type of terrestrial isolationism on the basis that further space development would make nuclear war more likely because of the complex "geography, geohistory, and geopolitics" of space exploration (Deudney, 2020: 8). Proponents of this position call for a stop to the current space race, seeing danger on the horizon. The second, ostensibly more refined position we call space neutrality, insofar as their critique of space exploitation rests not on the ills of space technology or exploration itself, but rather on a basic opposition to prioritizing or funding any kind of space exploration when funds are short for other terrestrial priorities. Those who make this argument often ask: "why are we spending money on space when we should be spending that money on X, Y, or Z ills here on Earth?" Those critics who are space neutral, then, support a redistribution of time, energy, and fiscal decisions away from space activities and toward terrestrial projects—and consequently reject the current space race. Establishing and explicating this typology of those dissenting from the space status quo marks this article's first major contribution.

Unfortunately, both camps' positions from which they critique continued human expansion into space do not take seriously enough that the new space race *is* happening and shows no sign of abating. Worse still, these camps *converge* in their reliance on and deployment of instrumental rationality as their primary frame and thus assess space exploration on an economic costs and benefits basis. Both groups' central reliance on this instrumental rationality as their epistemology and political rationality means they fail to confront the central political theoretical questions about the purposes of space

and cede too much ground to the logic of instrumentalizing and exploiting that which is deemed non-human nature. The political theoretical linking and critique of these two camps of space race critics are our second major contribution.

In order to better understand why space discourse remains confined to instrumental rationalities, we then explore the various ideological and political–economic motivations underlying the widespread and often uncritical enthusiasm for space exploitation within the status quo, where space is understood as an untapped cornucopia of material and resource-based gains. This section examines three drivers of the space race and of its enthusiastic supporters. First, we assess the capitalist imperative of space as a new realm for capital accumulation. Second, we interrogate how the logics of space exploitation restage colonial logics of frontier expansion and exploitation, in which the space race projects manifest destiny and its propertarian and frontier ideologies upward. Finally, popular fascination with space exploitation serves as an attractive faux-alternative to what Mark Fisher (2009) called capitalist realism: that it is easier to imagine the end of the Earth than the end of capitalism. Rather than solve capitalism's various crises—social, ecological, and so forth—space exploitation represents for many an escape from these anxieties. Musk's regular proclamation that he wants to make humans a multiplanetary species finds a way to blend all three of these strands: he positions himself as the uniquely clever and capable businessman that can solve humanity's problems (or, more accurately in our perspective, solve capitalism's contradictions) by efficiently transforming space into an infinite frontier fit for extraction and colonization. Our third contribution is thus examining the concomitance of primitive accumulation, settler colonialism, and capitalist realism as a set of interlocking ideological and material forces and logics motivating the space race and its enthusiasts.

As a consequence of these linked problems of instrumental rationality, both space pessimists and the space neutral camp do not generate a position that escapes the forces of state and capital that are driving the new space race, nor one that can capture the different modes of popular enthusiasm or wonderment regarding space.[2] Our own dialectical position remains critical of space exploitation as it is currently being undertaken, but on grounds other than mere utility, and thus offers a way to reorient the discussion toward a critical theory of space. From this perspective, space's meaning-making role for humanity can be understood as a good that should be held in common, rather than being either abandoned wholesale or plundered in a campaign of primitive accumulation under a thin patina of techno-utopianism. Adding this critical and dialectical position to the dissent from the status quo of space perspectives is the article's fourth contribution.

On these bases then, both proponents of the new space race and the various camps of critics we engage barely take seriously the critical currents referenced above, and it is our contention that a much-needed dialectical position has not yet been developed by political theorists. Insofar as the ideological boundaries that shape the new space race are political in nature—neocolonialism, techno-utopianism, neoliberal instrumental rationality, and the blinders of capitalist realism—we offer a political theoretic alternative to confronting these deeper currents and moving beyond them.

Ad astra, cui bono? A typology and critique of space race skeptics

The contours of the new space race are importantly different from its mid-century predecessor: rather than the inter-state competitive drama of the United States versus the Soviet Union and the outcome's implications for what ideological flavor our supposed end of history might be, the current relevant actors are predominantly exemplars of American capitalism, as intertwined with space policy and defense policy. Musk and Bezos are the most obvious figures, but NASA's increasing reliance on subcontracting to private firms like Boeing, Northrup Grumman, and Aerojet Rocketdyne makes competition in the capitalist marketplace the only relevant sense in which some sort of "race" might exist. Nevertheless, these actors, especially figures like Musk who regularly promise the Moon and beat a techno-optimist drum, have garnered an incredibly energetic and devoted following. This interest, coupled with NASA's legacy as one of the most beloved federal agencies, makes space research, exploration, and potentially exploitation an endeavor popular with the public. A 2018 Pew poll found that 65% of Americans believe that "it is essential to continue to be involved in space exploration" (Pew Research Center, 2018).

Widespread interest and large costs, especially when publicly funded entities like NASA subcontract to private companies like SpaceX, naturally also draw criticism. Though these critiques are often drowned out by the sheer volume of new space race fans, a growing number of voices express reservations. Though largely unorganized and often articulated in the messy realm of social media and digital screed, for the sake of analytical clarity we group these skeptics into the two burgeoning dissenting camps noted in the introduction: the space *pessimists*, who for one reason or another think that space exploration is ultimately too dangerous or fundamentally inadvisable as an endeavor; and those who are space *neutral*, remaining agnostic on the possible goods of space exploration but contending that those funds are better utilized for exclusively earthly ends. In this section, we delve into a brief typology of these positions before critiquing them on the basis of their shared epistemological and theoretical commitments to a cost-benefit oriented calculus. This ground clearing enables us to stake out a dialectical position that bases its critique in claims beyond mere instrumental rationality, so that the value of space exploration can be pursued without constantly reinscribing the deleterious logics of various modes of exploitation.

Space pessimism represents a large umbrella of critiques—it is, after all, a position animated by an ultimately negative judgment on space exploitation *and* exploration, even if each adherent's reasons differ. For instance, Gary Westfahl, scholar of science fiction and a decade-long supporter of space exploration, argued before the most recent wave of space activity that the animating forces of the first space race were no longer defensible (1997). For him, the mid-20th century belief that venturing into outer space was a necessary stage in the all-too-human urge to explore terminates after the initial flurry of near-Earth space travel. The imagined linear progress of humanity's journey into the stars runs up against the cold vastness of space—once beyond Earth's atmosphere, those celestial bodies that we gaze upon from our terrestrial haven are still way too far away to access. Most importantly, Westfahl appeals to science fiction in order to argue

that visions of future utopias in space often can actually represent *regressions* in our social and political imaginary:

> They [science fiction narratives] envision these outposts as beneficial throwbacks to the past, the favorite metaphors being the space colony as the new United States formed after revolting against evil colonial masters, or the asteroid belt as the New American West … Space travel is predominantly pictured as a way to help humanity *return* to some idealized past existence before the bureaucrats, internationalists, politically correct professors, and other villains started to destroy civilization. (1997)

This inversion that turns enlightenment curiosity into nostalgic retrogressive escapism couples with the colonial undercurrents of extractivist justifications for space exploration. Foreshadowing current attempts to conceive of space as a new, infinite "Horn of Plenty," Westfahl contends that space exploitation simply is not as profitable as its fans hope it to be: space programs routinely go over budget and their public benefits are realized only in retrospect. Thus, Westfahl argues that "there is no compelling reason for present-day governments to expand or even continue their space programs" (1997). For him, justifications for continued space exploration fail on the grounds that the initial reasons for pushing past Earth's atmosphere no longer persuade.

More contemporarily, Matthew King argues against space exploration on the grounds that rather than expanding humanity's existential and scientific horizons, continued commodified utilization of space only spreads humanity's recklessness in the form of "space junk," in which we reenact our "plunder and pollution" in the domain "above our heads and arguably the last unravaged by human intervention" (King, 2022). According to him, debris from decayed satellites and collisions produces multiple negative consequences. The introduction of hundreds of small satellites, such as SpaceX's Skylink constellation of mini-cube-sats, obscures terrestrial telescopes' ability to observe the heavens, even when each satellite is functional and accounted for—all the worse when they begin to fail and are blown into thousands of small pieces. Space debris (often itself begetting further space debris) also threatens many quotidian functions: "The blue GPS dot on your phone, emergency weather monitoring services, and digital financial transactions are just a few of the essential services that rely on satellites in LEO, [MEO], or deep, geostationary orbit," namely, the "realms most cluttered with debris" (King, 2022). On these grounds, King is implicitly space pessimistic: the only way to deal with the cascading deluge of space junk is to not create it in the first place, as our failing terrestrial attempts to stymie environmental disaster demonstrate.

Perhaps the most sophisticated recent account of space pessimism is political scientist Daniel Deudney: like Westfahl, Deudney locates the origins of the fervor for contemporary space exploitation (what he terms "space expansionism") in the intersecting currents of enlightenment rationality and technological modernization (2020: 6). Similarly, Deudney adeptly places the ideological allure of space exploitation into the context of a widespread Western "big history": those he calls "space futurists" view space expansion as a turning point, in which "the threshold of an ultimately limitless expansion across the 'final frontier'" marks the agents of exploration and exploitation as "bearers of

Enlightenment modernity" (12–13). Criticizing the great arc of history he details, Deudney presents a contrasting "large story," in which humanity's ventures into space are less a culmination of ever-expanding Promethean understanding than a restaging of Icarus's hubris:

> My case for this darker net assessment of actual space activities centers on the role of space activities in making nuclear war more likely… In sum, [I] argue that the large-scale expansion of human activities into space, past and future, should join the lengthening list of catastrophic and existential threats to humanity, and that the ambitious core projects of space expansionism should be explicitly relinquished. (7)

Deudney's prescription is to rely on a coalition of states to "regulate, reverse, and relinquish" the weaponization and militarization of space, including large infrastructure projects, research into asteroidal diversion and the dream of colonizing Mars (373–75). This position would entail immediately ceasing many current space-related activities on the basis of outsized and unexamined risk: what he describes as the existential risk of "astrocide" for the human species (371). In this way, Deudney illustratively lands in the realm of space pessimism—alongside Westfahl and King—on his shared belief that the risks of space exploration simply outweigh the benefit, and thus space activity should cease.

Space pessimists then ultimately reject any further space exploration on the grounds of an instrumental calculation: that the mere costs or risks of polluting space and/or damaging vitally important technology that already exists there, combined with the possibility of nuclear exchange, outweigh in advance any possible gains. In doing so, however, the position takes for granted and cements into place the ways in which space exploration is currently conducted, rather than holding open the possibility that our relationship to space could be otherwise. Moreover, space pessimism itself cedes too much ground to the capitalist instrumentalization of space through its instrumental political rationality—a quality that, we go on to contend, space pessimism shares with space neutrality.

The second position in our typology of critics of the space race, space neutrality, similarly rejects space exploration as a tenable project, but from a particular political, theoretical, and epistemological position: that the funds to be utilized for space are better spent on our present terrestrial ills. The "neutral" here indicates a kind of dispositionality: this critique of space exploration rests not on an absolute negative evaluation of the enterprise itself (as in space pessimism), but rather on the *prima facie* belief that the possible goods of space exploration do not outweigh the goods of what the same amount of funding could do on Earth. This position, then, means that adherents may harbor interest in space exploration or may even think that the project as a whole is worth undertaking, *just not at this time or for that cost or as a portion of this specific set of funds.* For the space neutral camp, this disposition against funding space activity stops its ratiocination in its tracks: because the funds ought to be spent on Earth, and the choice is represented as inevitably zero-sum, we need not critically engage the project of space activity any further because it must be rejected.

Like space pessimism, "space neutrality" represents a broad tent of arguments in several forms over a span of decades, but they fall back, once again, onto an evaluative logic of utility. Perhaps, this position is most memorably crystallized in Gil Scott-Heron's 1970 spoken word poem "Whitey on the Moon." Written in the wake of the Apollo Moon landings, the poem immediately juxtaposes the real presence of earthly, material racialized suffering with the conspicuous decadence of space travel:

> I can't pay no doctor bill.
>
> (but Whitey's on the moon)
>
> Ten years from now I'll be payin' still.
>
> (while Whitey's on the moon)
>
> The man jus' upped my rent las' night.
>
> ('cause Whitey's on the moon)
>
> No hot water, no toilets, no lights.
>
> (but Whitey's on the moon). (Scott-Heron, 1970)

The effect is to draw attention to the relation between these two experiences, with the implication that space travel is only possible because of—or at least facilitates or exacerbates—the racialized distribution of attention and funds in America. Scott-Heron's critique of space exploration and its perceived zero-sum relationship to terrestrial spending on social ills was similarly made by English philosopher and historian Arnold Toynbee when he observed: "In a sense, going to the moon is like building the pyramids or Louis XIV's palace at Versailles. It's rather scandalous, when human beings are going short of necessities, to do this. If we're clever enough to reach the moon, don't we feel rather foolish in our mismanagement of human affairs?" (cited in Gregory, 1970).

These mid-century critiques of the first space race are, unsurprisingly, resurfacing in the face of the new space race. The specific targets of their critique are slightly recast (e.g., not necessarily NASA, but billionaires; not walking on the Moon, but colonizing Mars, and so on), but the logic is much the same: those precious funds should be disbursed here on Earth and not wasted in space. Given the increasingly rapid production and circulation of digital media, many of these critiques surface in the form of online opinion editorials. Shannon Stirone (2021), writing in *The Atlantic*, for instance, states simply that "Mars is a hellhole" and "question[s] anyone among the richest people in the world who sells a story of caring so much for human survival that he must send rockets into space. Someone in his position could do many things on our little blue dot itself to help those in need."

Similar sentiments are echoed far and wide on social media whenever a major space launch makes the news. Robert Reich, the former US Labor Secretary and online progressive microcelebrity, captured the core of this sentiment in a tweet: "Is anyone else alarmed that billionaires are having their own private space race while record-breaking heatwaves are sparking a 'fire-breathing dragon of clouds' and cooking sea creatures to death in their shells?" (Reich, 2021). Meanwhile, David Beasley, the UN World Food Program Executive Director, centered worldwide hunger as the primary overlooked charge in the second space age (Beasley, 2021): "Hey, @RichadBranson, @elonmusk and @JeffBezos, so excited to see you compete on who gets to space first! BUT, I would love to see you TEAM up together to save the 41 million people who are about to starve this year on Earth! It only takes $6 Billion. We can solve this quickly!" As Beasley's tweet illustrates, those who are space neutral are not against space exploration *per se*, but are against it when they believe that its existence necessarily or exclusively trades off against various political priorities on Earth that they comparatively assess to be more important.

While we are sympathetic to the space neutrals' commitment to rectifying worldly injustices—and therefore are much closer to this camp than to the astro-fatalism of the space pessimists—we nonetheless reject both space pessimism and space neutrality. In this sense, we concur with Chanda Prescod-Weinstein when she writes that "Too many people believe that we must choose between living in better relations with our ecosystems (and each other) and going to space. … We can afford to do more than be space curmudgeons, and we can go to space without relying on a weaponized military-industrial complex" (Prescod-Weinstein, 2022). Our work takes her point further, lodging the same criticism of both pessimists and neutrals: first, neither camp's prescription of rolling back the space race takes seriously the pace at and incentives with which the new space race is exploding; and second, each camp's analyses hinge exclusively on their self-limiting evaluation of space exploration's *utility* and *instrumentality*. Conceiving of space in calculative terms of utility defuses meaningful practical criticisms and interventions and obfuscates instrumental rationality's own foundational role in space exploitation itself.

We look to Max Horkheimer's critical theory and his concept of instrumental rationality in order to argue that the space pessimists' and space neutrals' framework of understanding space in terms of instrumentally calculating costs and benefits forecloses the possibility of non-exploitative understandings of space exploration. On this view, debates about the new space race—and its adherents and critics alike—enact what Horkheimer diagnosed as the increasing dominance of subjective and instrumental forms of reason. For Horkheimer, subjective reason "is essentially concerned with means and ends, with the adequacy of procedures for purposes more or less taken for granted and supposedly self-explanatory," and this type of reasoning "attaches little importance to the question whether the purposes as such are reasonable" as it instead focuses on "subjective gain or advantage" (2004: 3). With respect to the space race, instrumental rationality obstructs two lines of more critical questioning: one epistemic (that the stars above provide us with specific knowledge, insights, or meaning) and the other ontological (that space is connected to us in ways that transcend whether or not

we can mine it for helium and other resources, or pursue some other instrumental goal). Relatedly, the logic of both space pessimists and space neutrals rests centrally on instrumental reason. Horkheimer argues that via instrumental reason, thought "has become completely harnessed to its "operational value"—namely, "its role in the domination of men and nature"—and has "been made the sole criterion" for political evaluation and policy preferences. For Horkheimer, it "is as if thinking itself had been reduced to the level of industrial processes, subjected to a close schedule—in short, made part and parcel of production" (15). As a consequence, "leading principles of ethics and politics" are rejected as superfluous, meaningless, or just simply useless for deploying means to achieve (dominating) ends that take social reality in its current formulation as an unchangeable given (6–7).

Again, the space pessimists and neutrals' critiques fall flat insofar as their sole criteria for rejecting space exploitation is that it simply *isn't worth it* in their utility calculation. Because of this, both of these critiques of human space activity fail to grapple with the motivating forces that underlie the second space race in any substantial or genuinely critical way—nor do they leave room for pursuing a future in space that is grounded in different values. This is most clear in the context of the space neutral position: we might imagine a hypothetical future or alternate timeline where space exploration is not seen as competitive for funds with contemporary terrestrial social ills, or when space exploration becomes profitable enough to subsidize terrestrial programs that benefit all, or when the earthly injustices of which these critics speak (e.g., racism, environmental catastrophe, hunger, etc.) have in fact been solved. In each of these counter-scenarios, we might easily imagine those who had previously counseled against space exploration embracing it once again, so long as it no longer represents a *misused cost* according to their own instrumental epistemology, never mind the deeper underlying political forces (for instance, capital accumulation or the extension of settler colonial logics) driving space activity. Their very dispositionality betrays their fundamental conception of space as reducible solely to its economic utility; their prescription, then, simply reflects their evaluation of that utility calculus.[3]

In this way, even though we support the amelioration of social and political ills that the space neutral position prioritizes, we maintain that their reliance on a comparative costs–benefit framework in evaluating space exploration accepts and perpetuates a conception of space that precludes imagining it in categories separate from and, indeed, in tension with instrumental rationality. This includes a dismissal of space's ontological and epistemological role in meaning-making, or the possibility of its existence as a commons that can benefit all terrestrial inhabitants. Ultimately, we contend that the space neutral position relies on instrumental rationality in order to arrive at the answer to their normative questions, which ultimately leads them to unknowingly affirm precisely the theoretical frameworks that give rise to the political issues they seek to address in the first place.

Even more worrying, those space enthusiasts who uncritically pursue and defend the new space race and the exploitation of space mobilize this very same logic alongside the productive forces of capitalist industry to charge ever upward. For all the enthusiasts' rhetoric about humanity's future—creating backup plans to Earth, developing suborbital space reefs or colonies, mining asteroids, and the like—the most crucial ethical and

political values, questions, and judgments at the heart of such an endeavor are secondary or tertiary to their thinking at best and simply passed over at worst. When in rare instances such issues are considered by space enthusiasts, their techno-optimistic faith lets them sidestep the possibility that pursuing profit may conflict with other values or have deleterious effects. Yet, private interests, capital accumulation, and assumptions about space's utility—the space race's examples of Horkheimer's "utilitarian values," "choice and predilection," and "efficiency" (4–7)—are the contentless pseudo-justifications for the ends of space exploitation.

One of these effects is the continued and expanding domination of non-human nature. Bound up as it is with the domination of humans, this drives not only instrumental reason for Horkheimer, but also underscores the ways such modes of reason operate in both camp's defenses and criticisms of the new space race. As he explains, the instrumental reason instantiates the "total transformation of each and every realm of being into a field of means," where "each subject not only has to take part in the subjugation of external nature, human and nonhuman," but also the subjugation and domination of other humans, who of course are also part of nature (64). Horkheimer contends that this domination of nature culminated in his own time in nature becoming "the object of total exploitation that has no aim set by reason, and therefore no limit" (74). Making the problem even more domineering today is his foresight that, while earlier societies "were limited by the necessities of their physical existence," in the 20th century, humans developed an "avidity to extend [their] power in two infinities, the microcosm *and the universe*" (74; emphasis added). Horkheimer even illustrates his analysis of this kind of reason's domination of nature with an astronomical reference:

> The story of the boy who looked up at the sky and asked, "Daddy, what is the moon supposed to advertise?" is an allegory of what has happened to the relation between man and nature in the era of formalized reason. On the one hand, nature has been stripped of all intrinsic value or meaning. On the other, man has been stripped of all aims except self-preservation. … Though people may not ask what the moon is supposed to advertise, they tend to think of it in terms of ballistics or aerial mileage. The complete transformation of the world into a world of means rather than of ends is itself the consequence of the historical development of the methods of production. (69)

The new space race is transforming the allegory and the avidity to the infinite into actuality. In the plans of the billionaire space entrepreneurs, the Moon becomes little more than a staging ground and possible resource cache to further accelerate capital accumulation. But, even the space neutral position accepts the inevitability of this particular relationship to space in its cost-benefit assessment.

A reliance on and deployment of instrumental reason sidesteps substantively contending with the most crucial political and ethical values and concepts that should be integral to any large-scale social project, such as space exploration, or even more acutely space exploitation. The reign of instrumental reason across such a wide range of positions on space distorts and downgrades "the guiding concepts of morals and politics, such as liberty, equality, or justice" when considering "human aspirations and potentialities"

(21). Visions generated by instrumental reason are enervated by their lack of substantive critical thought, judgment, and concepts. Moreover, because science "is as positive or negative as" both "the function it assumes in the general trend of the economic process" and its "relation to the society for which it functions," scientific progress in our age, without a re-centering of political and ethical values, is simply going to entrench or reproduce existing patterns of domination (41).

Thus, in order to counter not only the barons of the new space race, but also the shortcomings of their critics, we must reject the space pessimists' and space neutrals' positions on the basis that their conception of space reduces it to its utility. Basing one's assessment of human space activities on such a logic is *an epistemic decision* that is *in actuality foundational to space's exploitation in the first place*. Such epistemological commitments, even by the critics, leave untouched the various ideological and material incentives that are driving the second space race in the first place—and all but guarantee that these same incentives and ontological priorities will continue to frame our future. Moreover, those remaining committed to such approaches make it impossible for the truly dialectical position vis-a-vis space: can we not be supportive of space exploration, but critical of the way that it has been and is currently being undertaken? Taking seriously that space is being exploited as we write, what does transcending the dead-end binary decision between an exploitative future (for example, "allow space to be colonized by the rich") and a futile position denying the current ideological and economic commitments to space (for instance, "throw the brakes on space exploration entirely") look like?[4]

For precisely these reasons, we argue that any vision of space must include engagement with critical thought and political values as part of the theoretical, epistemological, and analytical processes that will yield our way forward in space. In opposition to the instrumentality of how many approach the new space race, we seek to infuse discussions about space with a process of evaluating and prioritizing values in general—and, as we gesture to in the conclusion, specific values rooted in ideas of a genuine and critical commons—so that they are included in the conception of space and humanity's relation to it. In other words, we insist on the need for considering social and political values beyond monetization, extraction, and profit so that the vacuum of space does not also become a vacuum devoid of substantive modes of reasoning and visioning. Such a process would subject ideas about space to the political theoretical and ethical critique that the most prevalent positions in the hegemonic political economy and culture currently lack.

Space enthusiasm: spatial fixes, colonialism, and capitalism realism

Grappling with the deficiencies of the space pessimism and space neutrality positions while also positing a constructive theoretical alternative necessitates an examination of the material and ideological forces fueling the new space race and its enthusiastic adherents. Our analysis of the linked material conditions and ideological functions of how space exploitation is currently being pursued identifies the underlying conditions of

our contemporary moment in order to highlight ways to move beyond it. Many prevailing positions in the space debate fail to take these conditions seriously enough, but doing so is crucial because they are also the dynamics with which an alternative vision will need to contend. Through our interrogation of the current conditions of the new space race, we elaborate a critical apparatus that relies on critiques both rooted in a Marxist materialism and those that push further boundaries of critical theory. We argue that not only spatial fixes and primitive accumulation, but also settler-colonial, propertarian logics, as well as capitalist realism enable and accelerate the current trajectory of the new space race. By pursuing this wide-ranging critical analysis, we demonstrate the circularity of the uncritical space enthusiasts' logic in which colonizing space in response to capitalist crises is pursued via the same capitalist-colonialist methods that generated the crises in the first place. Not only does this circular self-justifying logic doom space exploration as it is presently configured, so too does it present a challenge and opportunity for the critics of the new space race who must repudiate this logic and generate an alternative vision to contend with it.

A straightforward Marxist materialist reading of the new space race interrogates the political economic purposes of human activity in space: in Marxist terms, space exploitation operates as an extension of primitive accumulation that enables the expanded reproduction of capital. Rosa Luxemburg poses the problem of expanded reproduction—a need for capitalism to realize surplus value in an ongoing and ever-growing way—as central to any analysis of capitalism (Luxemburg, 2016). Luxemburg contends that the expanded reproduction and accumulation of capital requires the continual expropriation of heretofore non-capitalist realms, and that this drives capitalist imperialism and marks the *ongoing* character of what Marx called primitive accumulation as constitutive of the capitalist order (Luxemburg, 2016: 261–65; 325–30). Imperialism then becomes the "political expression of the process of the accumulation of capital in its competitive struggle over the unspoiled remainder of the non-capitalist world environment" (325), and moreover is a racialized and racializing colonial process that sutures racial domination to capitalist violence (Issar, 2021).

More recently, David Harvey (2001) has examined the way in which capitalism depends on ongoing "spatial fixes," in which capital geographically expands its purview to soak up capital surpluses and over-accumulations. Space exploitation projects the spatial fix skyward to ensure the reproduction of capital through processes of expansion, primitive accumulation, and imperialism in space itself. As Victor Shammas and Tomas Holen argue, outer space as a spatial fix "swallows up surplus capital, promising to deliver valuable resources, technological innovations, and communication services to capitalists back on Earth," a dynamic that "places outer space on the same level as traditional colonization" (2019: 5). Indeed, national and international legal regimes have adapted and been interpreted to foster the colonial extraction of resources from celestial bodies (Bhatt, 2023; Durrani, 2019; Singh, 2023: 97; Storr, 2021). In Luxemburg's terms, capitalist forces convert space into a zone for expanded reproduction. From this standpoint, the political dimensions of space exploitation—the SPACE Act, the proliferation of public–private partnerships, relying on private firms for launches, prospects for lunar mining, and so on—constitute specifically imperialist processes that express in

political terms capitalism's struggle to expropriate not what Luxemburg calls the "non-capitalist world environment" (Luxemburg, 2016: 325), but rather the not-yet-fully-capitalist *astronomical* environment.

We need, however, more than this Marxist materialist account for primitive accumulations and spatial fixes additionally restage settler colonial and propertarian logics in space: the spatial fix *also* facilitates an ever-expanding frontier in line with the American settler colonial imaginary that aims to convert land (or space) to private property, pushing manifest destiny beyond the Karman line. Where critics, such as Rubenstein, examine the religious and eschatological underpinnings of the settler colonialism-to-space-colonialism trajectory (Rubenstein, 2022), we use political theory resources to argue that the drive to exploit, traverse, extract, settle, and colonize space projects a distinctively Lockean notion of private property upward into the cosmos. John Locke (in)famously justifies the appropriation of parts of nature (which was previously given to humans in common) as one's private property through the process of mixing one's own labor with nature: by extending the property that some inalienably have first in their person into nature through one's labor, one removes that nature from what had been held in common and makes it their own (Locke, 1690: chap. 5). Moreover, Locke claims that this adds value and efficiency that is greater than the vacant void of *terra nullius* that for him characterizes undeveloped nature.

Even at this very simplified level, we witness a Lockean logic becoming more prominent in the new space race. In 2015, Congress passed and President Obama signed the U.S. Commercial Space Launch Act of 2015, also known as the Spurring Private Aerospace Competitiveness and Entrepreneurship Act, or SPACE Act (Public Law 114–90). While explicitly disavowing territorial sovereign claims over space, the Act legislates the following:

> A United States citizen engaged in commercial recovery of an asteroid resource or a space resource under this chapter shall be entitled to any asteroid resource or space resource obtained, including to possess, own, transport, use, and sell the asteroid resource or space resource obtained in accordance with applicable law, including the international obligations of the United States. (Section 513.03)

A basic Lockean justification functions here: as the US citizen mixes their labor and technology with the unclaimed "resource," they become entitled to legal ownership over the resource, not to mention the profit derived from the resource.

Space provides an outlet not just for the capitalist necessity of opening new spaces to its forces and processes, but also a Lockean outlet to terrestrial limits on territorial expansion. Locke avers that his theory is more actionable in America than England, given that England has been mostly claimed and appropriated by the time of his writing, while he paints America as an uncultivated expanse. This becomes especially important given his proviso derived from natural law that "Nor was this appropriation of any parcel of land, by improving it, any prejudice to any other man, since there was still enough, and as good left; and more than the yet unprovided could use" (1690: sect. 33)—never mind the indigenous peoples living on and working on and with this so-called vacant waste for

thousands of years prior to European settlers. Space exploitation *escapes from* the territorial limitation on property acquisition by redirecting new appropriative efforts into the infinity of the cosmos.

Considering the enthusiasm among segments of the public for the new space race, today's space billionaires might for some embody the Lockean ideal of the "industrious and rational" to whom providence granted use of the Earth—so long as we can overlook their covetousness and quarrelsomeness (sect. 34). In her political ethnography of Kahnawà:ke political life in the face of settler colonialism, Audra Simpson notes the Lockean underpinning of settler colonialism in relation to land, property, and social hierarchy:

> [Locke] enunciates the hierarchies of social value and their accordant rights, which were tied to the understanding of people and a social ranking as defined within an agrarian-based, panoptic view of humanity: people laboring specifically in scenarios defined by a behavioral performance of extraction or mixing, (a labor) that was sedentary, fixed, observable. This would be labor in the fields, labor in gardens—labor in a manner that moved these spaces out of "the commons" and into the realm of the private. (2014: 101)

Settler colonial projects are not limited solely to some historical period, but persist as a structure whereby practices and imaginaries of frontier and property-making persist as they motivate racialized and colonial regimes of private property and capital accumulation today (Blomley, 2003; Wolfe, 1998). Structurally, space exploitation projects a racial-colonial frontier into space to expropriate new zones of capitalist–colonial development and extraction.[5] And, more specifically, Deondre Smiles contends that a "venture such as space exploration does not exist in a vacuum, but instead draws from settler colonialism and feeds back into it" (Smiles, 2020).

Expansionist frontier logics that underpin the new space race also often operate in conjunction with existing and pervasive American imaginations of nature. Such propertarian sensibilities motivated a *providential* vision of nature in 18th- and 19th-century America, in which undeveloped nature existed in an incomplete state, empty, but ready to meet human needs through private development of productive resources by the "industrious and rational" operating under an ecological determinism and dominionism of "Manifest Destiny" (Purdy, 2018; Rubenstein, 2022). Today, a similar providential, frontier-settling imaginary operates in space; space takes up position as the natural object or zone for new resources, new development, new settlement, and as escape or outlet from the ills of that which is internal to the imagined frontier (Rubenstein, 2022). If, in the 18th and 19th centuries, nature's providence was located in the central and western regions of the American continent, in the Anthropocene age, outer space's appeal can in part be said to derive from a technologically updated providential, colonial imaginary in the final frontier.

The new space race not only searches for capitalizable "outsides" in the modes of primitive accumulation, propertarian settler colonialism, and frontier logics. We argue that an underestimated dimension of enthusiasm for the new space race is the way it also offers a seeming outlet to the conditions and atmosphere of neoliberal *capitalist*

realism. The tongue-in-cheek notion originating with Frederic Jameson that states "it is easier to imagine the end of the world than it is to imagine the end of capitalism" epitomizes capitalist realism, which Mark Fisher conceptualizes as "the widespread sense that not only is capitalism the only viable political and economic system, but also that it is now impossible even to imagine a coherent alternative to it" (2009: 2). Within contemporary material conditions, one dimension of the space race's ideological and libidinal operations is that the hope in, escape to, or reliance on space as a response to terrestrial ills apparently responds to—but in fact reinforces—what Fisher diagnoses as capitalist realism. Put most colloquially, going to space is a way to accumulate resources, colonies, and tourist destinations, but *also* is just a really appealing escape from the crushing reality of terrestrial life. As a concept, capitalist realism captures a "pervasive *atmosphere*" that is political–economic, symbolic, psychic, libidinal, and cultural, and works "as a kind of invisible barrier constraining thought and action" (16; emphasis in original). This atmosphere suspends hegemonic and critical standpoints alike in a nebulous capitulation to the languishing capitalist present. In doing so, it preempts the envisioning of alternative systems or ways of living and being. As Emily Ray and Sean Parson suggest (2020: 71), it may be "easier to imagine lassoing an asteroid and supporting human colonies on Mars than it is to imagine addressing the dangers of climate change," and furthermore "[p]erhaps the only thing scarier than leaving the capsule to explore the cosmos is leaving the proverbial capsule of a neoliberal status quo."

We argue that the faith proffered by the barons of the new space race—the promise of private space tourism, resource exploitation, and colonization—supplies a supposed outlet for a broader frustrated desire for the new and the different. While it is necessary to take such claims seriously, the allure of these apparent alternatives in fact can provide cover for ongoing domination and for bolstering capitalism's hegemony. If capitalist realism diagnoses a condition in which nothing new is thinkable, then desires, such as Musk's promise to make humans a multiplanetary species or Bezos' plans for orbital quasi-societies, can serve as a repository for hope and desire for the new, but without challenging capitalism's pervasive hegemony. We claim that it is important to recognize that part of the popular appeal of space is its promise of transforming human existence and imagination, as false as that promise may be. Desiring space, either for one's self-fulfillment or along with others, can be the stuff of reverie that confronts hopelessness and diminished agency. Witness, for instance, Musk's (2021) tweet criticizing "those who attack space" for not realizing that "space represents hope for so many people" (Musk, 2021) or Bezos' awe upon returning from his suborbital space flight in summer 2021 paired with his statement of "thanks [to] every Amazon employee and every Amazon customer because you guys paid for all this" (Replay—First Human Flight Post-Flight Press Conference, 2021). What kind of hope does this actually represent and for whom (and for what) is space in fact hopeful? Musk and his ilk's civilizational discourses project a kind of enchantment that is supposedly open-to-all while masking the modes of domination that the practices driving these proffered visions actually intensify (Crandall et al., 2021). Furthermore, existing visions of space—from both enthusiasts and critics—fall prey to what Fisher calls "precorporation," the "pre-emptive formatting and shaping of desires, aspirations and hopes by capitalist culture" (2009: 9).

So all-encompassing is the capitalist horizon that it conditions the sense of what exploration into space can possibly be.

A pervasive sense (and the reality) of catastrophe further strengthens space exploitation's specific appeal in response to capitalist realism. Realistically, climate catastrophe suggests that "capitalism is in fact primed to destroy the entire human environment," and yet capitalist realism's fantasies, especially when coupled with techno-optimism, imagine that "any problem can be solved by the market" and "the earth itself is merely a husk which capital can at a certain point slough off like a used skin" (Fisher, 2009: 18). A drive to space exploitation stages this very rationality, in which space exploitation purportedly serves as a response to crisis consistent with the relationship between imaginaries of crisis and capitalist visions of futurity (Kalmbach et al., 2020). This imaginary replicates humanity's future—or at least the future of some part of humanity—in space and in the process furthers the denial of its responsibility for our real unfolding environmental and climatic crises in the here and now (Ray, 2021: 11–15).[6] While space functions as an escape from capitalist realism in both a broad sense and in terms of environmental crises, private space exploitation at the same time acts as an auspicious force that bolsters capitalism's ideological and material hegemony. Thus, space exploitation reproduces the very same dynamics of extraction and destruction we are supposedly escaping.

Taken together, the examination of primitive accumulation, spatial fixes, Lockean propertarianism, settler colonialism, and capitalist realism demonstrates that not only does private space exploitation "offer utopian visions of humanity in space that attempt to provide technological solutions to the political problems that colonialism and capitalism have caused" (Utrata, 2021), it does so by relying on *precisely the same strategies of colonialism and capitalism* that it pretends to solve or escape. This circularity—in which the end of colonizing space because of problems generated by capitalism is achieved by the same methods—dooms the current project of space exploitation and its enthusiasts, in part by the way it prevents them from ever viewing space as a commons of the kind we begin to sketch in the conclusion. It also, however, sets a trap for critics of the new space race, who must reject these circular self-justifying logics at the linked material and ideological levels and break out of them with a new constructive vision.

Conclusion: space as a commons for all

Our analysis of space and capitalism's exploitative practices demonstrates the need for any response to the current space race to do more than critique its dangers or demand that money be used terrestrially. Such responses do not combat the material and ideological forces fueling the space race and space enthusiasm in part because of their own reliance on instrumental rationality. Rather, our critical responses must include a constructive vision of space that might respond to sources of its ideological and cultural appeals. Our political theoretical analysis of the new space race—and even its critics—has operated along two related trajectories. On the first track, we developed a typology of two main camps of space race skeptics (the space neutrals and the space pessimists),

even as we ultimately argue that these positions fail to engage substantively with the underlying ideological parameters of the new space race. On the second trajectory, we further critically analyze the ways contemporary space enthusiasm restages capitalist and colonialist territorial expropriations, as well as entrench a hegemonic notion of capitalist realism. These tracks converge in our diagnosis of their shared instrumental rationality, a reductionist political epistemology of space that sets aside the necessary political theoretical as well as ethical questions of space exploration in favor of a political imagination-limiting cost–benefit analysis. Two questions remain: what does this wide-ranging critique enable or accomplish on its own, and what could be a positive alternative orientation to space?

Establishing a dialectical critique moving through and beyond both the space enthusiasts and the various camps of skeptics enables us to maintain a position that does not instrumentalize space to either justify space exploitation as with the enthusiasts or dismiss space in the way the neutrals and pessimists do. That is, we reject both uncritical enthusiasm for space exploitation *and* insufficient critiques of the new space race that rest on logics that leave exploitative bases unexamined. Moreover, our position makes clear the sinewy links of instrumental rationality that (in different ways) undergird space neutrality, pessimism, and uncritical enthusiasm, whether that takes the form of a self-limiting cost–benefit analysis or a desire to extract as many resources as possible from asteroids and colonize the cosmos. Identifying and critiquing instrumental rationality work to pry open the possibility of excitement or transformative potential for space that does not require going down the colonial–capitalist path.

To be sure, our analysis of the ideological and material conditions of space exploitation resonates with some of the criticisms from both the space-pessimist and space-neutral dispositions. We contend that our dialectical position theorizes greater depths and connections of the forces behind the new space race, particularly in the way we articulate the connections between the spatial fix, frontier and settler-colonial, and capitalist realism logics of space exploitation. We further argue that such a framework sets up not full or partial rejection of space exploration, as with the space-pessimist and space-neutral critics, but rather a dialectical turn to developing alternative visions for space as a commons for all that proffers a vision of flourishing rather than one of colonial neoliberal domination. That is, by avoiding the reductionist trap made possible by status-quo-cementing criticisms of the new space race, we develop a standpoint for more critically, more politically, and more ethically engaging in the theoretical work of envisioning how another relationship to space is possible.

We are not alone in this effort: many of those who express reservations about the new space race, including for its capitalist–colonial impetus, still seek to hold onto some constructive and transformative vision of outer space and seek inspiration from outer space. For instance, Prescod-Weinstein examines the "violent, colonial nightmares" of the private space race while drawing Afrofuturist imagination from poet Nikki Giovanni and engineer and astronaut Mae Jemison (2022); Rubenstein criticizes the supposedly divinely sanctioned conquest metanarrative of colonization, but turns to Afrofuturist and Indigenous cosmologies in search of "other spacetimes" (2022: chap. 7); Ray rejects "techno-optimism" to "suggest there is a possibility to harness these technologies

toward the public good and liberation" (2021: 14); Saskia Vermeylen and Jacque Njeri propose replacing the Lockean *terra nullius* with a principle of *res communis*, literally "belonging to 'mankind'" (2023: 121–122); and Francesca Ferrando expresses skepticism of utilitarian space logics in order to turn to posthumanism (2016). The goal for our critical space theory has been to clear the atmosphere for us and our fellow travelers to chart this alternative trajectory for space.

While articulating a political theory of the commons in space would necessitate a second article, we close with an all-too-brief manifest for a commons in and of the cosmos. Lifting off from our critical space theory, we suggest that theorizing space as a commons for all requires the following: reject both the colonial–capitalism of the enthusiasts and the instrumental rationality of the neutrals and pessimists; articulate space as a public domain; avoid reliance on the exception-riddled conception of the commons in the Outer Space Treaty; draw lessons from popular culture of space futurities while recognizing their political and epistemological limits; learn from Afrofuturist and indigenous cosmological visions and reciprocally support indigenous sovereignty movements; and reimagine terrestrial accounts of "commoning" whereby the commons is a shared practice that is "to be used by all … without distinction," that "is not for sale," and that results in a particular set of social relations that come with both entitlements for and obligations on all (Federici and Caffentzis, 2018: 93). Our critical space theory sets a course between the Scylla of space pessimism and the Charybdis of space enthusiasm linked to colonial capital while rejecting the instrumental rationality of space neutrality in order to seek new horizons where space might indeed be for all.

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Notes

1. Two notable recent exceptions to this are Utrata (2024) and Harvey (2023).
2. As one interlocutor put it to us, they were uncomfortable with the privatization of space and with our "space billionaires," but on the other hand, space is "cool as hell." We aim to find a critical way out of this quandary.
3. Also see Eleni Panagiotarakou's brief critique of "those who support the funding of space science solely on economic and societal benefits" (Panagiotarakou, 2016: 56).
4. Or, in the words of James S. J. Schwartz, how does one "lov[e] space exploration" without at the same time "endorsing contemporary spaceflight culture?" (2023: 140).
5. Ingrid LaFleur locates the Lockean propertarian logic in both American racism and space colonization, writing "Just as cities and states constructed highways that cut right through bustling Black communities, thereby destroying them, the United States has entered space with a familiar arrogance, treating planets like objects instead of living beings." (LaFleur 2023, 154)
6. Emily Ray examines this development as the point at which space is included in the category of "the environment": space "is looped into the extractive industries operating in a neoliberal capitalist environment, which binds outer space to the terrestrial environment such that outer space objects are 'naturalized' as resources, and space joins the environment but on the terms of capital" (Ray, 2021: 11–12).

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