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Space tourism in the Anthropocene

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ABSTRACT

There is growing acceptance that we are living through a transition between geological ages, from the Holocene to the Anthropocene. This paper examines the burgeoning space tourism industry in relation to the Anthropocene. The development of outer space has significant implications for Earth's inhabitants, yet only a small cadre of individuals, companies, and governments are involved in this process. Space tourism provides a germane context for conceptualising the ongoing debates regarding the extent to which Anthropos - humankind as an undifferentiated, unitary geological force - is responsible for the impacts that have culminated in the Anthropocene. We apply the Capitalocene framework to elucidate how the factors that brought the Anthropocene to fruition are now extending beyond Earth.

Introduction

The development of outer space is advancing more rapidly than many people are aware. The space economy was valued at approximately USD 350 billion in 2018 (Foust, 2018), and it is estimated that the industry will be worth USD 1.1 trillion (Morgan Stanley, 2018) to 2.7 trillion (Bank of America Merrill Lynch, 2017) by the 2040s. Abetted by the increasing involvement of the private sector beginning in the early 2000s, the space tourism industry has likewise expanded rapidly (Benjamin, 2018; Cohen & Spector, 2019; Spector, Higham, & Doering, 2017; Webber, 2019). Space tourism developments are associated with a range of complex environmental, social, political, ethical, legal, medical, and economic implications, many of which are not well understood (Cohen & Spector, 2019). As government space programmes have been scaled back, private enterprise driven by the personal ambitions of 'space billionaires' such as Elon Musk (SpaceX), Richard Branson (Virgin Galactic), and Jeff Bezos (Blue Origin), have thrived in a deregulated environment that has been largely devoid of scholarly critique. Access to outer space continues to become less expensive and more frequent (Federal Aviation Administration, 2018), and there is an urgent need for frameworks capable of theorising the far-reaching impacts of such developments.

While the Anthropocene is still debated, there is growing acceptance from a range of fields that we have entered a new, human-induced geological age (Ruddiman, Ellis, Kaplan, & Fuller, 2015; Zalasiewicz, Williams, Haywood, & Ellis, 2011). The Anthropocene argument is substantiated by the presence of climate change in addition to myriad other attributes of environmental change and degradation on an unprecedented scale (Crutzen, 2006; Dirzo et al., 2014; Rockström et al., 2009; Steffen, Crutzen, & McNeill, 2007). Evidence now even includes a new category of stone discovered in Hawai'i (Fig. 1) – a 'plastiglomerate' which was "formed through intermingling of melted plastic, beach sediment, basaltic lava fragments, and organic debris" (Corcoran, Moore, & Jazvac, 2014, p. 4). The concept of the Anthropocene plays an important role in communicating the urgency of human-induced environmental change within the Earth's biosphere. Because of this, the Anthropocene has experienced rapid uptake throughout the social sciences and

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Fig. 1. Plastiglomerate from Kamilo Beach, Hawai'i, displayed at Museon in The Hague, The Netherlands (Wikimedia Commons, 2016).

humanities, which emphasise its utility in highlighting our society's impacts on the planet (e.g. Alberts, 2011; Cohen, 2012; Lorimer, 2012; Rose et al., 2012).

While space tourism developments are motivated by a very small cadre of individuals, companies, and governments, the concomitant impacts extend throughout human societies, across the planet, and even into the cosmos. Despite the claims of pro-space narratives, a tiny fraction of humankind – the 'space billionaires,' the investors backing them, and a select number of extremely wealthy tourists – rather than the entire species, is not only driving forward ambitious space tourism programmes but is also primed to attain most of the benefits available in outer space. We argue that this problematises the positioning of humankind as a unitary and undifferentiated geological force, indicating a need for frameworks capable of theorising the role of capital in bringing the Anthropocene epoch to fruition and now motivating a small segment of society to extend the process of capital accumulation beyond Earth.

We apply the Capitalocene framework as a means of drawing attention to the emergence of space-based capital and the search for 'capital fixes' in the cosmos. Little attention has been given to space tourism as both a manifestation and facilitator of such endeavours. The Capitalocene is instrumental in explaining central facets of space exploration and development, including the privatisation of outer space and the drive to access space-based resources. In this paper we adopt the recent movement in tourism studies to conceive of tourism in terms of a "fuzzy cluster of 'discretionary mobilities'" (Cohen & Cohen, 2015, p. 15). This perspective is apt in the study of space tourism given the indistinct boundaries between, and increasing integration of, travel and tourism in the space context. Indeed, SpaceX, Blue Origin, and Virgin Galactic/Orbit are simultaneously driving forward touristic spaceflight and space travel more broadly through their scientific, technical, and military endeavours. This paper first discusses the Anthropocene in addition to some prominent critiques of the concept. We then analyse space tourism in relation to the Anthropocene and apply the Capitalocene framework to elucidate the precursors to and implications of space tourism development.

From the Holocene to the Anthropocene

The definition of distinct periods of geological time is the responsibility of the International Commission on Stratigraphy. The current geological period is the Holocene, which began at the end of the last glacial period of the Pleistocene approximately 11,700 years ago. The Holocene has been defined by a relatively warm and stable climate. Compared to previous glacial regimes, the Holocene has provided climatic conditions conducive to the cultivation of crops in fertile environments, while zones suitable to human habitation expanded significantly northward in the continental northern hemisphere. Many of the surface bodies of sediment upon which humans live, including soils, coastal plains, fertile river deposits, and high biomass deltas, were formed during this period (Zalasiewicz et al., 2011). The climatic and environmental conditions of the Holocene have been conducive to the accelerating development of human societies through the processes of agriculture, control of water, sedentism, industrialisation, and urbanisation that have been associated with ever-greater scales of environmental change. The International Commission on Stratigraphy has yet to make a determination on the end of the Holocene and the start of a human-induced geological epoch.

However, such has been the extent of global environmental change in recent years that the International Commission on Stratigraphy has come under pressure from the scientific community to consider the dawn of a new geographical age. Paul Crutzen and Eugene Stoermer's (2000) short article '*The Anthropocene*', which is credited with precipitating the concept, argues that the Holocene has ended and a new epoch, for which humankind is responsible, has begun. Topics such as climate change, pollution, species extinction, exhaustion of soils, over-exploitation of resources, and population growth are commonly cited as evidence of the Anthropocene's existence (Crutzen & Stoermer, 2000). Amongst those who support the Anthropocene thesis, many consider its origins to lie in the Industrial Revolution and, particularly, the industrial use of fossil fuels (Moore, 2015).

Others identify an earlier starting point, such as the advent of large-scale international trade in the early 1600s (see Lewis & Maslin, 2015). This date, the 'Orbis Spike,' has been selected due to two factors. First, a rapid and frequent exchange of species across oceans began occurring (Crosby, 2003). Second, large-scale land-use changes were caused by the deaths of tens of millions of people in the 'New World' due to diseases brought by colonists (Dull et al., 2010; Mann, 2011). The expansion and acceleration of imperialistic and capitalist systems in the 16th and 17th centuries can be seen as precipitating the changes that have now brought the Anthropocene to fruition (Lewis & Maslin, 2015; Wallerstein, 2011). The Orbis Spike was occasioned by the actions of a relatively small number of entities searching for new sources and forms of capital. In a similar but exponentially-extended manner, this same dynamic is now spreading into outer space. As will be discussed in the following section, the Capitalocene perspective aims to bring to the fore the role of a minority of actors in inducing potentially drastic environmental, social, and economic changes.

Regardless of the specific date it began, the concept of the Anthropocene has become prominent in the tourism literature. Huijbens and Gren (2015) edited a volume specifically addressing the topic, arguing that tourism has become a geophysical force, signifying a new phase of the history of the Earth and the future of humanity. Many of the central rationales for the Anthropocene – such as climate change, resources usage, and pollution – are also central concerns associated with tourism growth (Gössling & Hall, 2006; Gössling & Peeters, 2015). If our species is a geological force and tourism's impacts are likewise geophysical in scope, this significantly increases the ethical stakes associated with discretionary travel (Gren & Huijbens, 2014; Huijbens & Gren, 2015).

Some scholars have criticised the Anthropocene concept due to the abstract conceptualisation of humankind that some proponents appear to adopt (Hartley, 2016; Head, 2014; Malm & Hornborg, 2014; Moore, 2016; Woods, 2014). Climate change, a prominent factor in the Anthropocene, is useful in elucidating why it is problematic to discuss of the species in the abstract. An average United States citizen emits tens to hundreds of times more carbon dioxide than individuals living in less developed countries (Piketty and Chancel, 2015; Roberts & Parks, 2007; World Bank, 2019). Indeed, developing countries are responsible for less than one quarter of historic emissions (Mattia, Rydge, & Stern, 2012; Organisation for Economic Co-operation and Development, 2004). Furthermore, a list of only 100 state- and investor-owned entities accounts for nearly two thirds of cumulative CO_2 emissions (Head, 2014). This dynamic also pertains to tourism. A recent study shows that tourism is accountable for 8% of global CO_2 emissions; this impact is almost entirely driven by the most affluent segments of the most affluent societies (Lenzen et al., 2018). Approximately 80–82% of the world's population has never flown on an aeroplane (Gurdus, 2017; Mandyck, 2017). Anderson and Bows (2011) draw attention to the 'high emitters' – the small fraction of flyers who are responsible for disproportionate levels of anthropogenic emissions. While the privileged minority fly more and more (Higham, Ellis, & McLaurin, 2019), the global majority are excluded from the personal benefits of flying. Yet, many of those who have never flown live most immediately with, and are most vulnerable to, the elevated environmental threats of climate change (Young, Markham, Reis, & Higham, 2015).

The above discussion indicates that climate change is more accurately considered *socio*genic rather than anthropogenic (Malm & Hornborg, 2014). Some argue that referring to *anthropo*genic climate change – or climate change in the *Anthropo*cene – might conceal the social relations that are integral to understanding the phenomenon (Moore, 2015). The Anthropocene concept has been critiqued based upon these grounds. For instance, Hartley (2016) has said,

> At the heart of the Anthropocene lies the Anthropos: the human. But what or who is this Anthropos? No clear definition is ever given… To speak of the 'human enterprise' is to make of humanity an abstract corporation in which 'we're all in this together' (the David Cameron maxim of 2009), thus belying the reality of class struggle, exploitation, and oppression. (p. 155–156).

Moore (2016) presents a similar argument. In reference to the dominant Anthropocene narrative he notes that the origins of modern world are traced directly to England at the dawn of the nineteenth century, saying,

> The motive force behind this epochal shift? Coal and steam. The driving force behind coal and steam? Not class. Not capital. Not imperialism. Not even culture. But…you guessed it, the Anthropos: humanity as an undifferentiated whole. (Moore, 2016 p. 81).

This has led Hartley (2016) to argue, "As a way of talking about geological changes, the Anthropocene discourse is relatively harmless. Danger arises, however, when geologists enter the political arena" because "there exists something like a 'spontaneous ideology' of Anthropocene scientists; they have produced an implicit philosophy of history" (p. 155).

As a result of the issues highlighted in the preceding quotations, there have been recent efforts in the social sciences to 'differentiate' the *Anthropos* within the Anthropocene concept rather than discarding the term altogether (see Lewis & Maslin, 2015; Morton, 2016). Whether the International Commission on Stratigraphy gives the new epoch official designation or not, the underlying mechanisms cited in support of the Anthropocene argument are beyond debate, and we do not dispute that the Anthropocene has begun. However, it is the task of the social sciences to elucidate the social relations that have given rise to the conditions of the Anthropocene. We argue that the Capitalocene framework (see Jason Moore, 2014a, 2014b, 2015, 2016) is instrumental in bring to the fore the role of capital in providing the impetus for the issues that have led to the Anthropocene.

The Capitalocene thesis focuses on the historical relations that, aided by the emergence of capital, made it desirable to engage in particular forms of exploitation (this concept is also discussed by Bruno Latour, 2017, and Donna Haraway, 2015). While it matters which resources are utilised (as Moore, 2014a, himself explicates), the Capitalocene primarily focuses on the social systems under which that usage occur. Moore considers the Industrial Revolution to be an important event in – but by no means the root cause of – the historical developments that have led to contemporary socio-environmental issues. Moore (2016) instead draws attention to capitalism becoming a method of organising nature and thereby making the exploitation of certain resources economically advantageous. Exploitation of course pre-dates capitalism, but only with the emergence of capital have forms of exploitation become extensive enough to potentially warrant a new geological epoch (Altvater, 2016).

Our suggestion is not to replace the Anthropocene with the Capitalocene, but rather that the latter offers insights that are useful

for understanding the social relations that have precipitate the former. As Moore (2016) argues,

> The difference [between the Anthropocene and Capitalocene] speaks to divergent historical interpretations – and also to differences in political strategy. To locate modernity's origins through the steam engine and the coal pit is to prioritize shutting down the steam engines and the coal pits, and their twenty-first century incarnations. To locate the origins of the modern world with the rise of capitalism after 1450, with its audacious strategies of global conquest, endless commodification, and relentless rationalization, is to prioritize a much different politics – one that pursues the fundamental transformation of the relations of power, knowledge, and capital that have made the modern world. (p. 94).

The locus of responsibility is important. It is necessary to question how particular topics come to the fore and who stands to benefit depending on how those public issues are framed (Dewey, 1927). Visions of the development of outer space are interwoven with assumptions regarding who stands to benefit and who will bear the indirect costs associated with those benefits. It thus becomes important to discuss the relationship between the burgeoning space tourism industry and the concepts of the Anthropocene and Capitalocene.

Space tourism, the Anthropocene, and the Capitalocene

While discussions regarding the Anthropocene pertain primarily to the terrestrial environment, there are interesting parallels with discourses about outer space. Pro-space advocates frequently cite benefits 'for humankind.' This type of discourse is pervasive in the space tourism industry (e.g. Davenport, 2018; Kemp, 2007). For instance, Jeff Bezos (founder of the spaceflight company 'Blue Origin') discussed "having millions of people and then billions of people and then finally a trillion people in space" (quoted in Clifford, 2018, n.p.). The Space Tourism Society (2019), a pro-space advocacy group, says that it "believes that space tourism is the most logical endeavor for private enterprise to pursue towards the goal of expanding humankind into space" and that its mission is "to make space tourism available to as many people as possible as soon as possible" (n.p.). Virgin Galactic's Richard Branson (n.d.) said, "We are at the vanguard of a new industry determined to pioneer twenty-first century spacecraft, which will open space to everybody – and change the world for good" (n.p.). Discourses propagated by the space tourism industry thus sell the notion that a significant proportion of humans will soon be able to travel into space, or at least benefit from others engaging in spaceflight. Precisely how the benefits of space will be democratised, if at all, is not explained.

The 'overview effect,' which results from viewing Earth from outer space (White, 2014), further illustrates the dynamic of discussing of the species *en masse*. Speaking of his experience of spaceflight and looking back at Earth from space, astronaut Gene Cernan commented that, "You don't see the barriers of color and religion and politics that divide this world" (cited in White, 2014, p. 37). Edgar Mitchell noted that he felt an "overwhelming sense of oneness and connectedness" (cited in Hunt, 2015, p. 73). Yuri Artyushkin said, "The feeling of unity is not simply an observation. With it comes a strong sense of compassion and concern for the state of our planet and the effect humans are having on it. It isn't important in which sea or lake you observe a slick of pollution or in the forests of which country a fire breaks out, or on which continent a hurricane arises. You are standing guard over the whole of our Earth" (cited in Jaffe, 2011, p. 9). These narratives adopt an abstract and undifferentiated view of humankind and are deeply problematic. For those not capable of leaving Earth, the racial barriers, polluted lakes, and myriad other issues that astronauts cannot see from space do in fact matter a great deal.

Discourses of 'benefits for all' also underlie discussions regarding the survival imperative, which is predicated on the notion that 'the species' must extend into space in order to survive. SpaceX's Elon Musk (2013) has stated that "The future of humanity is going to bifurcate in two directions: Either it's going to become multiplanetary, or it's going to remain confined to one planet and eventually there's going to be an extinction event" (n.p.). The late physicist and cosmologist Stephen Hawking (2010) argued, "Our only chance of long-term survival is not to remain inward looking on planet Earth but to spread out into space" (n.p.). Likewise, Carl Sagan (1994) declared that "we have a basic responsibility to our species to venture to other worlds" (p. 312). But who earns inclusion in the 'humanity,' 'our,' and 'we' referred to by Musk, Hawking, and Sagan?

Increased access to space, facilitated by the commercial spaceflight industry (Federal Aviation Administration, 2018), is also projected to enable the mining of space resources. There is an immense amount of wealth even in the nearby cosmos (Lewis, 1997; Spector & Higham, 2019), and companies have begun forming with the aim of capitalising on space-based resources. As with narratives about private spaceflight and the overview effect, space resources are often positioned as capable of benefiting everyone. For instance, the Organisation for Economic Co-operation and Development's (2012) 'Handbook on Measuring the Space Economy' defines the space economy as "the full range of activities and the use of resources that create and provide value and benefits to human beings in the course of exploring, understanding, managing and utilising space" (p. 20). The Handbook has a section on socio-economic impacts, but that section does not discuss global inequality; it instead states, "The main message is that many space-based services have positive impacts on society" (Organisation for Economic Co-operation and Development, 2012, p. 89).

The lack of known lifeforms in the areas proposed for space settlements and mining operations abets those who advocate substantively altering such areas (Spector & Higham, 2019). Indeed, while the human-induced alteration of Earth's geology is viewed negatively within the Anthropocene framework, there are many proposals to overtly and substantively alter other celestial bodies. For instance, Zubrin (2011) outlined a detailed plan for terraforming Mars by adding halocarbons to its atmosphere, and Green et al. (2017) suggested making the Red Planet habitable by shielding it from radiation with a large dipole magnet. Powell (2015) went so far as discussing the possibility of colliding an asteroid into Mars in the hopes of creating a greenhouse gas effect in its atmosphere. Pro-space advocates argue that accessing outer space will advantage 'humankind' in a plethora of ways, and space development is suggested as means of overcoming the issues that plague the Anthropocene.

There is a clear need to challenge the local-national-global scale of tourism systems, which have now extended beyond the biosphere and into the cosmos. Given the present trend towards privatisation, it is unlikely that *Anthropos* (as an undifferentiated species) will benefit from the development of outer space. Indeed, the U.S. 'Space Resource Exploration and Utilization Act' (2015) states that the President should:

> facilitate the commercial exploration for and commercial recovery of space resources by U.S. citizens; discourage government barriers to the development of economically viable, safe, and stable industries for the commercial exploration for and commercial recovery of space resources in manners consistent with U.S. international obligations; and promote the right of U.S. citizens to engage in commercial exploration for and commercial recovery of space resources free from harmful interference, in accordance with such obligations and subject to authorization and continuing supervision by the federal government. (n.p.)

The principal international treaty in this context, the 'Outer Space Treaty' (1967), does not prohibit private citizens and companies from accessing, utilising, owning, and benefiting from space-based resources. A subsequent treaty, the 'Moon Agreement' (1984), took a much more restrictive stance towards the use and ownership of celestial resources, but none of the prominent space-faring nations ratified this later treaty. The legal and regulatory milieu indicates that a select few individuals, companies, and governments are primed to engage in space travel and reap the benefits (Spector & Higham, 2019).

Continuing to reference an undifferentiated and abstract view of humankind suppresses important debates surrounding the complex social relations implicated by spaceflight. The Capitalocene elucidates the possible effects of access to outer space and contributes to understanding the motivations underlying the recent drive to develop outer space. Capitalist methods of production are increasingly confronted with terrestrial limits. Outer space contains vast amounts of resources (Bernasconi & Bernasconi, 2004; Lewis, 1997; Organisation for Economic Co-operation and Development, 2012; Yarris, 2010), thus offering the next 'capital fix,' the next 'outside' for the pursuit of continued economic growth and capital accumulation (Dickens, 2009; Ormrod & Dickens, 2019).

While there has been notable progress in developing a sociology of outer space (Dickens & Ormrod, 2007; Ormrod & Dickens, 2016; Peters, 2017), further work is warranted in this realm. The Capitalocene encourages analysing which particular socio-economic segments will benefit from space-related capital. The central issue is arguably not so much the prospect of spaceflight or the use of space resources but rather the processes by which those resources are attained and the benefits subsequently distributed in addition to questions regarding who will be physically, economically, and politically capable of travelling into space.[1]

The individuals, companies, and governments currently involved in space-related activities are already in positions of comparative power and wealth (Spector & Higham, 2019). As spaceflight technologies are progressing rapidly and wealth continues to concentrate in a small number of hands, some individuals have begun looking skyward for the next iteration of conspicuous tourist consumption (Ormrod & Dickens, 2019; Spector et al., 2017). As per Veblen's (1899) theory of the leisure class, manifestations of conspicuous consumption tend to eventually become attainable by larger portions of society. The seven tourists who each paid USD 20–40 million to travel to the International Space Station, the hundreds of individuals who bought advance tickets for Virgin Galactic's suborbital flights for USD 250,000, and the Japanese billionaire who paid an undisclosed sum for a future SpaceX-operated Lunar mission can be seen as 'opening' new destinations. The initial forays of space tourists are thus potentially precursors to privileged segments of society attaining the ability to leave what they consider to be an increasingly undesirable 'Earth centre.' The need to investigate these dynamics is substantiated by the fact that there appears to be significant demand for space tourism (see Crouch, 2001; Crouch, Devinney, Louviere, & Islam, 2009; Laing & Crouch, 2004; Olya & Han, 2019; Peeters, 2010; Reddy, Nica, & Wilkes, 2012; The Tauri Group, 2012).

Despite the process of space development being well underway, there has been limited academic debate regarding who will have access to outer space and any benefits thereby generated (see Dickens & Ormrod, 2007; Ormrod & Dickens, 2016). It is noteworthy that the very act of leaving Earth and travelling beyond the biosphere has a significant impact on the Earth's environment. It is estimated that 1000 space launches produces the equivalent carbon footprint of annual global aviation (Ross, Mills, & Toohey, 2010). As has been the case on Earth, the process of space development will have significant implications for those who are excluded or otherwise left behind. In its refusal to portray humankind as an undifferentiated whole and its focus on the role of capital accumulation, the Capitalocene framework is instrumental in elucidating these dynamics.

Conclusions

Earth is not the sole domain of human influence. Indeed, human impact has increasingly extended beyond the biosphere since the launch of Sputnik 1 in 1957. In recent years the reach of human impact in space has greatly accelerated, with implications for life both within and beyond Earth's biosphere. Interplanetary space is now increasingly filled with human-made material culture

[1] Some have extended this logic to the point of suggesting that 'unmodified' humans may be deemed unfit for space travel, the task being instead left to either heavily modified humans (cyborgs) or non-human entities (see Cohen & Spector, 2019; Launius & McCurdy, 2007). Advances in so-called 'NBIC' (nanotechnology, biotechnology, information technology and cognitive science) raise the possibility of space travel being left to sentient, non-human beings (posthumans) or heavily modified human 'cyborgs' (transhumans) (Cohen & Spector, 2019; Ferrando, 2013; Pop, 2018). This led Ferrando (2013) to argue, "As the Anthropocene marks the extent of the impact of human activities on a planetary level, the posthuman focuses on de-centering the human from the primary focus of the discourse" (p. 32). If, as suggested by transhuman and posthuman writings (e.g. Huxley, 1957; More, 2013; More and Vita-More, 2013; Roden, 2015), the current human form is merely an intermediate step in a long evolutionary chain, it becomes even more problematic to focus on the *Anthropos* as an undifferentiated group rather than the select few humans (or post/transhumans) involved in space development.

(Gorman, 2005). Much of this archaeological record in space does in fact constitute space junk in Earth's orbit and at planetary landing sites. As on Earth, the human propensity to explore, exploit resources, consume, and generate material impacts is already playing out in space (National Aeronautics and Space Administration, n.d.; Weeden & Chow, 2012). For instance, the recent SpaceX launch of a Tesla Model S into outer space is considered to constitute the largest collection of microbes to ever leave Earth (Zacharias, 2018). The current human development pathway beyond Earth's biosphere is being largely driven by the interests of 'space billionnaires' who enjoy international legal regimes and national regulatory systems that are highly conducive to private sector space developments. Under such circumstances the democratisation of space travel and any benefits arising therefrom appears unlikely (Dickens & Ormrod, 2007; Ormrod & Dickens, 2016; Peters, 2017).

There are a plethora of unanswered questions and unresolved tensions regarding space tourism. Many of the individuals involved in the space industry hope that the initial forays of space tourists represent a step towards 'humankind' settling the cosmos. On Earth, tourism has been responsible for opening destinations and precipitating their development (De Jong & Fuller, 2010; Garrod, Wornell, & Youell, 2006; Smith & Doherty, 2006). Space tourism may thus serve a similar role. However, it is an open question to what extent outer space will be opened to the masses or, conversely, remain a sight of joy-rides and capital accumulation for the elite few able to afford such endeavours and to escape (rather than ameliorate) the issues plaguing the Earth (see Weinzierl, 2018).

There is an interesting parallel between space development and the suburbanisation that many countries have experienced. The process of suburbanisation has resulted primarily from growing affluence, the development of transport and telecommunications technologies that increase the ease of living further afield, and city centres being deemed over-populated, unsafe, and polluted (Hartshorn, 1992; Wang & Zhou, 1999). Similar dynamics can be identified in relation to spaceflight. Space transport technologies have progressed swiftly; and pro-space narratives, in order to substantiate the need to expand into the Universe, frequently highlight both the population crisis and the vulnerability of an Earthbound species to a wide range of hazards (Bostrom, 2013; Burrows, 2006; Spector & Higham, 2019). On Earth, suburbanisation is associated with negative outcomes for city centres, including environmental impacts, racial tensions, wealth and income disparity, increased crime rates, and reduced economic development as capital transitions to peripheral areas (Gainsborough, 2001; Jargowsky & Park, 2009). As with terrestrial suburbanisation, affluence will significantly dictate who is empowered to escape Earth and attain the benefits residing in outer space.

The dynamics that led to the Anthropocene are now clearly being extended into the cosmos. This paper has argued that in order to conceptualise these dynamics it is necessary to not position humankind as an undifferentiated whole but rather analyse the implications of select individuals, companies, and governments extending their reach into space. We have highlighted issues inherent in discussing humankind *en masse* in relation to pro-space discourses related to space tourism, the overview effect, the survival imperative, and the benefits of space-based resources. Whether analysing terrestrial or cosmic issues, narratives too often invoke the concept of an undifferentiated species. A shift towards a more nuanced conceptualisation of inter- and intra-species relations is necessary. Emphasising species-wide impacts may come at the expense of addressing the future trajectory of how particular segments of society are exerting increasing influence on – and beyond – the Earth. We have argued that the Capitalocene framework provides insights into the motives underlying the current drive to travel to, control, own, and exploit outer space.

The context of cosmic development is rife for future research. We identify an increasing need for critical scholarly input into the activities of private spaceflight companies and the governments that facilitate their development. Tourism and travel systems are possibly experiencing the first stages of the emergence of a new transport paradigm. While some initial work has been completed (Spector et al., 2017; Spector & Higham, 2019), there is a need to further understand how space tourism is interwoven with sustainability both within and beyond the biosphere. Finally the intentions and assumptions propagated by pro-space advocates are notably discordant with leading narratives in academic spheres regarding what a desirable transport future looks like and whether humans should devote terrestrial resources to solving terrestrial problems or instead look to the heavens to ameliorate the environmental catastrophes that have precipitated the Anthropocene.

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