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Fragmenting a Monolith:

Exploring and Disrupting an Outer Space Imaginary

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This book is for Nao and Yuna, my wife and daughter, my shining stars.

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Abstract

Fragmenting a Monolith explores imagining outer space and examines a predominant and problematic outer space imaginary. The research focuses on the production and narration of outer space by a Euro-American vision of humankind as a spacefaring civilisation, and questions what this vision means for human futures on and off Earth. The primary interest is the human settlement of outer space, as a technological project inseparably entangled with the social and the subject of a "sociotechnical imaginary" (Jasanoff and Kim 2015: 4). Here, historical precedents and ideological values saturate contemporary representations and materialisations of desirable space futures. The thesis responds to the idea of the imaginary — a collectively held and publicly performed vision or narrative — as a formidable social and political force. Most importantly, it articulates the imaginary as a kind of *infrastructure* that shapes and stabilises a movement of influential space industry actors with ambitions to colonise and commercialise the cosmos. This infrastructure is made of myths, metaphors and master narratives which manifest in the imagery and rhetoric of spaceflight advocacy. Distorted and deeply flawed, they nevertheless combine to normalise outer space in a powerful collective imagination.

This PhD project works at the intersection of artistic research, science technology studies and film theory, with a specific focus on the essay film. The project aims are twofold. First, in apprehending a Euro-American imaginary as spaceflight infrastructure, I study its normalising functions and mechanisms from an artistic perspective; finding double exposures, inversions and other aesthetic gestures at the heart of its "structuring matrix" (Gaonkar 2002: 4). In exploring how this imaginary is performed, I establish the need for its disruption. This need creates the premise for the second aim: a critical response, founded upon the practices and processes of the essay film. Montage forms a central method for the essay film to *think* through moving image,where discrete fragments of image and sound cohere and collide in infinitely multiple arrangements. Through such arrangements, film essayists convey film to be another audiovisual structure — a fragmentary structure for countering and destabilising the problematics of a monolithic space imaginary. Montage means a material film practice and also a montagist sensibility for reading moving image, often found in film criticism. As method, montage relates my writing to a series of short essay films I made, which experiment with found footage to explore particular themes and concerns that I describe in the thesis chapters. It is through this multidisciplinary approach that the project critiques and contests a predominant outer space imaginary across imaginal, fictional and scholarly registers.

Introduction

Relational, Mediated and Normalised Outer Space

A great deal of what we know, we know only through our imagination — and that knowledge is crucial to our lives.

— Peter Turchi

Wow!

"Wow! If that does not inspire you, you are at the wrong event," quips Jeff Bezos, as he steps on stage in Washington DC, in May 2019, to unveil a lunar lander prototype designed by his aerospace company, Blue Origin. On surrounding screens, a cinematic montage of footage capturing the Apollo 11 Moon landing fades to audience applause, forming a prelude to the event. The iconic imagery of men on the Moon render Bezos' passion for space relatable, while further amplifying a sense of technological optimism about the space future Blue Origin and other commercial actors are building towards. A year later, in April 2020, the National Aeronautics and Space Administration [NASA] selected Blue Origin as one of three companies to develop a human lunar lander for the Artemis programme, which aims to return American astronauts to the Moon in 2024.[1] This time, Bezos says, "we are going back to the Moon to stay."

On Saturday 30th May 2020, at 3:22pm Eastern time, Doug Hurley and Bob Behnken became the first American astronauts in nine years to be sent into outer space from US soil. Hurley and Behnken were launched from Launchpad 39A at the Kennedy Space Centre in Florida — a highly symbolic choice, as the same pad from where the goliath Saturn rockets blasted the Apollo missions to the Moon between 1969 and 1972. Transporting them to the International Space Station, Hurley and Behnken's spaceflight was, nevertheless, pointedly presented as "Launch America." Some fifty years after Apollo, this mission is historic for different reasons. Namely, because the two astronauts were carried into orbit by vehicles that were designed and manufactured by a commercial company. The company in question is SpaceX, founded by another Silicon Valley billionaire in Elon Musk.

1 Blue Origin was the prime contractor in a self-styled "National Team" including other U.S. companies Lockheed Martin, Northrop Grumman, and Draper (NASA 2020a). Forming the competition, the other companies selected were Dynetics and SpaceX. In April 2021, SpaceX would win the $2.9 billion NASA contract to continue developing and build the lunar lander for the Artemis mission (NASA 2021).

Figure 1: Jeff Bezos presents Blue Origin's Blue Moon lunar lander prototype in Washington, DC on May 9, 2019. Credit: Blue Origin.

Figure 2: The SpaceX Falcon 9 rocket and the company's Crew Dragon spacecraft launch NASA astronauts Robert Behnken and Douglas Hurley to the International Space Station on May 30, 2020. Credit: NASA/Bill Ingals.

The defining role of SpaceX in returning human spaceflight to the United States, and the preliminary selection of Blue Origin for the next NASA moon shot are the latest milestones to mark a steady yet significant shift in the space industrial landscape. NASA has a long history of commissioning a select group of private contractors, such as Boeing and Lockheed Martin, to produce space hardware for various programmes. However, at the turn of the twenty-first century, commercial operators emerged from the shadows to collaborate more prominently with state agencies in public-private spaceflight partnerships. The reusable Falcon 9 rocket and the Blue Moon lunar lander both materialise the increasing power and responsibility sought by SpaceX, Blue Origin and other commercial companies to build the physical infrastructures for human outer space activities in the present and into the future. Furthermore, and most importantly for this thesis, the increased presence of Bezos, Musk and other private spaceflight actors in the public realm means they also hold the power to affect what outer space means in collective imaginations. By framing their offworld practices in grand visions of the future, these actors actively consolidate a particular and normative outer space imaginary that is predominant and persistent in Western popular culture.

Fragmenting a Monolith

This PhD project explores imagining outer space and examines a predominant and problematic outer space imaginary. The research focuses on the production and narration of outer space by a Euro-American vision of humankind as a spacefaring civilisation, and questions what this vision means for human futures on and off Earth. The primary interest is the human settlement of outer space, as a technological project inseparably entangled with the social and the subject of a "sociotechnical imaginary" (Jasanoff and Kim 2015). Here, historical precedents and ideological values saturate contemporary representations and materialisations of desirable space futures. The thesis responds to the idea of the imaginary — a collectively held and publicly performed vision or narrative — as a formidable social and political force. Most importantly, it articulates the imaginary as a kind of *infrastructure* that shapes and stabilises a movement of influential space industry actors with ambitions to colonise and commercialise the cosmos. This infrastructure is made of myths, metaphors and master narratives which manifest in the imagery and rhetoric of spaceflight advocacy. Distorted and deeply flawed, they nevertheless combine to normalise outer space in a powerful collective imagination.

The aims of the PhD are twofold. First, in apprehending a Euro-American imaginary as spaceflight infrastructure, I study its normalising functions, mechanisms and materialisations from an artistic perspective; finding *double exposures, inversions* and other aesthetic gestures at the heart of its "structuring matrix" (Gaonkar 2002: 4). From this analysis, a particular metaphor emerges to describe a double movement, in *straight circles*, by which this imag-

inary propels significant parts of the space industry towards a common image of the future. The first part of the metaphor relates to a notional straight line of history, connecting memories of the past with future speculations, and enabling space settlement to be projected on the "cutting edge" of progress (Robertson 1980: 8). The second part pertains to a pervasive, circular recycling of images and narratives, abstracted from Western history, science fiction and popular culture, to render a space-based future familiar and therefore desirable. In exploring how this imaginary is performed, I establish the need for its disruption. This need creates the premise for the second aim: a critical response, founded upon the practices and processes of the essay film. Montage forms a central method for the essay film to *think* through moving image, where discrete fragments of image and sound cohere and collide in infinitely multiple arrangements. Through such arrangements, film essayists convey film to be another audiovisual structure — a fragmentary structure for countering and destabilising the problematics of a monolithic space imaginary. Montage means a material film practice and also a montagist sensibility for reading moving image, often found in film criticism. As method, montage relates my writing to a series of short essay films I made, which experiment with found footage to explore particular themes and concerns that I describe in the thesis chapters. It is through this multidisciplinary approach that the project critiques and contests a predominant outer space imaginary across imaginal, fictional and scholarly registers (Dunnett 2020: 45).

This project works at the intersection of artistic research, science technology studies [STS] and film theory. It is founded upon close readings of various scholars, who are engaging with outer space as a critical and relational site of human futures, and my aesthetic analysis of space industry media and other materialisations of "astroculture" (Geppert 2012: 220) — from science fiction films to space industry conference plenaries. In a parallel investigation, my study of the essay film found an increasingly appealing medium for not only engaging with the particular myths, metaphors and mechanisms of the Euro-American imaginary but also as a means to critique its problematics through moving image. The multidimensional nature of the project led to an eclectic set of outputs and contributions to the STS field[2] and a broader critical space culture. Considering my process, montage stands as the central method tying the projects combined fragments of image and word together.

The aims of the project relate to three broader, connecting interests in outer space. In the following paragraphs, I articulate these interests as catalysts for the project and also expand upon them to frame an interdisciplinary state of research. To very briefly summarise, I am most interested in: (1) how outer space is a relational site of earthly social and cultural productions; (2)

2 See Popper (2019; 2020a; 2020b).

perceptions and perspectives of outer space are mediated by imagery and fiction; (3) and yet outer space has also become colonised by a normative, Western imagination in need of disruption and alternative.

Relational Outer Space

We are already in space.
— Buckminster Fuller

Outer space represents an expanding field of practices and discourses, including the arts, humanities and social sciences. This expansion arguably reflects the creation of "a new outer space" (Dickens and Ormrod 2016: 8) in the early twenty-first century. On the one hand, changes in outer space policy made by the U.S. government — particularly the Bush and Obama administrations — apportioned significant funding and increased responsibility to the private sector and catalysed the rise of a burgeoning commercial space industry (Beery 2012: 29, Valentine 2012: 1046, Launius 2014: 31, Gál 2021). Furthermore, this commercial shift helped to fuel "NewSpace" as a powerful social and economic movement, comprising entrepreneurs; public-facing societies and other space industrial actors who together support the human colonising and commercialising of outer space. On the other hand, space is being "made social" (Dickens and Ormrod 2016: 8) by different actors, advocates and activists who are constructing space as a *place* according to different sociopolitical and economic agendas. With this in mind, cultural anthropologists, historians and other social scientists are also increasing their common interest in outer space as an important site of critical discourse.[3] Here, the writings of various scholars including Alexander C.T. Geppert, Lisa Messeri, Peter Redfield, David Valentine and Janet Vertesi were influential in developing the theoretical concerns of this PhD project. Together, their words imbue outer space with a "social thickness" (Jasanoff and Kim 2015: 3) and a terrestrial relativity.

Outer space is relational in numerous ways. In her study of exoplanet astronomy, Lisa Messeri notes a shift led by astronomers from positioning Earth as special and unique — inspired by the iconic photographs[4] from the NASA Apollo programme and the *Whole Earth* countercultural movement they later inspired — to one that places our planet's significance in relation to other planets. "And if Earth is connected" argues Messeri (2017a: 338), "then

3 From personal experience, at the annual *4S* Conference (Society for the Social Study of Sciences), the number of thematic panels dedicated to outer space rose from just one in 2019 to three in 2020.

4 Such as *Blue Marble*, taken by the Apollo 17 mission (1972).

how we understand the cosmos is inseparable from how we understand Earth." The image of a connected Earth rhymes with the notion that "the worlds we enter have never been entirely Earth-bound," as anthropologists Debbora Battaglia, Valerie Olson and David Valentine say (2009: 15). They posit outer space as "crucial site for examining practices of future imagining in social terms" (Ibid), a context opening up for not only "re-setting our questions for and about the future" (Ibid) but for "reworking social histories […] space/time norms, and terrestrial humanness as a given state of being and meaning" (Ibid: 11).

The sociologists Peter Dickens and James S. Ormrod (2016) bring another relational dimension to light in defining outer space as a human production.[5] They introduce ideas of philosopher Henri Lefebvre (1991) to pose that human societies produce the spaces around them as they simultaneously produce themselves, and therefore cannot be considered independently of the "world" or universe. Dickens and Ormrod contest the very term "outer space" for its inherent creation of boundaries. They refer to the Kármán line, demarcating a threshold separating Earth from the cosmos, to exemplify space as a social construction. The Kármán line is drawn at 100 kilometres high, however, this is "not a material boundary. Nothing changes abruptly…" (Dickens and Ormrod 2016: 3) Yet this arbitrary line has a profound effect on the perception, use and governance of the space beyond it.[6] It can therefore also be read as part of what the authors find to be an "othering process" going on (Ibid), where the universe is imagined to be a "dead, mechanical" and an "object to be worked upon." Nevertheless, the authors (Ibid: 2) emphasise an inseparable and dialectical relationship of any space created with its outside, which means outer space is very much a "constitutive part of social order rather than something divorced from it." Furthermore, they determine "[w]hat happens at the intersections of outer space and the terrestrial is very important for establishing social power" (Ibid).

Outer space is thus recognised as "a crucial site for human futures" on and off planet Earth (Valentine 2012: 1065). Space projects entangle with terrestrial conditions, from their speculative implications to their actual ramifications; in the words of anthropologist Peter Redfield (2000: 183), "the vastness of modern heaven weighs heavily on the ground." This entanglement is no more apparent than in Redfield's multivalent and poetic study of the European spaceport in French Guiana, where sociotechnical relations between ground

5 Geppert (2018: 125) consolidates this idea by stating "Rather than having always been "out there", space was made, imagined and configured by humans on Earth, especially since the interwar period."

6 As the authors say (Dickens and Ormrod 2016: 4): "We feel differently (for better or for worse) about placing weapons there, commodifying resources or creating pollution. Correspondingly, different international agreements, legal regimes and policies apply to activities in outer space."

Figure 3: *The Blue Marble* photograph by the crew of the Apollo 17 mission to the Moon (1972). Credit: NASA.

Figure 4: The European Space Agency's Ariane 5 rocket launches from the European Spaceport in French Guiana. Credit: ESA.

Figure 5: Dr. David Morrison, Director of the Carl Sagan Centre for Study of Life in the Universe at SETI Institute, in the film *Disaster Playground* (2015) by Nelly Ben Hayoun. Credit: Nelly Ben Hayoun/Nick Ballon.

and sky are rendered richly complex. Redfield (Ibid: 182) describes the transformation of a tropical wilderness into a "Space Age launch site," examining not only the logistical concerns behind constructing a spaceport deep in the tropics and its wider, complicated social impact on the region, but also exploring different layers of meaning about the project in a relational sense. First, he surveys the geographical and political criteria rendering Guiana as a desirable launch site for the European Space Agency. Not only is a remote, equatorial location a distinct advantage for explosively launching objects into space, but Guiana also appeased a certain "bias against any political landscape threatening movement, and a preference for sites within the French sphere of influence, former colonies and continuing territories" (Ibid: 127). Here, in a conflation of local and technical concerns with colonial histories, Redfield finds an "irony" about the Guiana Space Center as an "unlikely (but carefully chosen) point of the planet…" (Ibid: 183) where, for some, a marginal and underdeveloped land is reimagined as "Heaven's Gate" (Ibid: 124). As Redfield continues, this unlikely choice not only demonstrates the capacity of space exploration to "simultaneously re-position the surface [of Earth] already known" but a technological projects acknowledgement of "place" (Ibid: 182) — a place where Redfield finds the past and the future; and the local and distant interacting together.

Redfield's study in Guiana complements the film *Black Drop* (2012), by artist Simon Starling. In an essayistic manner, *Black Drop* describes a historical relationship between astronomy, photography and cinema in telling the story of nineteenth century scientific endeavours to record the transit of Venus across the sun. Charting historic expeditions made to the Pacific islands of Tahiti and Hawai'i, chosen for their perfect weather conditions for observing the heavens, Starling further entangles astronomical aspirations with problematic colonial histories. The relationality of outer space is also explored, in a very different atmosphere, by designer Nelly Ben Hayoun in her film *Disaster Playground* (2015). Responding to the premise of a disastrous asteroid collision with the Earth, Ben Hayoun follows "the chain of command that runs from the SETI Institute and NASA to the White House and United Nations" to meet scientists, politicians and other people responsible for "protecting us" from a devastating event (Disaster Playground 2015). Through a playful aesthetic that she describes as "space decadence" (Ibid), Ben Hayoun uses the performative enactments of a speculative scenario to demonstrate a more nuanced relationality about Near Earth Objects and their potential impact; their offworld presence catalyses a complex connection of space actors in a network of earthly scientific organisations and political institutions.

From art, design and anthropology, the work of Starling, Ben Hayoun and Redfield help to stress human offworld activities as social and technological projects. Their shared emphasis aligns with science technology studies [STS] scholars and their critical focus on technology's "social thickness" (Jasanoff and Kim 2015: 3), a phrase for explaining science and technology as inseparable from the social context which they both produce and are produced by. This means any

scientific knowledge and technological progression does not transcend but is firmly embedded in the social; and just as "outer" space is found inseparable from Earth in a constantly shifting dialectic, technoscientific projects do not develop in isolation from society but emerge from it. The sociologists Sheila Jasanoff and Sang-Hyun Kim are important touchstones for this thesis, in particular for their concept of a "sociotechnical imaginary." Though I expand upon their concept more in the first chapter, the sociotechnical imaginary can be briefly described as a collective vision of a desirable future that is founded upon common social understandings and the promises of science and technology (Ibid: 4). Jasanoff and Kim are important for highlighting the belief systems out of which technological "materialities emerge and which give them value and meaning" (Ibid: 22). From reading the different authors mentioned here, it becomes clear that any proposal for a future in outer space is laden with ideas and beliefs about human ways of life, while outer space practices impact the Earth across complex social, cultural and environmental registers. Simply put, outer space projects do not exist in a vacuum: outer space "makes a difference" (Battaglia, Olson and Valentine 2015: 247).

Mediated Outer Space

To a large extent, the collective imagination of outer space relies on the power of images, both still and filmic.

— Alexander C.T. Geppert

At the time of writing, a total of five hundred and sixty-eight human beings have travelled across the Kármán line and into outer space.[7] Of this number, just twenty-four have left Lower Earth Orbit and only twelve white, American men have set foot on another celestial body. For the rest of us, imagery and fiction are necessary for rendering outer space a sensible and meaningful place. In other words, outer space is arguably mediated by default. Because of the enormous scales and hard limits imposed on getting and being there, the cosmos must be imagined, represented or described. These Earth-binding constraints also mean most designs and projects for space are indelibly speculative. The role of imagination — or human "creative powers" (Geppert 2012: 8) — in shaping understandings of and relations to the "infinite vastness" (Ibid) of outer space is thus incredibly important. In varying disciplines and fields, artists and scientists familiarise the extraterrestrial through artistic choices and poetic leaps (Praet and Salazar 2017: 319). Anthropologists Istvan Praet and Juan Francisco Salazar apprehend an aesthetic stylisation of space science, where a certain "cosmic imagination" (Ibid: 312) characterises research in the absence of any "direct, unmediated perception" of the cosmos (Ibid: 313). For example, they refer to a study of dig-

7 This figure is according to statistics published on www.worldspaceflight.com.

itally processed images made by the Hubble Space Telescope (Kessler 2012), and their "striking affinity with […] Romantic landscape painting" (Praet and Salazar 2017: 312) to strengthen their claim that any astronomical and other natural scientific representation of space is "science, but it is also an art" (Ibid: 309).

Imaginative leaps and theatrical gestures are also found at the heart of analogue space simulations. In her book *Placing Outer Space* (2016), Messeri describes analogue astronauts inhabiting a purpose-built facility in the Utah desert, the Mars Desert Research Station [MDRS][8], conducting high-fidelity simulations for crewed missions on Mars. These analogue missions are part of what Messeri terms practices of "place-making" (Ibid: 30), comprising *aesthetic* methods by which scientists mediate the infinite geographies of outer space according to a scale of human experience. In doing so, these scientists turn the cosmos "into a theatre dotted with potentially meaningful places that are stages for imaginations and aspirations" (Ibid: 3). I find a number of interesting aesthetic methods in analogue space simulations, including the case study that Messeri describes, which also correspond to a general, correlating ambition to imaginatively *alienate* planet Earth in order to "familiarise" the extraterrestrial" (Praet and Salazar 2017: 319). For example, in Utah, the space simulation materialises in particular designed artefacts, such as the 1:1 scale cylindrical habitat representing an "early settlement" on Mars (Messeri 2016: 27). Inside the habitat, the analogue astronauts perform specific roles and abide by scripted rules which "establish the habitat as "safe" and the outside as "hostile" (Ibid). Outside the habitat, simulator space suits — with helmets made out of dome-shaped rubbish bin lids and drainpipes — are worn to enable the astronauts to withstand the imagined "unbreathable Martian atmosphere" (Ibid). Together, these "place-making" artefacts and practices interact with the visually and geologically analogous qualities of an isolated earthly landscape to shift perceptions from one planet to another. In Messeri's words (2017b: 133), these aesthetic methods create experiences of Mars on Earth with "impossible immediacy."

Turning to contemporary art and design, artist Agnes Meyer-Brandis also adopts a space simulation aesthetic in her project *The Moon Goose Analogue* (2011), where she endeavours to "actualise" a concept of moon geese (Meyer-Brandis 2021a) — first imagined by bishop Francis Godwin in 1638 in his book, *The Man in the Moone*. Through conducting, documenting [on film] and presenting [as a multimedia installation] a rigorous programme, the artist trains a colony of geese to fly her to the Moon. Meyer-Brandis (2021b) names her artistic research approach as "subjective science," and her investigations appear to be as poetic as they are scientific. *The Moon Goose Analogue* is one such project where, through a dedicated yet knowingly playful approach, she leads the

8 The Mars Desert Research Station [MDRS] is founded and operated by the Mars Society: a space settlement advocacy group led by physicist and prominent astrofuturist Robert Zubrin.

Figure 6: An image of the Lagoon Nebula by NASA's Hubble Space Telescope (2018). Credit: NASA.

Figure 7: Csilla Orgel, a geologist, returns to the habitat in her simulated space suit at the Mars Desert Research Station on March 3, 2013. Credit: REUTERS/Jim Urquhart.

Figure 8: *The Moon Goose Analogue* by Agnes Meyer-Brandis (2011). Credit: Agnes Meyer-Brandis.

Figure 9: *The One-Way Ticket* by Joseph Popper (2012). Credit: Joseph Popper.

Figure 10: Sands Fish and Nicole L'Huillier perform with *The Telemetron* (2018). Credit: Sands Fish/Nicole L'Huillier.

audience into the liminal; to an outer space where a subjective imagination gains credibility in an absence of objective certainty. Meyer-Brandis' investigations of liminal knowledge spaces, to some extent, rhyme with my own critical speculative design project, *The One-Way Ticket* (2012), which explores the so far unprecedented scenario of a journey into deep space with no return. The project focuses on the experience of a lone astronaut and responds to research into the unique human factors particular to a one-way mission, from logistical concerns to psychological phenomena, such as losing sight of Earth for the last time. In practice, the project developed through the production of props, camera contraptions and film sets made from cardboard and other everyday materials; each designed for simulating, interpreting and communicating an exceptional and technological human experience on film.

From the artistic to the scientific, analogue space simulations share a similar vocabulary of aesthetic methods which can arguably be broadly described, in the words of writer and academic Roger Luckhurst (2018b: 181), the production of a "found" fantastic." As Luckhurst says, this is "the notion that bits and pieces of the world might already be in some ways fantastic and science fictional, or that it would only take a change of framing to render these objects or experiences broadly fantastic" (Ibid). In objects, landscapes and even birds, the aforementioned space simulations each render science fictional experiences and scenarios by changing the framing of their found materials. Through producing artistic artefacts, performative gestures and spatial interventions, high-technological experiences are imagined, narrated and enacted through low-budget means; a water-bottle top becomes a button, a goose becomes a spacecraft, a desert becomes another world. My interest in a notional "found" fantastic" has been a constant in my practice to date and continues into this PhD project. Whereas this interest previously lay in the fantastic potential of physical materials, objects and spaces, the "found" here relates to a developing interest in found-footage from existing films, videos and other audiovisual media. As I go on to elaborate later in this introduction, found-footage forms a material basis for *essayistic* practices and processes of the essay film, based namely in a multidimensional method of montage. Montage informs my critical study of the Euro-American imaginary, where I explore its normalising functions and mechanisms in an investigation that is considerably image-based. From science fiction film and space industry media, found-footage forms both the subject of my theoretical concerns and also my means of critique.

Concerning the imagining of outer space, the writings of cultural anthropologists, sociologists and space historians were also important for sharpening my interest into a critical research focus. The historian Alexander C. T. Geppert (2012: 220) provides a foundational definition of "astroculture": a specific cultural term for the "heterogeneous array of images and artefacts, media and practices that all aim to ascribe meaning to outer space while stirring both the individual and the collective imagination." Geppert is important here, for articulating the capacity of imagination to "ascribe meaning" to outer space, across individual and social scales and, furthermore, that these meanings manifest in a

range of images, media and artefacts. Dickens and Ormrod (2016) also help to set the scene by foregrounding the critical role of representation in the production of outer space. Also referring to Geppert (2007: 590), they argue that the way outer space is represented and imagined relates dialectically to practices of space exploration (Dickens and Ormrod 2016: 2). Dickens and Ormrod describe a *representational outer space*: a space of "mental inventions" (Ibid: 20), where "new meanings or possibilities for spatial practices" can be imagined. This outer space is a discursive space for imagining "alternative social practices" (Ibid: 22) and also for producing them, with science fiction a primary form for imagining and contesting both utopian and dystopian space futures. Nevertheless, the authors note a persistence of space colonisation plans as "modernist narratives of social progress," and argue that the creating and interpreting of space imagery has become "highly politicised as well as aestheticized" (Ibid: 7). Most importantly, Dickens and Ormrod describe outer space produced in both "abstract" and "real" terms. "It is conceptual, at the same time as it is associated with material practices" (Ibid: 19).[9] Here, they see a "substantial and growing gap between outer space as an 'ideal space' and outer space as a 'real space', one resulting in profoundly destabilizing effects on the psyche and hence our understanding of society" (Ibid).

This gap can arguably be traced to a problematic issue of *context*, as described by anthropologist David Valentine (2016), who considers its multidimensional impact upon human relations to outer space and, in turn, imagining any human future beyond Earth. On the one hand, he raises that outer space presents a multiplicity of alien environments for spacefaring humans to contend with. These environments are contexts which implore an attending to basic conditions for life, such as breathable air, which "cannot be assumed" (Ibid: 518) beyond Earth. From here, Valentine proposes that human life grounded in and by the extremities of outer space also promises transformation, where leaving Earth is "not a decontextualized detachment from humanity, but a radical rethinking of what it could be to be human with other humans and nonhumans in different configured atmospheres" (Ibid: 521). This potential for a radical rethinking, resonating from the fundamental conditions of life off-Earth, also manifests in contemporary art and design projects, including *The Telemetron* (2018): a musical instrument designed for outer space by artists Sands Fish and Nicole L'Huillier. The collaborators performed with the Telemetron on parabolic flights, where they describe microgravity as a "material" enabling the instrument with a distinct sense of agency (Sands Fish, personal communication, 22 October 2019). The object itself is a geodesic chamber, housing an array of sensors and gyroscopes for captur-

9 They (Dickens and Ormrod 2016: 20) appropriate a conceptual triad from philosopher Henri Lefebvre (1991) to organise three "dimensions" of outer space experienced, perceived and imagined. Here, they find physical productions of space infrastructure (spatial practices); space policy and scientific theory (representations of space) and space fictions (representational space) interacting with each other in a dialectical relation.

ing data about its motion as it floats through space, which is then synthesised into musical notes. As the Telemetron embraces, the poetics of weightlessness represent one aspect distinguishing outer space as an innately *other* environment. Through their project, Fish and L'Huillier respond to the realities of life in microgravity; breaking away from Earthbound constraints, physical and conceptual, in order to explore possible ideas deriving from a radical shift in context.

However, on the other hand, Valentine (Ibid: 518) also identifies a "fundamental contextual problem […] for thinking through permanent human communities in space," which is the dependency of humans to base understandings of their outer space activities upon earthly experiences, histories and perspectives. In the absence of a "nonterrestrial context," Valentine recognises an overt tendency of commercial space industry actors, including Jeff Bezos and Elon Musk, to appropriate "*terrestrial* historical events and processes, such as European colonialism, white settlement of North America, or Arctic and Antarctic exploration" for establishing analogous meanings about their grand plans for future space settlement (Ibid; emphasis in original). This tendency brings about critical implications. As Valentine infers, leaning on terrestrial metaphors to describe a spacefaring civilisation renders a disparity separating outer space as a contextualising experience from the outer space envisioned by a normative yet powerful collective imagination. Borrowing from Dickens and Ormrod, the dialectical presence of "abstract" and "real" spaces, and the widening gap between them, generate a sense of gravity and urgency about addressing how outer space is mediated and represented.

Normalised Outer Space

But, we are simply getting a repeat of white American–European heteronormative, capitalist imaginations of what outer space can be and this is done without thinking. It is done as though it is natural. As if it was the only human configuration that exists here and therefore exists elsewhere.

—Lisa Messeri

The issue of context, described by Valentine, leads directly to the critical focus of this PhD project — a normalising Euro-American imaginary that envisions the human expansion, exploitation and settlement of outer space as a desirable future. From the twentieth century onwards, in the Western geopolitical hemisphere, this imaginary has largely colonised historical and contemporary "astroculture" to powerful effect and is in need of disruption and alternative. As I elaborate upon in the following chapters, the spaceflight advocacy figured by this Euro-American imaginary is inherently bound to North American ideologies. Here, both spaceflight and Americanism play upon national cultural myths and master narratives to serve the legitimacy and potency of each other, with the frontier and progress forming essential myths constituting an "ideological bedrock" (Billings

Figure 11: Kepler-186f travel poster by the Jet Propulsion Laboratory (2020). Part of the *Visions of the Future* poster series. Credit: JPL/NASA.

2007: 485) foundational to an American national identity (Dark 2007: 555). Together, these myths help to frame spaceflight as not only a natural endeavour but as a moral imperative. Today, the rise of private space corporations and the momentum of the commercial NewSpace industry (Valentine 2012: 1046 in Gál 2021) has arguably consolidated values of a capitalist, free-market democracy as those "worth extending into the solar system" (Billings 2007: 496).

As historian Linda Billings (2007: 495, 2017: 325) and Benedict Singleton (2013: 3) suggest, the rhetoric of Euro-American spaceflight advocacy has not significantly changed since the mid-twentieth century. Billings (2007: 497) also conveys this rhetoric reflects a lop-sided and "dominant social order," and furthermore describes human spaceflight as a modern phenomenon that has "outlived the modern era" (Ibid: 496) and thus out of sync with the present. However, undergirded by potent North American ideologies, this Euro-American imaginary is not only dated but increasingly problematic. Through imagery and rhetoric, North American myths and metaphors combine to create a curious and troubling belief system that is driving the realisation of a particular space future — a space future that appears monocultural, technocratic, and far from inclusive. Furthermore, the emergence of the private sector in the space industry has empowered and emboldened entrepreneurs such as Jeff Bezos and Elon Musk, self-styled pioneers of the twenty-first-century space frontier, who lead a select group of wealthy and technologically-enabled white men claiming to be acting on behalf of humankind (Reid and Tutton 2020). Bezos, Musk and their contemporaries form part of a historical lineage of space settlement actors and activists who propagated the belief in humans as a spacefaring civilisation (Kilgore 2003); and, just as their predecessors, they appear uncritical of the heteronormative orders and values which their projects consolidate on Earth and threaten to extend into outer space. Theirs is a space future that is built upon what historian Patricia Nelson Limerick (1994: 3 cited in Billings 2007: 487) describes as a "deeply flawed understanding of the past," and one that avoids the need to address urgent Earthbound issues through "meaningful change" (Berry 1977: 36 cited in Billings 2007: 497). And yet, Bezos' Blue Origin and Musk's SpaceX continue to build larger and more capable spacecraft, demonstrating a belief in technological advance as a catalyst for social, moral and environmental improvement, according to an inherent logic of progress, where, as political scientist Taylor E. Dark III describes "*All Good Things Go Together*" (2007: 557; emphasis in original). Furthermore, these companies display a financial and technological might that suggest their "decisions may affect history" (Morton 2019: 218).

The constrained and normalising Euro-American outer imaginary is ultimately at odds with a dependency upon human creativity to make sense of outer space, along with its potential as a site for examining earthly issues from different perspectives and exploring more radical proposals for human ways of life. Instead, its enduring ideologies, reproduced today by space industry practices that are implicitly and explicitly settler-colonial (Gál 2021), project an ironic sense of closure onto the infinite expanse beyond Earth. The contribution

of this PhD project to a wider critical outer space discourse aligns with other artists who adopt a non-affirmative position towards this predominant and problematic imaginary. Here, Angelo Vermeulen and Alexandra Daisy Ginsberg are among those imagining beyond its embedded, archetypal imagery and rhetoric as a means of critique (Vermeulen, Nevejan and Brazier 2018: 176).

In the iterative community project *Seeker*, Vermeulen and the SEAD collective invite mixed groups of participants to build 1:1 scale starship prototypes; inhabitable simulations which house "self-sustaining systems simulating interstellar exploration" (Ibid: 177). *Seeker* resonates with Valentine's aforementioned notion of outer space as a site of multiple alien and transformative contexts. As Vermeulen, Caroline Nevejan and Frances Brazier convey, participants confront the inherent extremities and uncertainties of interstellar travel by experimenting with "intertwined technical, ecological, and social systems" (Ibid: 176) and their potential evolution in the course of a very, very long journey. In the artists' words, the metaphor of the starship ultimately enables them "to completely rethink their place in both the Universe and on Earth" (Ibid: 177). *Seeker* is not only interesting for engaging with the realities and ambiguities of deep space exploration, but also its artistic method of "co-creation," which denotes a "cross-boundary collaboration" (Ibid: 176) where participants transcend their disciplines to build "a shared body of knowledge" (Angelo Vermeulen, personal communication, 23 October 2019).[10] Through a mixing of participants, a transgressing of disciplines, and a "bottom-up approach to design," *Seeker* enables a more "organic and much richer exploration of ideas" (Vermeulen, Nevejan and Brazier 2018: 176) and, most importantly, the envisioning of human space futures that appear much more *inclusive*.

Vermeulen, Nevejan and Brazier (Ibid: 174) further offer the terraforming of Mars as a "perfect example" of the influence of settler-colonial narratives in imagining space futures. Through physical and biological transformations, "violently erasing its 'otherness" to copy planet Earth, an alien world is made in the "image of the conqueror" (Ibid). In response, Alexandra Daisy Ginsberg envisions an alternative Mars colonisation scenario *without* humans. *The Wilding of Mars* (2019) is another iterative, computer-generated simulation [manifest as a multimedia installation] where the Martian surface is seeded with plants from Earth, germinating a wild garden "that thrives over millennia, its growth visible [on video] over human hours"; their evolving ecosystems corresponding to changeable planetary conditions through accelerated timespans (Ginsberg 2019).

10 The artists define co-creation as "a cross-boundary collaboration where people are invited to transcend their self-defined professional expertise and work on different aspects of the project" (2018: 176). Co-creation also complements a "bottom-up approach" to the prototyping, where starship designs "emerge out of the interactions of the group" as opposed to following an "overarching detailed plan" (Ibid).

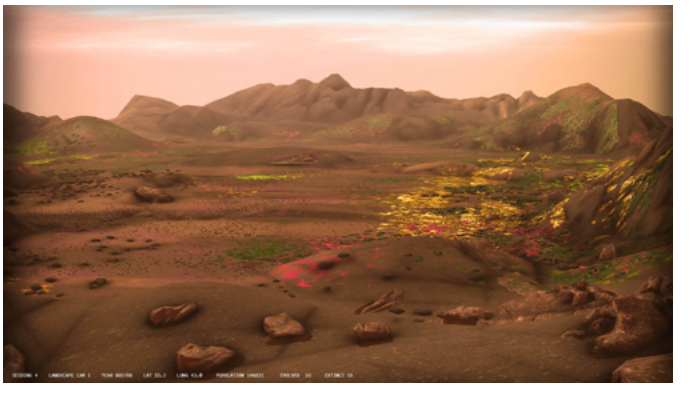


Figure 12: *The Wilding of Mars* by Alexandra Daisy Ginsberg (2019). Credit: Alexandra Daisy Ginsberg.

Figure 13: *Seeker* by Angelo Vermeulen (2015-). Credit: Angelo Vermeulen.

Whereas sowing another planet with Earth life represents another form of human intervention, the simulations thereon develop through biological and atmospheric relations between plant life and Mars. Here, in multiple simulations, other possible worlds emerge *independent* of human needs, desires or motivations. Through *The Wilding of Mars*, Ginsberg questions the normative assumption that "the outcome of space colonisation must be human benefit" (Ibid).

Other Imaginaries

In this section I acknowledge *other* outer space imaginaries which constitute the current blind spots of my research perspective. Together, they form the blank spaces on a map rendering the Euro-American space imaginary a form of "cosmic provincialism" (Geppert 2012: 4). Of these, the Soviet cosmic imaginary stands out, namely as the Cold War opponent of the United States of America in the *Space Race* — a race for technological and ideological supremacy ran not only in outer space but also in mass media (Grampp 2015: 3). In tracing its history, cultural historian Svetlana Boym (2001: 83) describes the Soviet imaginary as deeply ingrained in a Russian philosophy of cosmism, founded by philosopher Nikolai Fedorov in the late-nineteenth century. Fedorov would then find an influential pupil in Konstantin Tsiolkovsky, rocket scientist and "Father of Soviet Cosmic Exploration" (Ibid: 85). Through a lens of cosmism, the Soviets imagined the *cosmos* as opposed to "outer space"; not as an extension of planet Earth — a new "wild sky" replacing the wild West of the frontier (Ibid: 83) — but an extension of humankind into infinity. Here, the conquest of space was inseparably entwined with aspirations of reaching immortality, seen by cosmists as "the only worthy goal of mankind" (Ibid: 86). Boym (Ibid: 83) describes the Soviet cosmos as "a harmonized chaos, where human or divine presence is made manifest" through a realising and radical preserving of what Fedorov believed to be "the creative potential of [all] matter" (Ibid: 86). Ukrainian and Soviet scientist Vladimir Vernadsky augmented Fedorov's ideas to theorise the Noosphere as "an orbit around the Earth where all notions, ideas and dreams reside" (Boym 2001: 86; Triscott 2016: 415).

The Soviet cosmic imaginary merged mysticism, poetry and science together, combining space exploration with "eccentric beliefs, romantic faith, and scientific devotion" (Boym 2001: 90), where imagination and consciousness imbue or *enchant* space technologies (Ibid: 83). Nevertheless, in envisioning social transformation in space enabled by technological advance, Billings (2017: 325) suggests that Soviet beliefs are also proliferated by western space settlement advocacy: namely, "that humans are destined to conquer the planets and the stars, to populate the universe, to evolve to a higher form in space." Indeed, Billings (Ibid) notes that, while Fedorov remains in the background, Tsiolkovsky's claim that "[t]he earth is the cradle of reason, but we cannot live forever in a cradle," (Tsiolkovsky 1969: 76 cited in Boym 2001: 85) is regularly appropriated by those pursuing space colonisation.

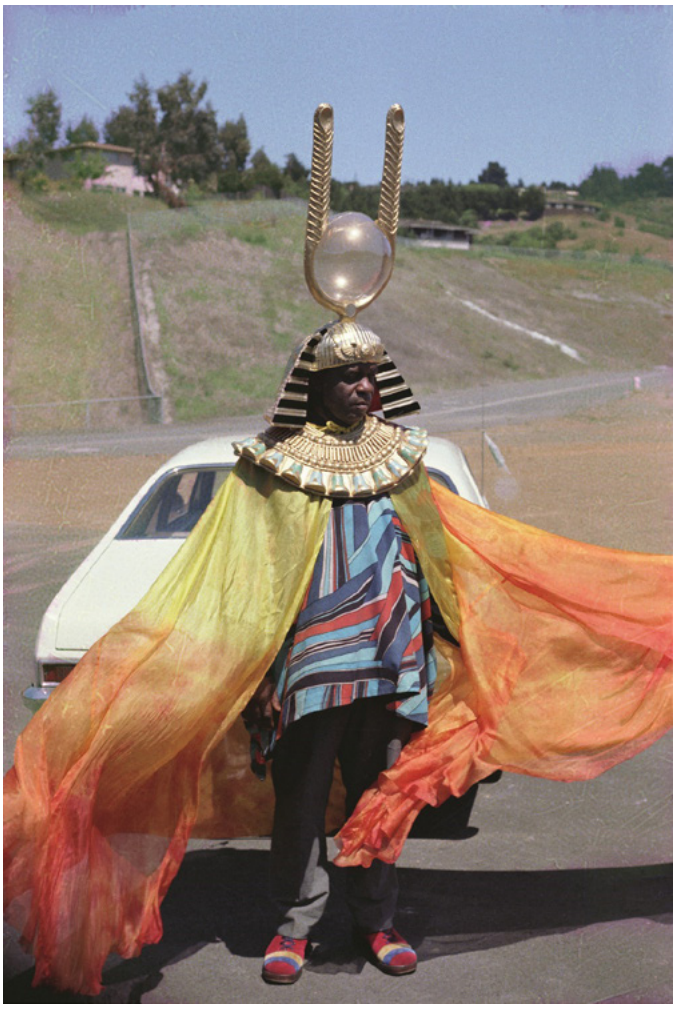


Figure 14: Sun Ra, Oakland (1972). Photographer Unknown. Credit: John Corbett and Terri Kapsalis.

Outer space is also a prominent and pertinent theme for Afrofuturism, a label for speculative fiction in art, music and literature which "treats African-American themes and addresses African-American concerns in the context of twentieth [and twenty-first] century technoculture" (Dery 1994: 180). For critical media scholar Kara Keeling (2019: 33), Afrofuturism is the site of a "Black radical imagination" that responds to the historical and contemporary subjugation, oppression and alienation of Africans and African-Americans in the United States and the wider world. Forced "to contend with alienating, dislocating societies and circumstances," as writer Greg Tate says (Tate in Akomfrah 1996), the mass experience of Black people within a "post-slavery" world (Ibid) is interpreted by many artists, writers and musicians as profoundly *science fictional*, where Black people occupy a sort of "unreality" space in the Western hemisphere (Keeling 2019: 60). In response, this Black radical imagination aims to refrain from and rupture the dominant, organising structures of this world, out of a "yearning for another world, another planet […] of and for Black existence" (Keeling 2019: 69). In Keeling's words, outer space is meaningful for Afrofuturism not only as a "place to escape a catastrophic situation on earth" but a site to "forge new relations by radically disrupting existing relations and the logics and violences through which they are held in place" (Ibid: 66).

One of the foremost and exemplary figures of Afrofuturism to date is Sun Ra, the jazz musician who claimed to be from Saturn. In the film *Space Is the Place* (Coney 1974), Sun Ra lands on Earth ready to set up a utopian colony for Black people on another planet. However, by imagining a Black colonisation of a (non)existent "cheesy psychedelic planet" (Keeling 2019: 67), Sun Ra presents a future plan that not only transfers the historical language of colonialism but is furthermore impossible. And yet, as Keeling describes, this impossibility confronts a current "spatiotemporal order in which there is no desirable future for Black people," and so, for Sun Ra, demands a "fundamental rupture" of not only geopolitical conditions but Black peoples' consciousness (Ibid: 60). In the opening sequence of *Space Is the Place*, Sun Ra says of his plan, "Equation-wise, the first thing to do is to consider time as officially ended. We'll work on the other side of time." Here, by announcing a radical break with "existing timelines and logics" (Keeling 2019: 67), he imaginatively *refrains* from present and violent social relations. This disrupting gesture then opens the way for sound and music to bring about other possible worlds emerging from alternative spatiotemporal coordinates.

These brief descriptions of Soviet cosmism and Afrofuturism barely scratch the surface of other, more "alternative poetic and progressive" outer space imaginaries (Triscott 2016: 441) lying beyond a predominant, monocultural and Western image of a human space future. Occupying the outer fringes of popular astroculture and offering an array of different perspectives, their presence reaffirms the notion of the collective imagination as a profoundly contested and contestable space (Levy and Spicer 2013: 660). However, these other imaginaries stay in the periphery of my research focus for this thesis, which centres on the Euro-American spaceflight imaginary and its distinct problematics. Given how in-

fluential this common future vision is in guiding the space industry today, these problematics are both interesting and urgent enough to incite my critical reflection and response in writing and on film. From an artistic perspective, I explore the imagery and rhetoric constituting the Euro-American imaginary as a formidable, infrastructural force. In exposing its flaws and amplifying its contradictions, I go on to identify means of contesting and disrupting this imaginary by artistic methods.

From Artistic Research to the Essay Film

This PhD project is the product of artistic research, shaped by essayistic methods and processes found in the essay film, which explores critical concerns informed by scholarly research into the production and narration of outer space. In this section, I describe my understanding of "artistic research" and "essay film," their shared tendencies, and what these characterisations mean for developing this project. First, my grasp of artistic research is shaped primarily by the ideas of philosopher Henk Borgdorff and artist, curator and scholar Lucy Cotter, who each approach this type of research from contrasting perspectives regarding its relationship to academia. Whereas Borgdorff (2012) attempts to acceptably embed artistic research in academia as a new field, Cotter tries to *reclaim* artistic research from "academic norms" (2019: 15) as research already embedded in "contemporary art practice at large," where only a "shift in emphasis" (Ibid: 14) is needed to bring it to the fore. Though they adopt different positions, Borgdorff and Cotter agree upon essential aspects in describing what artistic research is, which guide my understanding of this type of research and further help to frame my own aims, methods and outcomes. From reading the authors, both characterise artistic research by the centrality of art practice in the research, an open and discursive nature, and the deliberate and emphatic articulation of a *thinking process*. Moreover, as I explain later in the section, the characteristics described here also connect artistic research to the essay film and a wider array of *essayistic* forms of practice.[11]

11 Borgdorff and Cotter's characterisations of artistic research correspond to other definitions of art and design-based research. Hannula, Suoranta and Vardén (2014: 3) also claim artistic research to be indelibly embedded "inside practice." They affirm a similarly reflective and provisional nature by describing an "open-ended and self-critical historical context-aware research" (Ibid). Furthermore, they ascribe a discursivity about artistic research by highlighting its capacity for participatory acts and performative reflections (4). Candy and Edmonds (2018: 64) also characterise *practice-based research* as a "public" activity, which must make "a broader contribution to knowledge, rather than personal research that benefits only the individual." However, whereas Cotter; Hannula, Suoranta and Vardén find research "inside practice," Candy and Edmonds (Ibid: 63) explicitly distinguish *practice* from *research* as separate, non-interchangeable entities. Through this gesture, they embed the activities of practice *inside* the investigations of research, subject to scrutiny (64) in paradigms of general and original knowledge productions.

Borgdorff (2012: 143) positions artistic research in both academia and art, as a field of research and a form of "knowledge production" (Ibid: 143). For Borgdorff, artistic research is "*research in and through art practice*" (144; emphasis in original), emphasising the "world-constituting and world-revealing"[12] (Ibid: 173) powers that art offers as a "methodological vehicle, when the research unfolds in and through acts of creating and performing" (147). These powers ultimately distinguish artistic research as a type of research which explores "new experiences, outlooks and insights that bear on our relationship to the world and to ourselves […] as well as our perspective on what is or should be" (72); concerns that are "articulated, expressed, and communicated *through art*" (166; emphasis in original). For Cotter (2019: 14), artistic research means "communicating art as an aspiration, an open-ended process and an open-ended object, which includes, but is in excess of itself as an artwork." She claims there is no "outright difference" between art practice and artistic research; or "research-based" works and artworks in general," but articulating a research approach a "marks a shift in emphasis" (Ibid) which is nevertheless significant. Cotter (2019: 12) endeavours to describe artistic research *on its own terms*, where artists "use artistic criteria to establish the parameters and form of their research." Here, material enquiry; play; "attention to form" (Ibid: 10); methodological pluralism (16); and a critical disposition constitute art practice at the heart of artistic research.

Both authors stress the exploratory nature of artistic research, as "discovery-led" rather than "hypothesis-led" research (Borgdorff 2012: 164).[13] This idea implies an open-ended tendency where the research "eludes any defining thought regarding its content" (Ibid: 145). For Cotter (2019: 17), this tendency determines "the radical potential of art's epistemologies," where artists can comfortably explore the unknown and embrace the "unknowable" in knowledge spaces that "confound traditional research" (Ibid: 18) — spaces she names "non-knowledge" (Ibid).[14] Here, as Cotter conveys, artistic research "revolves around articulating new questions without seeking answers" (Ibid). Borgdorff (2012: 173) also argues that artistic research is "more directed at a not-knowing,

12 The expressions "world-constituting and world-revealing" pertain to what Borgdorff describes as the "performative and critical power of art" (2012: 173). On one hand, art has the capacity for making and presenting things for "making the world into what it is or could be" (Ibid). On the other hand, in Borgdorff's words, art can "disclose the world to us" (Ibid) by offering "new vistas, experiences, and insights that affect our relationship with the world and with ourselves."

13 "…whereby the artist undertakes a search on the basis of intuition, guesses, and hunches, and possibly stumbles across some unexpected issues or surprising questions on the way" (Borgdorff 2012: 164).

14 Cotter (2019: 17) further conveys that art's "openness to ambiguity and its encompassing of so many registers of knowledge inevitably pushes towards new ways of thinking."

or not-yet-knowing,"[15] enabling it to build knowledge in *unusual* ways (Ibid). He finds a distinctive, simultaneous articulation of "both our familiarity with the world and our distance from it" (171). This capacity of artistic research to spur critical reflections and responses, while escaping concrete definitions, is a "special quality" (Ibid) that ties an embodied "intimacy with the world" with an awareness that, in his words, "we will never explicitly understand what lies there in such plain view" (Ibid). This paradox of nearness to and distance from the world (Ibid: 145), and the "contingent perspectives" (173) it infers, brings about another crucial characteristic of this type of research, and one I find most interesting: "the deliberate articulation of *unfinished thinking* in and through art" (145; emphasis my own).

Borgdorff (Ibid) places *thinking* as the foremost "subject matter" of artistic research, over any "formal knowledge" it is supposed to produce. This specific articulation of thought, in an incomplete state, is furthermore a dialogical invitation for a reader or audience "to set our thinking into motion, inviting us to unfinished reflection" (Ibid: 173). This idea returns to the critical power of art, in Borgdorff's words, to make room for explorations, interpretations and reflections; to "prompt us towards a critical perspective of what there is" (Ibid: 148). Cotter (2019: 21) complements this claim by also stating that artistic research "foregrounds the artist as a thinker, while redefining the very nature of what it means to think." Though she argues that this idea is nothing new,[16] she uses it in her efforts to reclaim artistic research from the academic, where she argues "it is crucial to take formal intervention and material enquiry seriously if we truly wish to engage with art as a site for thinking" (Ibid: 11). For Cotter, artists think in particular ways that are associative and experimental, shaping a distinct "inner logic" about artistic research "in resonance with the wider languages and sensibilities of art" (Ibid: 12) — a logic that further enables a freedom to move within many different subject areas (Ibid). Describing artistic research in terms of art practice, she further complements the notion of unfinished thinking by characterising an insistence on "essential incompleteness, a non-closure and non-totalising form." In a further rhyme with the idea of artistic research prompting critical perspectives, Cotter claims this incompleteness is where art's "radical potential lies precisely…" (Ibid: 12); where dialogical gestures of open-ended thinking can lead to a "destabilisation of reality" (Ibid).

15 As Borgdorff states (2012: 173): "Especially pertinent to artistic research is the realisation that we do not yet know what we don't know."

16 Cotter (2019: 11) cites Susan Sontag (1982: 191), who "proposed over fifty years ago, all forms of art are "mainly, a form of thinking", "[E]ach work of art gives us a form or paradigm or model of knowing something, an epistemology."

Informed by Borgdorff and Cotter's descriptions, I understand artistic research to be based indelibly in the methods and processes of artistic practice — a practice that shapes an experimental, discursive and pluralistic sensibility to what and where research is and can be. Whether inside or outside academic paradigms, artistic research represents a hybrid form, able to interact in multiple fields through manifold means. Borrowing from both authors, a shift in emphasis regarding research in practice undergirds its "radical potential" (Ibid), particularly through a deliberate articulation of *thinking*. Emerging from encounters with the unknown or unknowable and embodying the unfinished, this expression of thought not only communicates the open-ended process of the artistic researcher (Cotter 2019: 14) — exceeding any research-based object or outcome — but forms a dialogical gesture for an audience to adopt a similar critical perspective towards given subjects of concern. By inviting "unfinished reflection" and "contingent perspectives" (Borgdorff 2012: 173), artistic research can arguably produce *destabilising* effects upon realities (Cotter 2019: 12), our experiences of them and relationships within them. Furthermore, this provisional characterisation of artistic research can also largely be used to describe the essay film.

By surveying the many characteristics shared by its textual predecessor, the literary essay, the artist Emily Huurdeman (2018) creates a theoretical bridge from artistic research to the essay film by proposing essaying as a research method. The root of the literary essay is regularly traced to the sixteenth century and to the statesmen and writer Michel de Montaigne (Corrigan 2011: 33, Papazian and Eades 2015: 3). Many regard Montaigne and his book, *Essais* (1580), as the original reference for the way his writing represents a "testing of ideas, [and] of his own subjectivity…" (Alter 2018: 8). The word *Essais* itself, further reflects the idea of "an attempt or test," (Papazian and Eades 2015: 3) which continues to be a foundational characteristic of the essay today in its different forms. Essaying is also synonymous with *weighing* or balancing (Huurdeman 2018: 64), which, as film scholar Nora Alter says (2018: 7), further suggests an "open-ended, evaluative search." After Montaigne and into the twentieth century, a number of other essayists[17] shaped wider understandings of the essay, including philosopher Theodor Adorno (1984: 171), who further determines its hybrid sensibility by describing an inherently transgressionary and heretical nature. Here, Adorno (Ibid) states "the law of the innermost form of the essay is heresy," countering a notional "orthodoxy of thought." As Huurdeman finds (2018: 62) this nature also relates to another important characterisation by Adorno in the essay's *unmethodical method*, which means "a methodical avoidance of methods: an intentional way of consciously and constantly breaking from possible constraints of systematic scientific methods, as a method" (Ibid). Returning to artistic research and the essay, Huurdeman (Ibid) finds the unmethodical

17 Including "…Roland Barthes, Walter Benjamin, Max Bense, Aldous Huxley, Georg Lukács, Siegfried Kracauer, Robert Musil, and Jean Starobinski" (Alter 2018: 8).

method is mutual, where both forms embrace a "paradoxical balance" of the artistic and scientific, creating room for aesthetic and theoretical approaches and aspects: "for playful and impulsive elements, for the subjective and objective, for the experiential and the intellectual" to interact together (Ibid: 66).

Huurdeman (Ibid: 58) finds many other parallels between artistic research and the essay, starting from their hybrid forms; their freedom to engage with many different research fields or topics; to a common articulation of a subjective, "individual perspective." On the essay, she emphasises the experimental and provisional nature of its approach, together with its expression of thought and critical reflection (Ibid: 52). "The initial intent," of the essay, says Huurdeman (Ibid: 66), is "not to justify, to conclude, or to proof, but to search and to express." Huurdeman proposes the "*pursuit of knowledge*" to perfectly describe the essays approach (Ibid: 62; emphasis in original); "although knowledge is not the end-goal…" she adds (63), "it is the driving force of endless attempts of its topic"; ultimately, the goal *is to attempt* (Ibid). Further echoing Borgdorff's characterisation of artistic research, Huurdeman says, "The essay as text, as well as in definition, does not have a final form or conclusion: the essay is in this sense truly *un-finished*" (Ibid: 58; emphasis in original). Most importantly, in applying essaying as a method of artistic research, Huurdeman proposes to essay *as a verb*; a way of doing (63) that frees the essay from any formal or linguistic constraints (53). This gesture opens the way for using the essential characteristics of essaying — connecting the essay to artistic research — to describe the essay film *as a kind of artistic research*.

From reading different scholarly studies of the essay film, the distinguishing features of artistic research and the essay readily appear. Just as the essay does not *belong* to any particular form of writing (Huurdeman 2018: 57), the essay film is also a hybrid that negates traditional categories of film genres, such as fiction and nonfiction (Alter 2018: 6, Corrigan 2011: 4). Films by John Akomfrah, Sergei Eisenstein, Harun Farocki, Jean-Luc Godard, Werner Herzog, Chris Marker, Agnès Varda, and many others display the essay films experimental tendencies (Corrigan 2011: 4) and its transgression of supposed cinematic boundaries (Arsenjuk 2016: 276). Nora Alter and film scholar Tim Corrigan (2017: 3) find a "blending" of forms and styles to be a distinctive quality of the essay film, along with "the foregrounding of a personal or subjective point of view […], a dramatic tension between audial and visual discourses, and a dialogic encounter with audiences and viewers." These qualities form some of the recognisably "essayistic principles and procedures" (Warner 2016: 28) demarcating the essay film and are further significant, for they help to reflect the essay films "pursuit of knowledge" (Huurdeman 2018: 62) as one similar, if not the same, as that of artistic research.

First, the emphasis upon a pronounced subjectivity and a "dialogic encounter with audiences" not only infers the discursive and reflexive nature of the essay film but leads to — in Corrigan's words (2011: 30) — the

"figuration of thinking or thought as a cinematic address" at the heart of this dialogical gesture. In the manner of the literary essay and artistic research, the essay film is also characterised as a form that *thinks*. Many recognise a mutual ambition by this type of film to "visualise thoughts on screen" (Richter 1940: 91) as it "explicitly reflects on the materials it presents" (Lee 2017a). The essay film also *tries*. Borrowing from Huurdeman (2018: 62), its "unmethodical methods" arguably emanate from attempts to broach intangibly complex subjects "too big to fathom" (Alter 2018: 2) by traditional documentary means alone (Richter 2017: 92). These attempts also resonate a particular position of essay films towards any knowledge they are said to produce, where any didactic, "authoritative agency" is replaced by a poetic and "discursive position" (Arsenjuk 2016: 293). By engaging with complex subjects while enunciating subjective thought and critical reflection and emphasising an *attempt or pursuit of knowledge*, the essay film presents itself as another form that is ostensibly "unfinished" (Borgdorff 2012: 173; Huurdeman 2018: 58). Whether in words or in moving image, this combination appears to make essays dialogical and ultimately, essayistic (Alter 2018: 27). From here, as Borgdorff (2012: 173) also characterises artistic research, an invitation for "unfinished reflection" extends to an audience or spectator to search for their own interpretations in response the materials presented — to test their own "associative, imaginative and constructive faculties" (Warner 2016: 47) in the overt presence of film essayists' contingent perspectives and in the absence of any final conclusions. To summarise briefly, here, I read the essay film as a form of artistic research because it also thinks, it also tries, and it also remains unfinished; in other words, because it essays. Here, montage — "the joining together of different elements on film in a variety of ways" (Rohdie 2006: 1) — emerges as the essential method tying these different acts of essaying together (Warner 2016: 34). Montage further extends from film to writing, forming the main method of this PhD project and my contribution to a wider critical outer space discourse.

Montage as Method

Montage means both a material practice and a critical approach of the *montagist* (Warner 2018: 101) that reaches beyond the editing room into film criticism and other modes of artistic practice. This transdisciplinary approach is adopted by film essayists, including Jean-Luc Godard; Chris Marker; and Cristina Álvarez López and Adrian Martin, who see film primarily as a site of critical reflection, often about the subject of film itself. Borrowing from López and Martin, whether on film or in words, by thinking through images and *through* images, montage "*makes* meaning, forges connections, [and] creates juxtapositions" (2014; emphasis in original). In the following paragraphs, I explain why montage is such an important and interesting method for this PhD project, before describing the ways it manifests in my own essay film productions and the word-based theorising of this thesis.

As a material practice, in broad terms, montage on film means the arranging of numerous audiovisual materials into a structured, time-based media configuration. Simply put, montage is a joining of two or more images or sounds together; but it also means much more than this. The potential nature of any audiovisual arrangement is where the real interest begins, for the infinitely multiple meanings made possible by bringing isolated elements together along the "seam of the cut" (Luckhurst 2018a: 193). Here, much depends upon the extent a sense of homogeneity or heterogeneity is described by an essay film about its assemblage of fragments, in a notional scale from synchronic to disjunctive compositions of image and sound (López and Martin 2014). Their audiovisual elements cohere or collide together, and ideas complement or conflict one another. It is this capacity for arranging the unpredictable (Alter 2018: 10) that places montage at the heart of the essay film and defines its playful and provisional tendencies. These tendencies further relate to the elusive, complex subjects explored by many film essayists. In the midst of the unfathomable and irregular, montage is arguably the most important method for the essay film to *think*; to "produce theory" by moving image (Ibid).

López and Martin (2014) see found footage as a mutual material joining diverse types of audiovisual essays together. The appropriation of pre-existing imagery and sound is shared by what they describe as "two major forms with two major tendencies" (Ibid), which further relate to two different types of knowledge production on film. The first form appears to be more didactic, a "pedagogical demonstration" or simply an "enhance form of illustrated lecture", which builds upon the traditions of film criticism and commentary and uses film as a "new" tool for building and sharing an argument *about* film and media (Ibid; Lee 2017; Grant 2020). The second form, what the authors term "cine-poem" (Ibid) is much more artistic. Here, montage shapes a history of film and other media practices which produce poetic imagery, narratives and other audiovisual fabrications from sampling found materials. This second description further aligns the essay film with Luckhurst's aforementioned notion of the "found fantastic" (Luckhurst 2008b: 181) where the fantastic potential found in existing footage is realised through imaginative changes of framing. Metaphor is also found to be one of the audiovisual essayist's primary "weapons" (Alter 2018: 8), and this aspect conveys an inherent *articulacy* of image and sound, as with other materials, where a honed literacy enables the exploration and manipulation of their "metaphoricity" in this particular form of artistic research (Cazeaux 2017: 100). This dual tendency, of ambitions to experiment and explore as well as to learn or to share, is present in the films of essayists that I discuss in the following chapters. Joining filmic poetry and criticism together, both of these tendencies of the audiovisual essay are also what López and Martin (Ibid) see as a "matter of montage."

In studying montage, different theoretical descriptions correspond to certain film essayists and also to types of movement. Whether in terms of vertical, horizontal, or folding, the montage signifies film as an audio-

visual structure for moving across in multiple directions. Sergei Eisenstein, Chris Marker and Harun Farocki were each influential in establishing the essay film as a "quasi-genre" (Warner 2016: 28), and their independent uses of montage describe different aspects of its imaginative and discursive potential. Together, these types manifest a "possibilist" approach to film (Ibid: 30), where multiple film materials exist simultaneously, ready to interact and interplay through poetic gestures. Of these figures, Eisenstein first explicitly refers to film as a layering of interrelating parts that constitute a "vertical structure" (1943: 74). For Eisenstein (Ibid: 75), vertical montage transforms a linear idea of montage — of images cut end to end — into synthesising polyphonic composition of discrete yet complementary "lines" simultaneously advancing in time as a film progresses. Later, Chris Marker also emphasises a fragmentary and vertical structure in a montage technique that film critic André Bazin (2017: 37) describes as "horizontal." Describing *Letter from Siberia* (Marker 1957), Bazin (2017: 22) notes an upending of traditional hierarchy, where sound leads the editing process "from the ear to the eye." Marker's horizontal montage thus denotes a lateral motion away from the footage, creating a critical distance for interpreting and reflecting upon what the imagery can mean. For a more ambiguous approach, Harun Farocki and Kaja Silverman (1998: 142) coin the term "soft montage" to define a folding of images and sounds together in "force fields" (Alter 2015: 152) of multiple, juxtaposing frames; whether on a single channel film or in multiscreen installations. In such force fields, Farocki (1998: 42) uses montage to connect imagery and sound based upon a principle of "general relatedness, rather than a strict opposition or equation", making his films *think* by creating "serial and concurrent linkages" (Warner 2016: 49) in nonlinear arrangements. The three film essayists' emphasis on simultaneous multiplicity also corresponds to the production and experience of digital film and video today; in particular, the impact of widely accessible digital production tools, from smartphone cameras to video editing software (Steyerl 2017: 278). Álvarez López and Martin (2014) reflect upon this turn by describing not only an explosion of audiovisual material to find and use in their films, but also that every fragment they choose is already an "heterogeneous, inherently multiple block" in itself, with "simultaneous levels and multiple channels" to dissect and manipulate ad infinitum along the audio or video tracks of a timeline. This notion suggests a structural potential of film expanding on macro and micro scales in a digital era. Álvarez López and Martin go on to echo their predecessors when they say, "montage means finding *which* channels or tracks can be connected in some way, creating a 'through line', a passage or movement" (Ibid; emphasis in original).

As method, montage joins filmmaking to film criticism, as demonstrated by different essayistic practices. Starting as a film critic, filmmaker Jean-Luc Godard "never stopped being a critic but began to use the medium of cinema to write his critical reflections" (Warner 2018: 12). For both Chris Marker and Harun Farocki, it is the *ideas* of their films which are the "primary material" (Bazin 1957: 19), for ideas are what join images and sounds together (Warner 2016: 48). Álvarez López and Martin (2014) also use film as a medium of film

critique, offering an interesting idea that a critical awareness for moving image is "always in operation," whether in making or watching films.[18] This notion further rhymes with a "montage way of thinking," (Petric 1978: 438), a phrase describing the "practical, embodied, intuitive" way that Russian filmmaker Esphir Shub edited footage for her films (Vassilieva 2020: 180). To be a montagist, then, means to sharpen and deploy a sensibility for moving image — or a film "intelligence" (Stob 2012: 37) — both as a filmmaker and proverbial filmgoer. Furthermore, this sensibility bridges the dialogical positions of the filmmaker and spectator, whose interaction is distinctly pronounced in essay films. Referring to the traditional editing table, Shub herself declared "the magic power of the scissors in the hands of a man who uses montage to express himself visually as he uses the alphabet to express himself verbally" (cited in Petric, 1978: 438). To borrow from film and media scholar Rick Warner (2016: 54) and his interpretation of Harun Farocki's films, the cinematic spectacle can galvanise the intelligence of both maker and viewer as protagonists in search for meaning. The montagist approach also manifests in the literary essay and its history. In describing its fragmentary nature, Brian Dillon (2017: 68) rhymes with a notional filmic *forging* of connections by describing that fragments of words or ideas "must be made to speak by a reader, to the fragments that surround it." Theodor Adorno (1984: 164) also states the essay "thinks in fragments" and conveys a nonlinear, essayistic thought advancing in multiple directions, where "aspects of the argument interweave as a carpet" (Ibid: 160). Here, Adorno complements the interweaving vertical and horizontal structures of film — articulated by Eisenstein and Marker — and consolidates a thought process linking literary and film forms of the essay.

In many ways, montage forms the main artistic method of this project as a multidimensional "means of investigation" (Warner 2016: 33). As a material practice and mode of thinking, it shapes my formulation of theoretical concerns about an outer space imaginary and informs an artistic strategy for a critical response. Borrowing from Álvarez López and Martin (2014), if alternatingly more or less pronounced, montage is arguably "always in operation" as the project develops through *making connections* of imagery and theory, folding different audiovisual and literary materials together, and testing their "degrees of relation" (Ibid) in word- and film-based juxtapositions and associations. Here, Álvarez López and Martin's idea of finding and manipulating channels — deriving from the "general relatedness" concept of Harun Farocki — is apt for describing the exploratory nature of this thesis as it finds threads; traces movements; and experiments with the imaginative tensions made by the imagery and rhetoric of twentieth and twenty-first century spaceflight advocacy. Furthermore, other characteristics of montage shape this PhD project. As Nora Alter conveys (2018:

18 Álvarez López and Martin's (2014; emphasis in original) "channels" metaphor is also evocative for describing, in sonic terms, turning the volume up or down depending on the most important channels before "*forging* that connection in the cut."

8), atmospheres of "contradiction and the collision of opposites" are not only found about the Euro-American imaginary but are also created as a means of countering its problematics. Here, metaphor — where one thing is conceived in terms of another (Lakoff and Johnson 1980: 74) — forms an essential montage technique for making essay films, including my own. As this project develops, a montagist approach travels from critical theory to media studies and into experimental film. In general, montage as method guides my investigation at the intersection of artistic research, science technology studies and film theory. By enabling a fusing of different discourses to study outer space through a specific lens, montage greatly informs my particular contribution to a critical outer space discourse. Although the outcomes of this PhD are multidimensional, in theory and practice, my research is also invariably filmic. In analysing films and media made by others and in making films myself, I explore audiovisual problematics of the Euro-American imaginary and test out different montage techniques to try to disrupt its normalising, image-based infrastructure.

Chapters Summary

As the chapters unfold, the focus of my investigation shifts from a critical study of the Euro-American spaceflight imaginary to the potential of the essay film as an artistic means for critiquing and disrupting its problematics. The chapters share common threads and overlaps, where each focus on the materialisations and representations of this imaginary, with a particular emphasis on film and audiovisual media. From private space corporations to science fiction, moving image performs as both a *stabilising* and *destabilising* medium concerning this heteronormative imagination of outer space and its proliferation in contemporary astroculture. In the first two chapters, I focus on what can be described as the "pervasive aesthetic and rhetorical framings" of this imaginary (Valentine 2012: 1057). Here, I connect close readings of theoretical texts and science fiction films with projections of a spacefaring future made by different space industry actors. These linkages help expose the narrative strategies of spaceflight advocacy, identify contentious continuations and contradictions, and further highlight points of disruption from an artistic perspective. Chapter 1 establishes the Euro-American spaceflight imaginary as a contemporary sociopolitical force. I introduce the foremost space settlement actors of the past and present, explore the ways they frame their space projects by amalgamating North American myths and science fiction precedents, and question what these framings mean for the human futures beyond Earth they are building towards. Whereas Chapter 1 determines the Euro-American spaceflight imaginary in a broader sense, Chapter 2 focuses on a particular, essential theme. Figured by deserted earthly or alien landscapes, planetary desolation grounds space settlement advocacy in interrelating hopes and fears for humankind on- and off planet; producing motivational imagery and rhetoric fraught by tense conflations of ambition and anxiety for things to come. It is here that my interest in film also shifts from a mode of imaginary instantiation to one of critical intervention. Through the

films of Werner Herzog and Ben Rivers, desolation imagery transforms from a stabilising to disrupting force.[19] Studying these films and their fictional reframing of earthly landscapes prefaces a deeper practical and theoretical exploration of the essay film in the third chapter. In Chapter 3, I elaborate upon my interest in the essay film as an audiovisual means of critique and a mode for engaging discursively with the Euro-American spaceflight imaginary. The chapter concludes with close readings of my own essayistic films, produced in the course of this project, which each respond to the issues I identify in the preceding chapters about this heteronormative imagination.

Chapter 1 introduces and explores the shared vision of humankind as a spacefaring civilisation; examining the core themes and critical functions that define it as a powerful and problematic Euro-American imaginary. Building upon Sheila Jasanoff and Sang-Hyun Kim's concept of the "sociotechnical imaginary" (Jasanoff and Kim 2015: 4), I argue the imaginary can also be considered as a form of *infrastructure*. Here, a common vision of a desirable future holds a community of space settlement advocates together (Ormrod 2016: 385) and directs the activities of significant parts of the space industry. Lisa Messeri and Janet Vertesi's idea of a "sociotechnical projectory" (2015: 56) is just as important, for describing an orienting path towards a future that is fragmentarily instantiated by different material artefacts. From studying space industry media and technological instantiations, I imagine a particular metaphor of in *straight circles* for describing a double movement which also forms a critical function of the Euro-American imaginary.

In terms of montage, the in *straight circles* metaphor connects and coheres two distinct characteristics of the imaginary that each embody a certain motion. The first half of the metaphor relates to a straight line that describes a common perspective of history connecting memories of the past with future speculations. The line enables space settlement advocates to imagine a human civilisation in outer space on the "cutting edge" (Robertson 1980: 8) of progress. The straight line also corresponds to a sense of continuity about offworld activities across a range of registers, where terrestrial practices and power structures are found extending beyond the Earth. The second half of the metaphor relates to a circular recycling of myths, metaphors and master narratives from Western history, science fiction and popular culture by prominent space actors and advocates, who harness them to the spacefaring cause. They render a distant space future desirable and "beckoningly familiar" (McCurdy 2011: 324) by abstracting and

19 In *Lessons of Darkness* (Herzog 1992) and *Slow Action* (Rivers 2011), Herzog and Rivers also narrate desolate landscapes but describe very different scenarios of humans traveling to alien planets and inhabiting future Earths; stories based upon an indifference *of nature* to humans, rather than the other way around, and so in contrast to the anthropocentric tales of spaceflight advocacy.

replaying symbolic materials, regardless of how far this future "can be disconnected or at odds with reality" (Tutton 2018: 5). As David Valentine conveys, concerning the prominent actors, the space settling future they "envision is already known to them" (2012: 1064). In general, the double movement I find about the Euro-American space imaginary reflects its "special kind of logic" (Robertson 1980: 21) — a logic that enables multiple continuities and contradictions to assemble into a formidable narrative infrastructure and sociopolitical force. However, this space imaginary remains distorted, inconsistent and fallible to criticism. By examining its themes and mechanisms in-depth in this first chapter, I establish specific points of contention to engage with through artistic practice.

Chapter 2 focuses on planetary desolation as a pervasive visual and rhetorical theme at the heart of the Euro-American space imaginary. Desolation can mean destruction or emptiness, and both images interact together to create a sense of agency and urgency among those advocating for expanding human civilisation beyond planet Earth. Through exploring space industry media and science fiction film and literature, I describe desolation as a stabilising force tying multiple motifs, myths and narratives of space settlement advocacy together — from the frontier of settler-colonialism to the asteroid as extinction event. The *double exposure* (a juxtaposition of time, place or imagery) and *inversion* (a reversal of positions or relations) form aesthetic gestures central to my investigation, informing readings of how space colonisation advocates imagine planet Earth, humankind and outer space respectively and, more interestingly, in relation to each other.

Returning to ideas of montage, the chapter builds upon the ideas of humanities scholars who articulate the sociopolitical effects generated by double exposures — "collisions of opposites" (Alter 2018: 8) — and their impact on a sociotechnical space imaginary. Space settlement actors regularly juxtapose Earthbound problems with their spacefaring solutions, in a "complex dialectic" of utopian and dystopian visions (Ormrod 2016: 388, Jasanoff and Kim 2015: 21). By pairing triumph with catastrophe, or the future with the past, leading space settlement actors create imaginary tensions that are productive for their cause. These tensions further relate to a "confluence of ambition and anxiety" (Dark 2007: 556) where the promise of space counters the horrors imagined of a human failure to transcend terrestrial limits. Fears of existential threats meet the material plenitude of alien landscapes, ready to be exploited for human benefit. Imagining desolation is then explored as a disruptive force, pivoting on an inversion of a human indifference to nature. Here, the cold and lethal ambivalence of space environments to human life figure hard limits to the earthly, frontier stories that are projected onto them. This is another collision of opposites; exposing troubling contradictions about common narratives that are both dated and flawed. The chapter then focuses on the films of Werner Herzog and Ben Rivers, in exploring the imaginative and discursive potential of desolation on film for countering the problematics of space settlement advocacy. Herzog and Rivers' films can both be considered "found-footage science fictions" (Luckhurst 2018a), and they share

complementary aesthetic gestures that reframe earthly desolations as heterotopian elsewheres and *elsewhens* (Foucault 1986). Through more double exposures and inversions, different desolate landscapes become science fiction stages for reimagining space travel and describing other ways of life on a future planet Earth.

Chapter 3 interfaces problematics of a predominant outer space imaginary with practices and processes of the essay film. In my films and films by others, I focus on the potential of essayistic methods for artistic research and as means for critique. I find the essay film most interesting because, as another form of audiovisual structure, it offers a different "special kind of logic" (Robertson 1980: 21) to engage with the "structuring matrix" of a normalising Euro-American space imaginary (Gaonkar 2002: 4). The chapter describes the distinctive characteristics of the essay film and elaborates on its capacity to address the more theoretical concerns of this PhD project. My interest in the essay film is founded upon montage, as an aesthetic technique and vocabulary that is arguably essential for producing experimental and unpredictable relations of image and sound. Most importantly, by figuring different movements — such as horizontal, vertical or folding — montage enables the essay films defining capacity to *think* through moving image. Finding movement in montage further highlights the structural nature of film, where each technique corresponds to a certain approach to combining audiovisual fragments in varying configurations. In the essay film and the Euro-American spaceflight imaginary, I play one form of image-based infrastructure against another, where the fragmentary counters the monolithic.

Ideas of movement also relate to an essayistic transgression of generic or disciplinary boundaries, where the essay film connects to other cultural forms. In particular, the essay film joins with the "science fictional" (Frost 2013): a term for practices lying beyond any defined science fiction genre which also adopt its aesthetic methods and critical approach. Most interestingly, essayistic and science fictional methods together "perform a kind of estrangement" (Alter 2018: 13) — in other words, they *destabilise* perceptions and create critical distance from complex concerns, be they subjective experiences or issues "too big to fathom" (Ibid: 2). This distance is furthermore generative as a basis for critical reflection and exploration of other, possible ideas. The chapter ends with a close reading of the short essay films I produced through the course of the project. The films are each made from found-footage and combine different techniques of montage as a means of critique. They each respond to particular and problematic themes about the Euro-American space imaginary which I describe in the earlier chapters. Individually and collectively, the films complement the writing by contesting this imaginary through moving image; experimenting with its prevalent aesthetic gestures to different, disruptive effects. Opposites collide, positions reverse, and tensions collapse as they question the "uncritical transfer" (Triscott 2016: 441) of heteronormative ideologies into outer space and into the future.

You can download and watch my essay films from the USB drive enclosed in the front cover of this book. The films are also represented as image sequences in Chapter 3.

Chapter 1

In Straight Circles: Outer Space in the Euro-American Imaginary

In short, imagination is not to be trifled with, but constitutes a real force with real-life consequences.

— Steven J. Dick

Heavy Rotations

The space station, an inhabited outpost floating free beyond the Earth, is an infrastructure and visual icon found "at the heart" of a social movement seeking to expand human civilisation into outer space (Valentine 2018: 198). As space historian Alexander Geppert (2018: 133) explains, it was first imagined serving "a double-purpose, simultaneously inward- and outward-looking," as a scientific or strategic Earth-observatory and a technological gateway to exploring distant planets.[1] Space station designs often form the shape of a ring, or in other words, a "great wheel" (Kimball 1955), that steadily rotates about its axis to create artificial gravity by centrifugal force — creating an offworld environment for human colonies to comfortably live and work. From the 1950s, the wheel-shaped station was propagated and popularised namely by Wernher von Braun, a German rocket engineer. Upon emigrating to America[2] after World War II, von Braun became an influential public advocate for space exploration (Geppert 2018: 128). Through special issues of Collier's magazine and a Disneyland television series dedicated to space travel, he established the floating, rotating megastructure at core of his future vision and "at the heart of his campaign to leave the Earth behind" (Ibid: 128). After von Braun, his vision of the wheel-shaped station was later represented by many mid-century science fiction films,[3] including *2001: A Space Odyssey* (Kubrick 1968), that is described as arguably "the Space Age's most influential" (Geppert 2018: 130).

1 A consensus of European engineers and space enthusiasts in the late 1920s agreed that the first step of "overcoming Earth's gravity […] on the way to the Universe was believed to be the hardest" (Geppert 2016: 127).

2 Von Braun first designed air-borne weapons, including the V-2 rocket, for Nazi Germany before emigrating to America after World War II to work for the US Army and then the National Aeronautics and Space Administration [NASA].

3 Including *Gog* (Strock 1954), *Conquest of Space* (Haskin 1955), *Mutiny in Outer Space* (Grimaldi 1965), *War Between the Planets* (Margheriti 1966) and *The Green Slime* (Fukasaku 1968).

Figure 15: A rotating wheel-shaped space station envisioned by Chesley Bonestell with Wernher von Braun for Collier's Magazine (1952). Credit: NASA/MSFC.

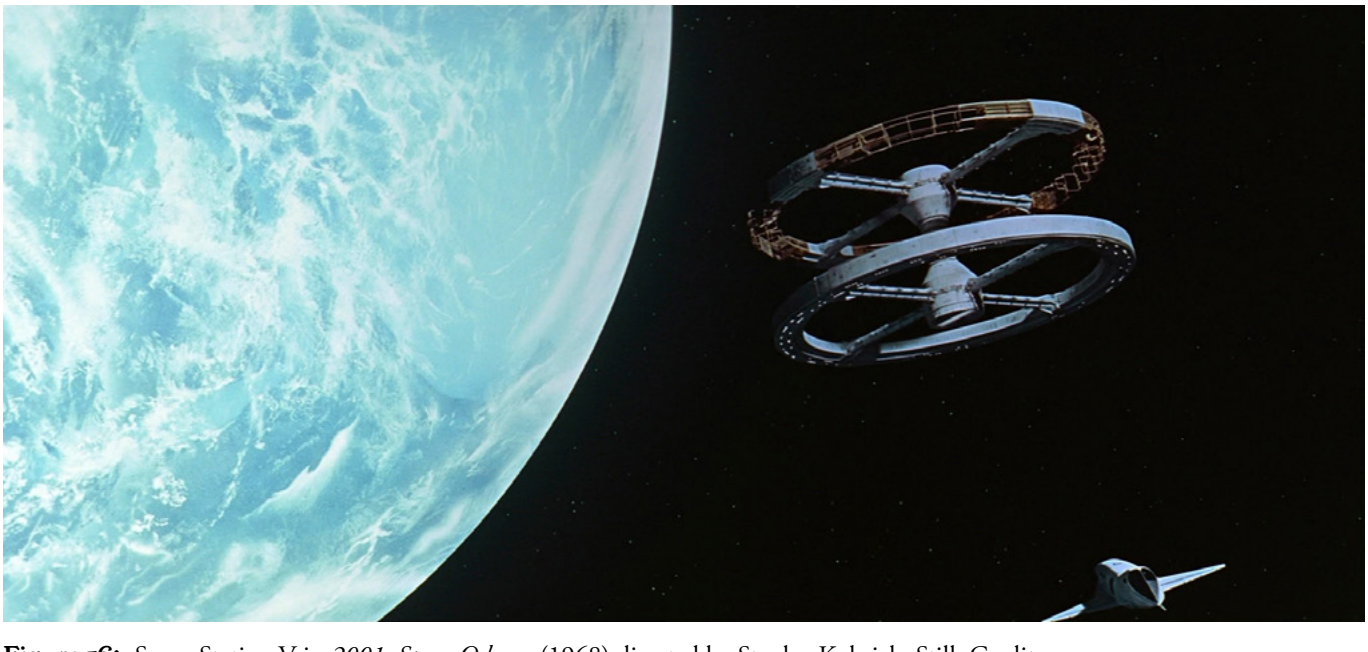


Figure 16: Space Station V in *2001: Space Odyssey* (1968) directed by Stanley Kubrick. Still. Credit: Metro-Goldwyn-Mayer Studios Inc.

Whereas von Braun and others imagined the space station primarily as a step for exploring other worlds, in the 1970s, Princeton physicist and futurist Gerard K. O'Neill imagined these outposts to be entire worlds in themselves. O'Neill proposed gigantic megastructures — in spherical, cylindrical and wheel-shaped forms — as habitats for housing thousands of people. He argued that floating space colonies, rather than planetary surfaces, were the rightful place for an expanding civilisation, based on amassing and exploiting the infinite material resources of space for the benefit of Earth and humankind. Nearly fifty years later, O'Neill's vision is found reanimated by the space industry. Silicon Valley tycoon Jeff Bezos, and his aerospace company Blue Origin, openly appropriate imagery of the "O'Neill colonies" as symbols for the thriving space future they and other private space actors are building towards.

From space stepping-stone to permanent space settlement, the wheel-shaped space station is established as an icon at the "centre of all expansion logic" that is projected onto outer space (Geppert 2018: 128). An imaginary line can be drawn through the great wheel's different representations in speculative space science and science fiction, connecting contemporary imagery with visions from a familiar "future past" (Valentine 2012: 1064). By charting a course of the space-wheel through a history of "astroculture,"[4] I find a double-movement going on — a movement in straight circles. To help articulate the purpose of this thesis, the wheel's complementary motion transforms into a metaphor for describing my central concern: an imaginary of outer space that is powerful yet problematic in directing large swathes of the space industry towards a shared vision of the future. The first half of the metaphor relates to a straight line, that describes a common perspective of history held by space settlement advocates. This perspective connects memories of the past with future speculations, placing an expanded human presence in outer space on the "cutting edge" (Robertson 1980: 8) of a progress that is imagined both traditional and transcendental. In this chapter, I examine powerful myths, metaphors and master narratives that demand a multidimensional continuum of earthly ideas, practices and power structures to extend beyond Earth's atmosphere. The second half of the metaphor belongs to the steady, heavy rotation of the space-wheel. Just as the station rotates to generate an artificial one-g environment, space settlement advocates create a gravity about their shared visions by recycling imagery and stories from western history and popular culture. By abstracting and replaying iconic symbols, they render distant space futures relatable in movingly simple and familiar terms. However, as I explore here, the use of powerful myths and metaphors to explain outer space ultimately widens a troubling and grow-

4 Alexander C.T. Geppert (2012: 220) introduces "astroculture" as a culture-related term that defines a "heterogeneous array of images and artefacts, media and practices that all aim to ascribe meaning to outer space while stirring both the individual and the collective imagination."

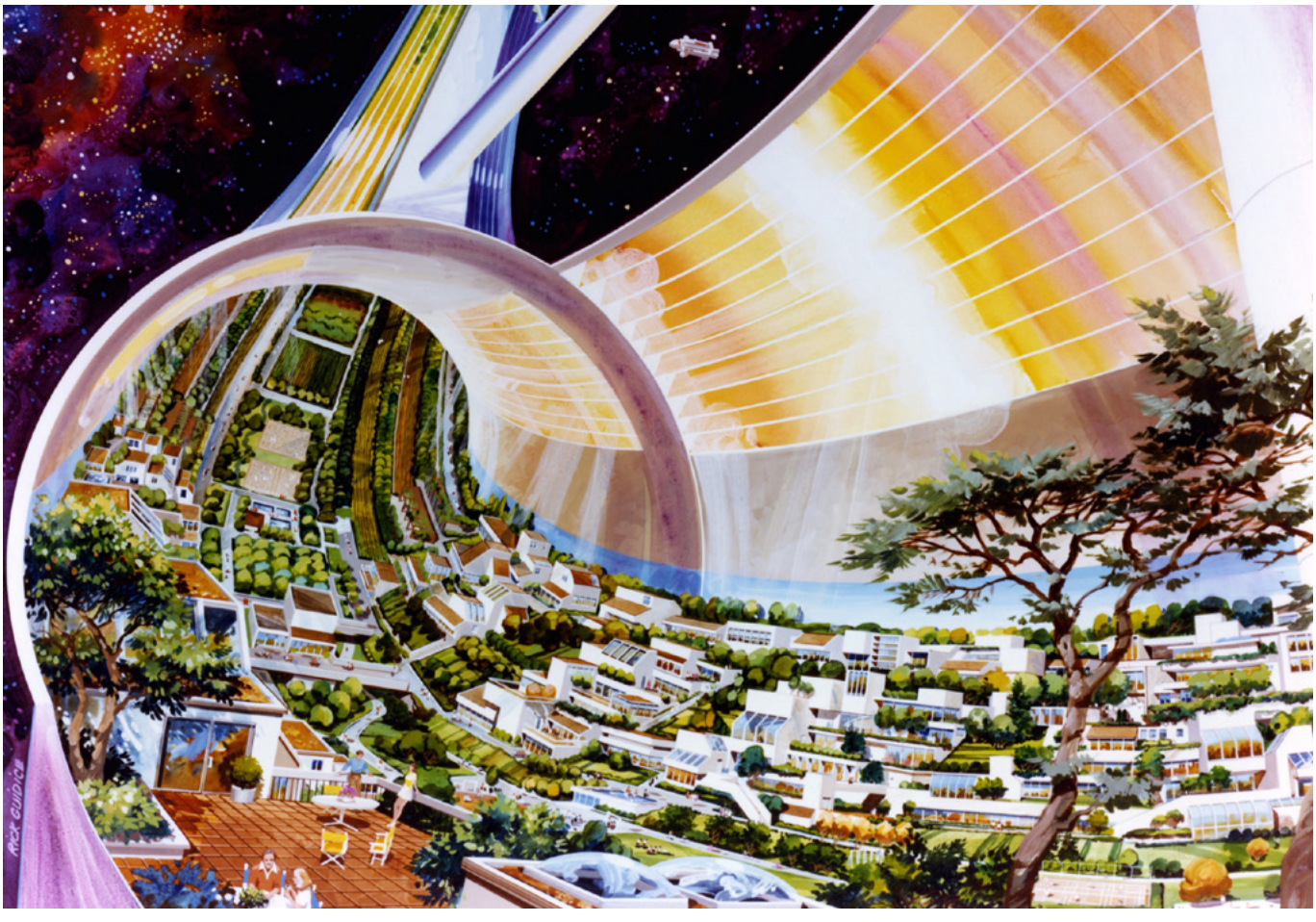


Figure 17: A painting of a space habitat concept by artist Rick Guidice for the Summer Studies at NASA Ames Research Centre. *Cutaway, exposing the interior* (1975) / NASA ID Number: AC75-1086-1. Credit: NASA Ames.

ing "gap" (Dickens and Ormrod 2016: 19, McCurdy 2011: 318) that separates spacefaring dreams from the complex realities of outer space practices and their Earth-space relations.

Spaceflight as a Sociotechnical Imaginary

The Euro-American spaceflight imaginary can be briefly defined as the shared vision of humankind as a spacefaring and interplanetary civilisation. Before I explore its intricacies and primary performers, anthropologists and other humanities scholars (Gaonkar 2002; Strauss 2006; Levy and Spicer 2013; Bottici and Challand 2011) help to make broader sense of what the imaginary is and does, identifying its significant power as a social and political force. The authors also help to frame the imaginary as a form of socio-political infrastructure. Emerging from the background at various moments, their ideas inform a more detailed understanding of the spaceflight imaginary. They help to grasp the specifics of its workings and to explain why it is so pervasive and powerful in directing the space industry and influencing wider space publics.

Whereas imagination can be very briefly described as the individual capacity to cognitively produce images (Singer 1999: 13), the imaginary means the collective imagining of a group of people, sharing images together to create a unifying social context (Bottici and Challand 2011: 28). In cultural studies texts, the word imaginary often stands for the "social imaginary," which is found working at the grand scales of the nation (Anderson 1983) and society (Castoriadis 1987). Claudia Strauss (2006) identifies an important difference in various concepts of the social imaginary, which is described by various authors either as how society itself is imagined (Taylor 2002, Anderson 1983) or "society's imaginings" (Strauss 2006: 324): in other words, people imagining together.[5] The two distinctions are in many ways importantly and inseparably entangled. It can be argued that common and "normative" understandings of social life (Taylor 2002: 106) invariably shape how people in societies imagine. However, it is the latter definition of the imaginary that I am most interested by. Here, I use imaginary to denote particular images of the future that are collectively held and publicly performed. This distinction further helps to foreground the ideas about the imaginary that resonate the most with my research.

Theories of the imaginary often project sense of infrastructure. For Dilip Parameshwar Gaonkar (2002: 4), the social imaginary is "the constitutive magma of meaning, the structuring matrix without which chaos would reign." Gaonkar (Ibid: 1) further describes the matrix as "enabling but

5 As Strauss says (2006: 326), "Societies are not creatures who imagine, but people do."

not fully explicable," so painting the imaginary as both integral to creating and maintaining a society and yet, to some extent, an elusive entity. David L. Levy and André Spicer (2013: 659) complement this image of the matrix by terming imaginaries as "shared socio-semiotic systems that structure a field around a set of shared understandings." These structures organise productions and other collective activities by prioritising cultural values and providing a "shared sense of meaning, coherence and orientation around highly complex issues" (Ibid: 660).[6] The capacity to organise also applies to "narrative infrastructure," a term introduced by media theorist Rob Coley (2018: 305) to describe how stories actively mediate our perceptions of, and actions in the world. For Coley, infrastructure "can be social and cultural," and furthermore, narrative infrastructure "is not just a metaphor — it describes the constitutive and material agency of stories" (Ibid: 305).

From the various authors, I understand the imaginary to be critical in enabling the conceptions of individuals, communities and realities. The imaginary's mediation is fundamental in producing shared meanings and making worlds.[7] It is made and performed by different representations, from imagery and myths, to stories and other rituals which are assimilated and carried by individuals in a given society (Cabanes, Segrestin, Weil, Le Masson 2014: 4); creating a sense of communal identity, common understandings and collective action. The imaginary assembles coalitions, mobilises projects and stabilises systems (Levy and Spicer 2013: 662). It is concretely, if not completely, locatable and has real effects. Furthermore, though it may be elusive, the structuring matrix of the imaginary is arguably more apprehendable in moments of failure, what Coley (2015: 306; emphasis my own) refers to as "*glitches* where stories no longer function as they should and cannot be contained by familiar narratives." Most pertinent for this thesis, these contradictions arguably "can trigger moments of crisis and set in motion a pathway for change" (Levy and Spicer 2013: 662). In identifying such moments of rupture, the authors above confirm the imaginary as both a critical social structure and a profoundly contested space.

In the following paragraphs, I survey two concepts relating to the imaginary that are particularly important for developing this PhD thesis. Together, they help to define the spaceflight imaginary more precisely and

6 Political scientist Benedict Anderson is often cited as a seminal influence for later theories on the imaginary, along with philosopher Cornelius Castoriadis. In his book *Imagined Communities* (1983), Anderson highlights the role of print media in the building of nations, where shared imagery and stories construct a sense of communal identity. Anderson's description of the imaginary as a "framework of a new consciousness" (Ibid: 65) also echoes the structural imagery of Gaonkar and Levy and Spicer.

7 Gaonkar (2002: 4) argues that it is "only through this mediation […] that we are able to conceive of the real in the first place."

sharpen my focus regarding particular thematic concerns. The first concept is the "sociotechnical imaginary," what STS scholars Sheila Jasanoff and Sang-Hyun Kim (2015: 4) define as a vision of a desirable future, based upon scientific and technological development, that is "collectively held, institutionally stabilized, and publicly performed." The second, complementary concept is the "sociotechnical projectory" that is coined by anthropologists Lisa Messeri and Janet Vertesi (2015: 56) to describe "the momentum of trajectory with the forecasting of projection" (Ibid: 56) and to denote a tangible path that orients a technoscientific community toward an imagined future (Ibid: 80). In both cases, the authors frame images of the future as stabilising forces that generate a sense of order about sociotechnical communities and valorise their activities in the present by inspiring an anticipatory discourse about what lies ahead. Here, together with performative storytelling, the different material artefacts instantiating an imagined future are found to be essential for creating this organising structure. Furthermore, the authors also note an embedding of technological projects in the social, where artefacts are saturated in beliefs and values that extend into the futures they promise to realise. In sociotechnical imaginaries and projectories, the promise of the future is also found shaped by different complicated dialectics, where utopian dreams interact with dystopian nightmares (Jasanoff and Kim 2015: 4) and past histories are abstracted to fuel anticipations and aspirations about things to come (Ibid: 21).

For Jasanoff and Kim (Ibid: 4), the sociotechnical imaginary is "animated by shared understandings of forms of social life and social order attainable through, and supportive of, advances in science and technology." This imaginary is thus defined by the central role of science and technology in imagining the future, where the design and fulfilment of technological projects ground positive visions of progress (Ibid: 4). As the authors describe, the sociotechnical imaginary is made "not only through material productions […] but through the very ideas and practices of "science" and "technology" as formative, and normative forces in the world" (Ibid: 338). That futures envisioned by a sociotechnical imaginary should be "desirable" is also worth noting when considering an important difference between "desirable" and "hopeful" futures, as highlighted by sociologist Richard Tutton (2018: 4). If hopeful means an achievable future, not all desirable futures are necessarily hopeful ones. Discussing outer space imaginaries, Tutton conveys a tension created by "imagination [that] is both performative in that it brings about new realities and also problematic in that it can be disconnected from or at odds with reality" (Ibid: 5). This nuance and the tension it signifies come into play as the present chapter develops.

Jasanoff and Kim are also important for describing the "social thickness" (Ibid: 3) of technological projects. Through an underlying concept of "co-production," they argue that science and technology both embed and are embedded in the social. In their words, "the ways in which we know and represent the world are inseparable from the ways in which we choose to live it" (Ibid: 3). This idea aligns what Gaonkar (2002: 4) terms a "double sense" of

imaginaries, whereby they are both ways of understanding the social that become social entities in themselves, forming an eternal entanglement of symbiotic relations between imagination and reality (Dick 2018: 31). This notion connects to philosopher Cornelius Castoriadis, who is credited for pointing out "that the *instituting* social imaginary is always at the same time *instituted*" (Bottici and Challand 2011: 25; emphasis in original). Jasanoff and Kim (2015: 337) go on to concisely emphasise the social entanglements of a sociotechnical imaginary, and the implications they pose for things to come, by stating a "self-evident truth that technologically enabled futures are also value-laden futures."

The sociotechnical imaginary depends upon fiction and performance for its popular articulation and propagation. Jasanoff and Kim build upon Yaron Ezrahi's political theory (2012) to argue that the performing of "necessary fictions" (Jasanoff and Kim 2015: 12) is essential for stabilising the imaginary in a public sphere and, furthermore, for the functioning of social order. Jasanoff and Kim (2015: 20) also note the closely related concept of the "master narrative," repetitive and resistant to change, as a monolithic rationale for society to consistently perform. The authors aptly offer American exceptionalism as an example of a master narrative, as a "singular retelling of national and cultural history" (Ibid: 20). By highlighting the critical role of fiction, Jasanoff and Kim frame society as a kind of theatre: "a matter of artifice, illusion, and pretense" (Ibid: 12). Of further interest regarding the sociotechnical imaginary is the correlation of desirable future visions with shared fears, in "an interplay between positive and negative imaginings — between utopia and dystopia" (Ibid: 4). This interplay informs not only images of progress but also common beliefs about the ways life should be lived, establishing shared understandings of good and evil. As I explore in this chapter, there is a "complex dialectic" of histories of the past interacting with images of the future, which is both described by Jasanoff and Kim (Ibid: 21) and recognisable in the Euro-American spaceflight imaginary. Here, as the authors convey, "the past is both a prologue and a site of memory excavated and reinterpreted in the light of a society's understanding of the present and its hopes for what lies ahead" (Ibid).

Messeri and Vertesi (2015) build upon the concept of the sociotechnical imaginary to define a "sociotechnical projectory," adding another dimension to the power of future images in shaping technological projects and organising communities around them. The authors connect the projectory to the sociotechnical imaginary by noting the stabilising effect of anticipatory discourse in the development of "ambitious technologies" (Ibid: 55), where the identity of a community is upheld through the "mutual articulation" of future narratives (Ibid: 56). In their words, "not only does a projectory shape objects — it shapes subjects as well" (Ibid: 80). Most interestingly, the sociotechnical projectory articulates that paths to the future are made tangible by different artefacts and representations. Messeri and Vertesi term the projectory a "material instantiation" (Ibid: 56) of a shared imaginary, a notion that resonates with Jasanoff and Kim's (2015: 12) reading of technologies as "performative scripts that combine values

and interests, materialising and making tangible the invisible components of social imaginaries." Both sets of authors describe a future projectory built into technological artefacts in the here and now, where science and technology become crucial sites for materialising a social identity in the present as well as shaping aspirations for the future. The artist John Timberlake further complements these ideas by thinking of the imaginary spatially and appropriating a phrase that is credited to science fiction author William Gibson: "the future is already here — it's just not very evenly distributed."[8] In describing science fiction, Timberlake (2018: 4) conveys that "fragments of the future are encountered, assimilated and historicised into the viewing subject's experience." Here, such fragments can also be interpreted as the aforementioned "material instantiations" which are steering sociotechnical communities. Reflecting on the sociotechnical projectory, the power of the imaginary arguably lies in the ability to materialise, in different ways, the desirable futures that it envisions (Levy and Spicer 2013: 660).

NewSpace

As founding directors of two of the foremost commercial space companies in Blue Origin and SpaceX, Silicon Valley billionaires Jeff Bezos and Elon Musk are today recognised as major figures of the space industry. Blue Origin and SpaceX stand as industry leaders primarily for their production of reliably reusable rockets, with the "Launch America" flight by the SpaceX Falcon 9 rocket being one of the highest profile demonstrations to date.[9] The reusable rocket is designed to ultimately lower the cost of spaceflight and is considered a key part of any future commercial space infrastructure.[10] Bezos (Blue Origin 2019) emphasises a radical reduction in launch costs as an essential prerequisite for increasing human activities in space. He draws upon the story of his company Amazon, where the 'heavy-lifting' of building the internet had already been accomplished by others, enabling a Silicon Valley start-up to grow into a global corporate monolith, and Bezos himself to become one of the richest people in the world. By lowering the cost of entry to the space frontier, he seeks to enable other entrepreneurs in his image to operate offworld.

8 Gibson is reported to have first said this in an interview on *Fresh Air*, NPR on 31st August 1993 (Wikipedia 2020).

9 Since then, SpaceX consolidated the first crewed launch by transporting another four NASA astronauts to the International Space Station on 15 November 2020 (NASA 2020b).

10 Elon Musk has suggested that the payload that can fly on a single SpaceX Falcon 9 rocket is "reduced by less than 40 percent with a reusable configuration and that the cost of recovery and refurbishment makes up less than 10 percent of the initial production cost" (Brown 2020). Though the exact figures are subject to debate (Ibid), there is nevertheless a consensus that the cost for refurbishing and reusing a rocket is substantially cheaper than manufacturing an entirely new vehicle for every mission.

The visual media and rhetoric of Bezos, Musk and their respective space companies are a primary focus of this thesis, supported by a cast of other contemporary and historical actors influencing the space industry in the form of a powerful social and economic movement. This movement goes by the name of "NewSpace" and comprises entrepreneurs, public-facing societies and other actors who collectively advocate for the commercialising and human colonising of outer space. This section briefly describes the origins of NewSpace, who the chief actors are and ultimately the particular Euro-American space imaginary they project onto the cosmos. In doing so, I articulate a tangible sense of continuity that connects a professional ascendancy, in particular geopolitical conditions, with childhood dreams of human spaceflight and space settlement. A continuum is traceable not only in terrestrial practices expanding into outer space but also from the seminal impact of Apollo and the interplay of its memory with science fiction precedents and American histories. This interplay is found guiding the grand narrations of commercial space projects in relation to human futures beyond Earth.

The work of anthropologist David Valentine (2012) catalysed my interest in, and exploration of, NewSpace. Valentine conveys NewSpace as a collective movement that is united not only by economic ambitions but also by a grand, totalising vision of human settlements in space. Libertarian positions anchor a belief in transforming human society beyond Earth, ensuring the survival and evolution of humankind through means of commercial enterprise, market forces and wealth production. Valentine (2012: 1047) continues to claim NewSpace actors and advocates — or "NewSpacers" — draw upon "liberal appeals to the common good, on metaphors of the American Frontier and European colonialism, and on sources of speculative fiction" to argue for their cause. Through the course of this chapter, I expand upon these metaphors and sources in exploring the core themes and critical functions of a Euro-American space imaginary.

The spacefaring imaginary closely relates NewSpace to a wider movement of pro-space activism, of which the human development and settlement of space is one branch (Michaud 1986, Ormrod 2016). Sociologist James S. Ormrod importantly highlights the common ideas of billionaire NewSpace industrialists with more historical grassroots pro-space activism. For the activists, the tenets of the libertarian right dominate ambitions for economic growth, such as individual prosperity and freedom, and a willingness to act apart from government institutions, arguably out of either distrust or disillusionment about their capacity to fulfil a spacefaring future. Ormrod and space historian Roger Launius (2018) help to introduce a history of this pro-space advocacy, which manifested in public-facing societies, government pressure groups and other forms of activism from the 1970s up to the turn of the 21st century. The leading grassroots figures of the post-Apollo decades, such as Gerard K. O'Neill, Barbara Hubbard and Robert Zubrin, are very important to consider for their role in circulating visions of outer space settlements in the wider public realm. At the time, their ideas

were deemed too radical by NASA or other government institutions (Launius 2018: 65). However, their visions would later greatly influence those of present day NewSpace actors, who possess the financial and technological powers to take matters of the future into their own hands (Morton 2019: 218).

Geographer Jason Beery describes the geopolitical factors around the promotion of commercial space industries that, in turn, powered the rise of the NewSpace movement. For Beery (2012: 27), the development is a case of mutual benefit for the US government and private space entrepreneurs, who share "overlapping views on privatisation." For the US government, outer space represents a site for expanding economic growth by creating new circuits of capital — what Beery (Ibid: 25) and MacDonald (2007: 610) refer to as "basic infrastructural maintenance" conducted by the state "in order to promote economic growth and stability and ensure the reproduction of the political-economic system" (Beery 2012: 25). Important shifts in US space policy initiated by the Bush and Obama administrations, who assigned larger funds and greater responsibility to the private sector, are credited for catalysing the momentum of commercial space industries in the early 21st century (Beery 2012, Valentine 2012, Launius 2014). The government therefore enabled space entrepreneurs to pursue new streams of revenue and enormous profits from tourism; transport operations; NASA contracts; and to speculate upon "harvesting trillions of dollars in precious minerals from asteroids" (Beery 2012: 28).

Beery highlights a sense of continuity about commercial practices in outer space, as he finds government support for privatisation as a conflating of space policy with wider political and economic goals that are explicitly grounded and entangled on Earth. The sense of reproduction is heightened by Beery's description of public-private partnerships in spaceflight as "part of a continuum of (re)negotiations and (re)definitions" (Beery 2012: 28), where space privatisation extends competition, capitalism and entrepreneurship — arguably the core tenets of the US social system — into the cosmos. With this in mind, the SpaceX-enabled "Launch America" flight is arguably the most recent and glaring instance of space programmes serving to perpetuate American economic and military dominance on Earth and beyond. The launch can be read as a firing of contemporary American exceptionalism, prompting President Donald Trump to declare "the United States has regained our place of prestige as the world leader" (Hoffman and Robertson 2020). Returning to the "master narrative" articulated by Jasanoff and Kim above, to the millions of people tuning in around the world, the launch performs an imaginative retelling of the same old story. From their perspective as critical geographers, Beery and others (MacDonald 2007, Klinger 2019, Dunnett 2020) clearly articulate an Earth-space relationality that further underlines the continuation of Earthly power structures and practices into outer space. To restate the case, the geographers are instructive because they tie the actions of private space entrepreneurs and the NewSpace movement to wider political and economic practices of *maintenance*: of repetition, reproduction and stabilisation by *extension* beyond Earth's atmosphere. Outer space is therefore

Figure 18: The Apollo 6 Saturn V rocket during rollout. Credit: Project Apollo Archive.

not a site of radical social departure, nor a "transcendent break from the past, [but] is merely an extension of long-standing regimes of power" (MacDonald 2007: 610); a space domesticated by the expansion of established "terrestrial political-economic processes and power hierarchies" (Beery 2012: 33) that share mutual benefits and success.

The Road to Space

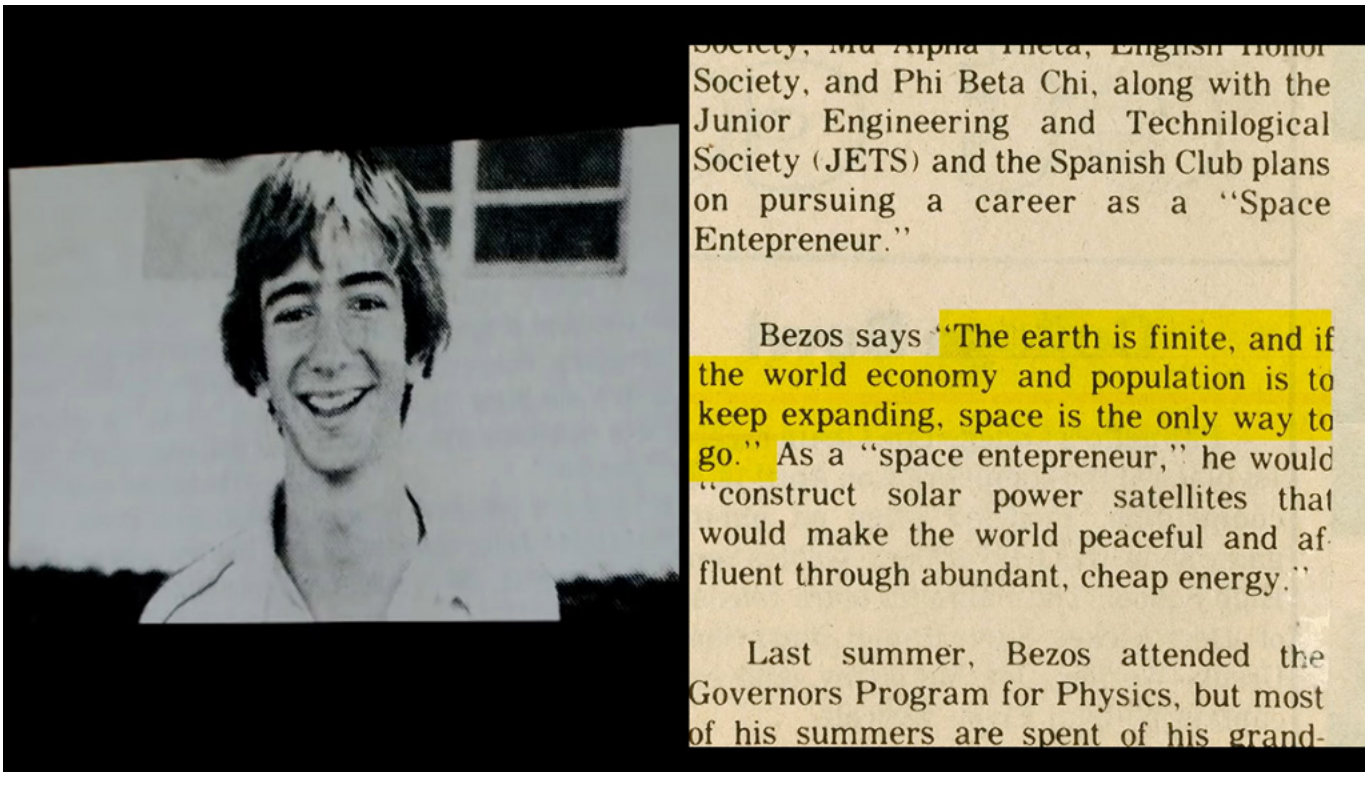
"We are going to build the road to space" says Jeff Bezos (Blue Origin 2019), "and amazing things will happen." The transcontinental railroad is an oft-used analogy by private space settlement advocates to compare the opening of the space frontier to commercial activities with the opening of the American West. As cultural and technology scholar Réka Patrícia Gál explains (2021; emphasis in original), Elon Musk has "carefully positioned his company as a space *transportation* company, and has explicitly compared the SpaceX project to building the Union-Pacific Railroad — for space."[11] The railroad analogy heightens the plausibility of a speculative space infrastructure and plays to settler-colonial histories from the old American frontier; as space historian Howard E. McCurdy infers (2019: 13), "To early nineteenth century travellers, the west coast of the United States was as far away from the east as twenty-first century earthly travellers were from Mars." To borrow Jasanoff and Kim's words (2015: 12), the reusable rockets built by Blue Origin and SpaceX also act as technological, "performative scripts," that materialise the road to space and render the space frontier tangible. Though important on a representational level, the analogy also relates to modes of public-private partnerships, and particularly to government investment in the private sector made to stimulate the road's production. In the 19th century, the construction of the transcontinental railroad was a private enterprise, where businesses were assisted by government land grants, tax breaks and other "favorable decisions" (Launius 2014: 38). Both Launius (2014) and McCurdy (2019) refer to public officials deciding to "do enough and just enough, to induce capitalists to build" (Launius 2014: 44). There are other comparisons between the American railroad and the space industry, including the high start-up costs and technological challenge of building efficient launch vehicles,[12] as well as the highly regulated environment and the high risk/reward potential of the project.

11 "The goal of SpaceX is really to build the transport system. It's like building the Union-Pacific Railroad," said Musk, "And once that transport system is built, then there's a tremendous opportunity for anyone who wants to go to Mars and create something new, or build the foundations of a new planet" (SpaceX 2016; Robertson 2016).

12 Here, the reusable rocket can be analogously thought of as *laying the track*.

Launius argues that the financial model of the transcontinental railroad works as a historical analogy for understanding how a "road to space" may be possible in economic terms. He offers a series of precedents for government initiatives to support the funding of the private-sector, with the exception of land grants in space. However, Launius remains sceptical about who can access outer space along such a railroad in the current political climate and economic market. He suggests that unless changes are made to space policy and regulations, access to Low Earth Orbit and beyond remains prohibitively expensive for many. The realities of space policy, governance and industry therefore expose a contradiction about the railroad analogy. As Launius (2014: 46) says, "Government customers are the major users of space transportation, not settlers on the American frontier homesteading land near the railroad." Jeff Bezos and other NewSpacers posit the radical reduction in launch costs as the key to opening up access to space. However, Launius' wry observation of the absence of "land" in space, to grant or to settle on, renders a major fault in the logic of the railroad analogy and also suggests the "road to space" will only open the space frontier to a select, wealthy few — at least in the near future. In another lesson from history, the transcontinental railroad was primarily built by four investors, each of whom became "fabulously rich" (McCurdy 2019: 15). Contrary to its promise of a democratising infrastructure — opening space for everyone — in economic and political terms, the analogy of the railroad pertains to a closing and centralising of outer space power and profits to a select group who can afford to build the road in the present. "Infrastructure lets entrepreneurs do amazing things," enthuses Bezos (Blue Origin 2019), "my generation's job is to build the infrastructure." Considering the "faulty logic" found by Launius (2014: 35), and the centrality of competition in NewSpace values, a different interpretation of Bezos' Amazon start up anecdote may apply here. As Oliver Morton (2019: 220) sharply reminds, Bezos riches are made by "ruthless expansion of a company which acts in predatory and anti-competitive ways." If the transcontinental railroad is replaced with Amazon as the historical analogy for the "road to space," values of open access and equality appear even less relevant to the shaping of human space futures.

The critical geographers (MacDonald 2007, Beery 2011, Klinger 2019) highlight an Earth-space relationality, while emphasising the implications of capitalist-democratic systems for space futures. They focus on the "basic infrastructural maintenance" sought by US government administrations in the early 2000s as critical to the rapid growth of NewSpace thereafter. The shared desire for economic growth tie both parties together in the pursuit of mutual benefits promised beyond the Earth's atmosphere, where the enormous profits gleaned from outer space enterprises can stabilise existing, terrestrial political conditions and power structures. In an ironic turn, by granting funds and responsibility to the private sector, the government policies served to enable and embolden NewSpace actors and other pro-space activists, of whom many had previously projected a distrust and disillusionment towards the establishment. This common ambivalence towards government is arguably rooted in the history



Society, and Phi Beta Chi, along with the Junior Engineering and Technilogical Society (JETS) and the Spanish Club plans on pursuing a career as a "Space Entepreneur."

Bezos says "The earth is finite, and if the world economy and population is to keep expanding, space is the only way to go." As a "space entepreneur," he would "construct solar power satellites that would make the world peaceful and affluent through abundant, cheap energy."

Last summer, Bezos attended the Governors Program for Physics, but most of his summers are spent of his grand-

Figure 19: Jeff Bezos and his high school paper entry. A compilation of two slides presented by Bezos at the Blue Origin event 'Going to Space for the Benefit of Earth' in Washington, DC on 9 May 2019. Credit: Blue Origin.

of Apollo and the subsequent failure of multiple administrations, in the near fifty years since its closure, to fulfil the spacefaring future that the Moon landings so tangibly promised.

Orphans of Apollo

Today, Elon Musk and Jeff Bezos are also the foremost representatives of multiple generations of space settlement advocates, for whom the NASA Apollo programme was a seminal event — the promise of becoming a multiplanetary civilisation found inherent to the missions' spectacular achievements. In historical, ideological and imaginative terms, the NewSpace movement is arguably inseparably entangled with Apollo and its legacy.

For spaceflight advocates and historians alike, the NASA Apollo program stands as arguably the greatest technological achievement in human history. Sending twelve American astronauts to the surface of the Moon and back between 1969 and 1972, the missions were profoundly impactful on 20th century popular culture and beyond; generating an excess of social, cultural and political meanings ever since. First, Apollo is commonly read as the final act of a proxy war with the Soviet Union, where planting the flag in the Moon dust signalled victory and with it a grandiose statement of triumphant American exceptionalism. In author Andrew Smith's words, "in the end, it was *theatre*." (2006: 342; emphasis in original). The Space Race was run, this was the end; from the contract of war to the obsolescence of the hardware. And yet, to many, Apollo was supposed to be the beginning; the Moon landings a preface to the opening of the heavens, with outer space the "new frontier in which a grand visionary future […] might be realized" (Launius 2018: 53). However, from 1971 the NASA budget began to decline and the later Apollo missions 18 to 20 were scrapped. The agency would then shift its operations and perspectives toward making spaceflight "routine, safe and relatively inexpensive" (Launius 2014: 20), a turn materialised by the Space Shuttle programme. As Alexander Geppert infers (2018: 3), the relative confinement of human spaceflight to low Earth orbit ever since has meant the memory and legacy of the Moon landings continue to overshadow other space exploration successes. The failure of the U.S. government to deliver on the promise of a spacefaring future would thus transform Apollo from an object of hope into one of disillusionment and nostalgia, inspiring a group to turn their dissatisfaction into an increasingly powerful movement that may just shape the future. These are the orphans of Apollo.

The name "orphans of Apollo" represents a generation of space settlement advocates who were making their own small steps around the time Neil Armstrong made his most infamous one. Space historian Roger Launius (2018: 52) uses the phrase to label the "true believers" in space colonisation, whose childhood dreams were abandoned by Apollo's closure. Come adulthood, there is also an embracing of "orphan" as an identity in social, economic and

political actions in varying degrees of radicality. For example, the documentary film "Orphans of Apollo" (Potter and Neiman 2008) follows the failed attempt by a group of NewSpace entrepreneurs to buy the Russian Mir space station and turn it into a commercial outpost. The conviction in the natural and necessary human settlement of outer space first inspired the forming of public-facing societies in the 1970s, such as the Committee for the Future and the L-5 Society, who lobbied NASA and other government bodies to commission studies into space colony feasibility. Since then, the leading actors of the pro-space movement have changed with time, along with their economic and political strategies. From Princeton physicists to internet billionaires, the contemporary and historical actors are unified by their determination to open the space frontier, with or without government support.

"If we can put a man on the moon, *why can't we put a man on the moon*?" complains engineer Robert Zubrin in (2018), founder of space advocacy organisation The Mars Society — inverting this popular aggrandisement of human potential to exasperate at conditions of Earthbound constraint. The story of Apollo is mobilised to different yet mutual effects for the spacefaring cause. The momentous technological accomplishment regularly serves as a source of inspiration, an example of what can be achieved when dedicated technical industry and ingenuity complement a grand vision and political will. However, the Moon landings also became a source of impatient frustration with the present, of a future trajectory misdirected. Political scientist Timothy E. Dark III (2007) describes a certain irony of Apollo, where its spectacular yet unconsolidated success would simultaneously inspire and threaten pro-space visions of progress. According to Dark (2007: 556; emphasis in original), the belief in an expanded space programme was embraced "*at the very moment that the Apollo program was coming to a close*," creating a particular "confluence of ambition and anxiety" where hope for human space futures combined with fear of a missed opportunity. Marshall Savage (1994: 230), founder of the First Millennial Foundation, epitomises this fear by describing a failure to colonise space as a "crime of unutterable magnitude." Social, cultural and economic collapse appeared to be imminent if the space frontier was not conquered soon. Andrew Smith (2006: 339) compounds this sense of irony by highlighting the built-in obsolescence of the Apollo mission hardware and the wider programme infrastructure: by design, the Moon landings "killed "manned" Deep-Space exploration, stone dead." History thus shows that space settlement advocates projected their hopes of a spacefaring future onto a space programme with markedly different ambitions; onto what later represented something closer to a historical "aberration" (Launius 2005: 135) than an ideal space policy direction. This combined firing of ambition and anxiety means Apollo can be read as a catalyst driving a shared pro-space enthusiasm into a pro-space movement — a movement that, from the 1970s onwards and through the rise of NewSpace, grows steadily in influence in the shifting landscape of the space industry.

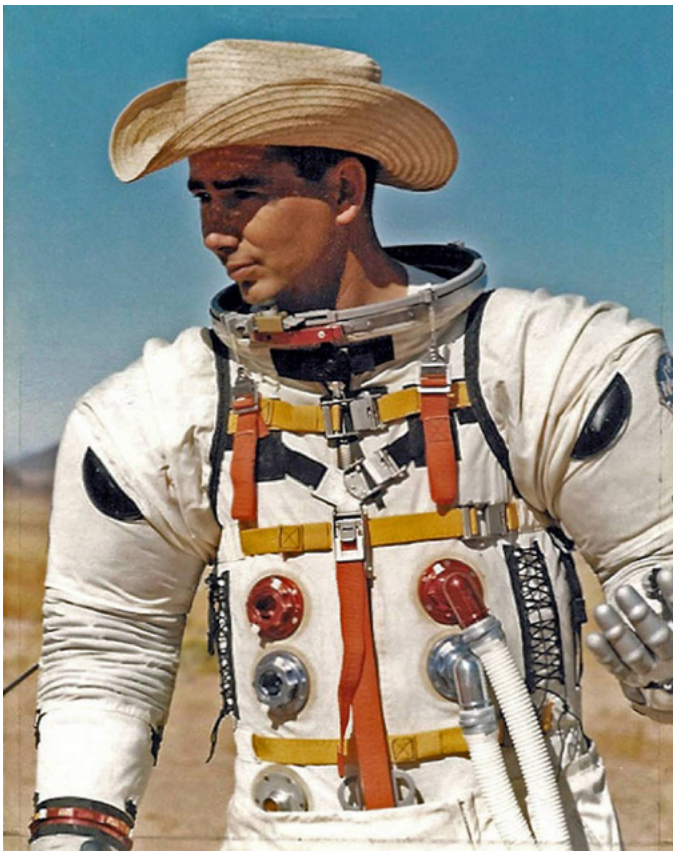


Figure 20: Scientist Joe O'Connor dons a cowboy hat and space suit during a NASA Apollo mission test (1965). Credit: NASA.

American Myths

On the Saturday 30th May 2020, as the SpaceX Falcon 9 rocket soared upward, it created a spectacle that reaffirmed American exceptionalism by projecting an economic and military dominance in space, while reinstating the Moon landings as the beginning of a spacefaring future. Here, Apollo is remembered not as an irregular space policy driven by war, but as a legacy for human futures in space to continue and build upon. The importance of Apollo to the NewSpace movement also signifies the entanglement of the Euro-American spaceflight imaginary with a deeply rooted American ideology. The vision of a spacefaring civilisation is bound to a predominant national imaginary, where both play upon the same cultural myths to serve the legitimacy and potency of each other. Here, the myths of progress and the frontier form the most important and indelible pieces of a shared "ideological bedrock" (Billings 2017: 485). For space settlement advocates, these myths help to frame human expansion into the cosmos as not only a natural endeavour but as a moral imperative.

Concepts of myth describe the use of imagery or stories to explain the unfamiliar or unknown, and their capacity to reconcile experiences in the present with projections of the future or memories of the past. For historian James Oliver Robertson (1980: 6), a myth "is a story told or an oft-told story referred to by label or illusion which explains a problem." This *explanatory* quality gives myths and their construction an "important function in social life" (Ibid: xv), they "give us a sense that the world is understandable and explainable" (Ibid: 8). Historian Thore Bjørnvig also offers "cultural masterplots"[13] as another label for myths, concisely yet richly describing stories that are "naturalised" by society, and which "through time have accumulated enough power to form an important frame of reference on which people feel cognitively and emotionally" (2018: 129). Here, Bjørnvig consolidates what philosopher Roland Barthes (1957: 154) understands to be "the very principle of myth: it transforms history into nature." Displaying an infrastructural nature that rhymes with ideas about the social imaginary (Gaonkar 2002), myths become "an unquestioned cognitive matrix through which we organize and interpret reality" (Bjørnvig 2018: 129). Robertson conveys myths reassure by creating "self-justifying" patterns based on descriptions of the past, that lead from the lived present into future speculations. Myths say, "this is the way it was […] this is the way it is, and this is the way it ought to be," (Robertson 1980: 6) carrying with them a sense of imperative that

13 Bjørnvig attributes the term "masterplot" to H. Porter Abbott (2003: 44), who further adds that it is "tempting to see these masterplots as a kind of cultural glue that holds societies together."

is also stabilising[14] (Kermode 1967: 39). In this way, myths are "made useful, becoming the bases for programs of action rather than mere narratives" (Wolfe 1979: 3). Robertson's (1980: 21) study of myths is most interesting because he explains the "special kind of logic" that renders them so powerful yet also problematic. He describes myths as innately irrational, reconciling the contrasts of ideals and realities which they ultimately help to create. Myths are made by a bundling together of "images and symbols, metaphors and models, and complex ideas," (Ibid: 21) and it is through these juxtapositions that myths "make logic out of the rationally illogical" (Ibid: 14). For Robertson, their inherent paradoxes and contradictions bring a "tension" that arguably both maintains and reflects "the dynamic of human societies" as irrational constructs in themselves, thus strengthening his argument that "if we would understand our world, we must understand its myths" (Ibid: xvi).

Not only are myths irrational, they are also seemingly immovable; their totalising explanations interpreted as "a sequence of radically unchangeable gestures" (Kermode 1967: 39). The tendency of myths to be "slow to," or against, change (Robertson 1980: xv) rhymes with Jasanoff and Kim's idea of the "master narrative" (2015: 21), which they offer as a close relation to their concept of the sociotechnical imaginary, as "a more monolithic and unchangeable vision." Such resistance pertains to a confusion, or *degeneration* of fictions into myths (Kermode 1967: 39) where stories are no longer "held to be fictive" but closer to a form of truth. As Robertson (1980: 37) conveys regarding the centrality of the frontier myth, for many Americans, "[n]o amount of evidence or debunking seems able to change the logic of our belief in a pre-Columbian, empty New World, inhabited by small numbers of primitive (virtually invisible) natives." Returning to space settlements, space historian Howard E. McCurdy (2011: 10) further consolidates a sense of inertia about myths by conveying: "If new worlds do not fit old dreams, it is the worlds that tend to change, not the dreams."

I also find myth to be closely tied to concepts around metaphor; both are complementary in highlighting the functional use of imagery in directing and understanding social life. Metaphor can be briefly described as an imaginative or rhetorical "device" (Gibbs 1999: 209) where one thing is conceived in terms of another (Lakoff and Johnson 1980: 74). For Gibbs (1999: 209), "[t]o think or speak metaphorically is to adopt a distorted stance toward the ordinary world." By describing the capacity of metaphors to "organize reality" (2011: 317) as well as motivate and "precipitate institutional change" (Ibid: 316), McCurdy aligns metaphor with myth as another infrastructural device. He conveys outer space to be "replete with metaphors" (Ibid: 318) that are regularly

14 As Mircea Eliade (1963: 141) says, "Myth assures man that what is about to do has already been done."

used by space settlement advocates to explain their future visions in familiar terms. McCurdy further echoes Robertson's theories on myth,[15] by conveying metaphors to be both "self-fulfilling" (Ibid: 317) and made by "recombining of familiar images" and existing memories tying them to the past, "often […] a past that itself imagined" (318). As with myths then, metaphors are arguably a social construction that also construct society.

Most importantly, McCurdy highlights a critical implication of both myths and metaphors, in their use to explain worlds or motivate changes in ways that are easily understood. In their distorting simplicity, metaphors ultimately fail to grasp the "nuances" of the unfamiliar (Ibid). It is from here that McCurdy poses that the "*use of metaphors promotes gaps between expectation and reality*" (Ibid: 318; emphasis in original). These gaps are pivotal to understanding the role of the imaginary and its power in ultimately shaping human futures in outer space. Peter Dickens and James S. Ormrod (2016: 19) further emphasise "a substantial and growing gap between outer space as an 'ideal space' and outer space as a 'real space', one resulting in profoundly destabilizing effects on the psyche and hence our understanding of society." As McCurdy helps to understand, these gaps are produced and maintained by a reliance upon metaphor by space settlement advocates, and society in general, to ascribe meanings onto the cosmos. However, as Robertson suggests (1980: 14), despite their contradictions, myths and metaphors of outer space continue to appeal "in the face of reason because reason often does not produce resolutions but rather gaping holes in which we urgently hoped was logic." In their "special kind of logic,"[16] Western myths and metaphors are found reconciling the very gaps separating outer spaces real and imagined. As I expand upon later, this logic has another tangible effect in the field of space exploration. This is where the "resulting gaps cause people to grow disillusioned" (McCurdy 2011: 319) with contemporary realities determined not by space dreams but by space policy. As McCurdy suggests, powerful metaphors fuel a disillusionment driving the "orphans of Apollo," where the widening gap between an "ideal" space frontier and a "real" domestication of Low Earth Orbit is a catalyst for ambitions to shift human activities in space away from government control and towards the realm of commercial enterprise. By highlighting this combination of organisation and dissonance, McCurdy and other authors add metaphor with myth as important dimensions constituting the imaginary as a form of spaceflight infrastructure.

15 Myths and metaphors are both made by borrowing from "a cultural storehouse" (Robertson 1980: 21).

16 In William Sims Bainbridge's (1976: 13) words: "The dream of spaceflight is glorious, the contemporary reality is dismal."

Figure 21–22: A match-cut transforming a flying bone into a spacecraft in *2001: Space Odyssey* (1968) directed by Stanley Kubrick. Credit: Metro-Goldwyn-Mayer Studios Inc.

Progress

In her historical survey of Western spaceflight advocacy, scholar Linda Billings (2007: 483) describes the relationship between the spaceflight imaginary and "an ideology of "Americanism" — what it means to be American, and what America is meant to be and do." For Billings, the essential American ideas are "frontier pioneering, continual progress, manifest destiny, free enterprise and rugged individualism and," perhaps most pertinently, "a right to a life without limits" (Ibid: 483). Billings finds the etymological root of progress in the Latin word meaning "to go forward" (2007: 485), which she augments by quoting J.B. Bury's (1932: 2) notion of progress as a movement "in a desirable direction." Billings further draws upon scholars Christopher Lasch (1991) and Robert Nisbet (1980) to convey that progress is not only the "most important idea in Western history" (Billings 2007: 485), but that the popular adoption of the concept remains distinctly "modern — an idea that is also supported by other scholars (Geppert 2018, Dickens and Ormrod 2016).

Progress is therefore definable as a "necessary and inevitable forward movement" that deeply embeds a sense of destiny in the cultural narrative of US space exploration (Billings 2007: 485). Billings conveys the rhetoric of governmental and grassroots space settlement advocacy communicates an ideology that could be "described, at its worst, as a sort of space fundamentalism: an exclusive belief system that rejects as unenlightened those who do not advocate the colonisation, exploitation, and development of outer space" (Ibid: 495). McCurdy (2011: 323) complements this idea, of spaceflight as a sort of religion, by describing a community of "believers" bound together by a "childlike faith" in a common spacefaring vision. In the eyes of these believers, any idea of constraining human expansion into the cosmos is thought to be "betraying the very progress of humankind" (Tamara Alvarez, personal communication, October 23 2019). Historian Frances FitzGerald establishes progress as a national myth that is central to the American experience. FitzGerald (1972: 9) argues that "Americans see history as a straight line and themselves standing at the cutting edge of it as representatives for all mankind." The idea is also found at play in the space industry, in particular by historian Patricia Nelson Limerick (1994: 13), who sees space development advocates projecting "a vector of inevitability and manifest destiny linking the westward expansion of Anglo-Americans directly to the exploration and colonization of space." Robertson (1980: 7) conveys that this linear understanding of history also explains a particular national feeling that is produced by American myths, including progress, which explicitly connect the lived present to the past — a past based on a history that stems from Columbus' discovery of the New World. "Does our sense of being at the cutting edge of history," Robertson poses, "come from our ancestors' belief that they were colonizing and settling at the edge of the earth?" (Ibid: 8). Robertson adds another interesting dimension to the image of Americans at the "cutting edge," by describing the historic adoption of Charles Darwin's theory of biological evolution to "validate" a national idea of progress. Here, evolution was not only seen

as "unceasing, inevitable proof of progress" (Ibid: 288) but proof that America, as a "new" nation, was the "highest evolved, … the cutting edge of the evolutionary process"; "a culmination of human experience" (Ibid: 289). Here, Robertson (1980: 289) helps to highlight the entanglements of progress and Americanism, where science is implicated in a mutual dependency and interaction of explanatory stories.

This sense of entanglement or entrenchment is consolidated by Timothy Dark, who describes the influential power of American myths for the NewSpace movement. Reflecting the "special kind of logic" of myths that Robertson describes above, Dark (2007: 570) infers that claims projected by NewSpacers and other spaceflight advocates in the name of progress are "deeply flawed" and unable to "withstand critical scrutiny," from the promise of profitable resources in space to the potential for new forms of social diversity and organisation. Nevertheless, Dark emphasises that these claims are powerful because they play directly upon progress and other American myths. Dark (Ibid: 555) also concisely outlines three, typical claims that comprise the idea of progress which, furthermore, address the core elements of American national identity:

(1) there are no fundamental limits on the human capacity to grow, however growth is defined; (2) advancements in science and technology foster improvements in the moral and political character of humanity; and (3) there is an innate directionality in human society, rooted in societal, psychological, or biological mechanisms, that drives civilization toward advancement.

The second claim I find particularly interesting, here. For this conflation of technological advancement with moral and political evolution is summarised by Dark as an underlying, universalising faith in progress where "*All Good Things Go Together*" (Ibid: 557; emphasis in original). This faith helps spaceflight advocates to easily connect capitalist wealth production with social good, and to pair material expansion in outer space with an evolutionary transcendence of inner space. Oliver Morton (2019: 171) reinforces this sense of conflation by describing how, in the eyes of the advocates, "human progress and human presence beyond the Earth were indistinguishable and good for everyone."

Dark dismisses the popular reasoning that exploration is a fundamental part of human nature; that expansion into the cosmos is driven by biology as much as morality. However, on the subject of human nature, in his reading of the classic science fiction film *2001: A Space Odyssey* (Kubrick 1968) historian Robert Poole offers a colder reading of what things "go together" in the name of progress. The narrative of *2001* spans an entire arc of human history, where interstellar space exploration joins to the very origins of the species. In the film, of particular is the iconic match-cut used by director Stanley Kubrick to jump from the primeval age of the apeman to the technological age of the

spaceman, where a flying bone is instantly substituted for a traveling spacecraft. Whereas the cut can be read as a transformative moment of transcendence in human evolution, Poole thickens the filmic and historical context around *2001* to add another dimension to the scene. *2001* was made and released at the height of the Cold War, amidst the tensions brought about by the threat of nuclear annihilation. Poole (2018: 107) also notes the consistent interest of Kubrick in the "human capacity for violence and deception" in his films as a general theme, with this space exploration epic made after *Dr Strangelove* (1964) and before *A Clockwork Orange* (1971). This history adds greater weight to acknowledging that, in this particular cut, the transformed flying bone, hurled in triumph by a hominid, was first a weapon for bludgeoning a rival to death in a territorial fight. For Poole, the imagery thus provides an alternative and pessimistic reading of a human progress based in violence. He suggests that "[if] 2001 is about transcendence, it is equally about the limits that have to be transcended" (2018: 107). This reading offers an important counter narrative to the transcendental story of progress told by many space settlement actors, who posit outer space as a site of evolutionary transformation, anticipated in a freedom from Earthbound limits. In a plenary at the 2019 International Astronautical Congress in Washington DC, Bob Richards, CEO of aerospace company *Moon Express*, went so far as to describe space colonisation as a transcending of our "adolescence" as a species bound to one planetary surface (Richards 2019). As Poole conveys, Stanley Kubrick and collaborator Arthur C. Clarke flip this idea by implying the limits humans must escape in space are, in fact, *inescapably ingrained* in human nature. Angelo Vermeulen (personal communication, October 23 2019), artist and evolutionary biologist, further rejects the naivety of Richards' pubescent suggestion by emphasising that human nature is inherently messy, and that it is inevitable that "we're going to take part of that mess to outer space."

The myth of progress imbues space travel as "symbolic of the entire directionality of human civilisation" (Dark 2007: 555) — a directionality that escapes terrestrial limits to human activity and aspirations (Kilgore 2003: 3). Here, the frontier becomes the complementary myth of spaceflight that helps space settlement advocates turn progress from a history into a crisis, motivated by the apparent closure of an Earth that is exhausted of wilderness and open lands to move forward into. The infinite expanse of the space frontier becomes the solution to this crisis; a counter for many perceived threats of scientific, cultural and economic stagnation claimed by Robert Zubrin, Jeff Bezos and other leading NewSpacers. The mutual benefit of this solution is not lost on Dark (2007: 558), who observes how renewing a modernist idea of progress in space serves to "buttress a central component of American national identity."

The Frontier

For Billings, Dark, Kilgore and many other scholars, the frontier is a fundamental myth for both spaceflight advocacy and American national ideology. Roger Launius (2005: 130) notes the "critical unifying purpose" of the frontier, that is arguably a product of scholar Frederick Jackson Turner and his, for some, infamously influential essay "The Significance of the Frontier in American History" (1894). Turner's essay (Ibid: 199) places the frontier at the heart of Americanism, where "free land, its continuous recession, and the advance of American settlement, explain American development." The historical effects of Turner's thesis mean, as anthropologist Peter Redfield (2002: 796) suggests, the frontier metaphor and its expansionist associations are familiar to anyone with a "passing acquaintance with the Space Age." The pervasiveness of the frontier metaphor in space imagery is also traced by McCurdy to the original Star Trek television series, which is starkly described by Gary Westfahl (2012: 8) as a "fraudulent" representation of space travel. Here, the success of Star Trek is credited to the writers' treatment of the series "as if it was a Western, for which ready audiences at the time already existed" (McCurdy 2011: 318). As McCurdy (Ibid: 317) reaffirms, the frontier is a metaphor loaded with American associations, including "the idea that the highest moral virtues emerge from hardy individuals working together in a pregovernmental "state of nature" before officialdom arrives". With particular pertinence for NewSpace visions, McCurdy also refers to the "anti-institutional streak" (Ibid: 317) that is pervasive in the stories of iconic American writer Mark Twain.

Set in contrast to the confined limits of life on Earth, Western imagery of the frontier describes wild, open spaces; replete with infinite resources. The frontier also encompasses other persistent and powerful American associations such as pioneering, settling and taming (Billings 2007: 486). Billings also charts the etymology of the word, which means forward-facing and denotes an area of activity, conflict and competition. In other words, the frontier myth plays directly into the cultural tenets of Americanism. Robertson (1980: 92) adds that "frontiers and lines are powerful symbols for Americans," where wilderness embodies both freedom and opportunity for American virtues "of riches, of equality, innocence and paradise" (Ibid: 121). The frontier also connects to the word "façade" (Billings 2007: 487): a front, which infers another meaning for how the metaphor is used and abused by space settlement actors to further their cause. Limerick (1994: 13) suggests a materiality about the frontier, as one of "the blinders worn to screen the past [which] have proven to be just as effective at distorting the view of the future." Returning to the image of "history as a straight line," the frontier crystallises the "cutting edge" of progress and signifies a constant expanse, where expansionist plans converge with utopian speculations.

American myths affirm that "[t]here no New World without wilderness" (Robertson 1980: 124). The frontier is imagined by as a site of utopian desire (Kilgore 2003: 11): where escaping the limits of Earth can also mean

breaking away from existing world orders. De Witt Douglas Kilgore (2003) coins the term "astrofuturism" to describe an influential form of spaceflight advocacy based in speculative fiction and popular science writing from the 1950s onwards, where narratives of space exploration are closely tied to engineering projects (Ibid: 3). The core principles of astrofuturism are the belief in humankind as a spacefaring civilisation, and in outer space as the key frontier for a human progress that is imagined as much traditional as transcendental. Kilgore roots astrofuturism in the entangled histories of Euro-American "imperial expansion and utopian speculation, which it recasts in the elsewhere and *elsewhen* of outer space" (Ibid: 1). The frontier is thus where progress is supposed to happen and, as Kilgore says (2003: 1), outer space is imagined to be "capacious enough" to hold hopes for social alternative. The space frontier is also seen as a site of renewal and resolution, one that would redeem the past and transform the present" (Ibid: 3). This idea of a fresh start resonates with Redfield's description of history "cleansed above the planet" (Redfield 2011: 797); outer space imagined as *a tabula rasa* on which to set about improving the human condition. Kilgore claims astrofuturists are unified by their faith in the potential of the open space frontier, with a sense of magnificent opportunity binding the ambitions and anxieties of space settlement advocacy. And yet, far from an escape to alternative, the space frontier can be read as the most recognisable part of a historical and political continuity that is decidedly inescapable. The more radical rhetoric espoused by NewSpace actors includes the words of Rick Tumlinson (2016), founder of the space settlement advocacy group, the Space Frontier Foundation, who describes the commercialising of outer space in terms of "revolution". However, Tumlinson and his peers are found merely amplifying familiar American principles of libertarian individualism.

The space settling vision shared by Tumlinson and other "orphans of Apollo" responds to their disappointment of the post-Apollo era, which created a distrust in government institutions to fulfil the spacefaring future promised by the Moon landings. This distrust further undergirds a belief in the powerful and virtuous figures of the hardy individual and the visionary entrepreneur. Here, the frontier becomes their stage for taking authorship, on behalf of humankind, of a future beyond Earth that is also beyond the control of any nation state. An important precedent for this figure can be found in the science fictions of Robert A. Heinlein and his character, D.D. Harriman. In brief summary, the story of *The Man Who Sold the Moon* (1950) follows Harriman, an entrepreneurial baron, in his attempts to travel to and possess the Moon. He succeeds by negating government authority through corrupt methods and accomplishes the first flights to the Moon, which later stimulate the building of lunar settlements. The story is true to Heinlein's faith in visionary individuals combining with capitalist mechanisms to ultimately produce wider social good. *The Moon is a Harsh Mistress* (1966) is another noteworthy novel by Heinlein, which tells a story of a lunar colony revolting against the rule of Earth in a cosmic replay of the American revolution (Day 2007a). More importantly, Heinlein uses the novel to discuss libertarian ideals at work in a frontier society. As personified

Figure 23: Apollo 11 astronaut Buzz Aldrin salutes the U.S. flag on the Moon (1969). Credit: NASA.

by one revolutionary character, Professor De La Paz, Heinlein describes a lunar colony independent of Earth government, a site of unregulated free markets that is upheld by self-determined "rational anarchists" (Heinlein 1966: 64). Heinlein is unabashedly pro-capitalist and pro-American. His novels abound with rich businessmen who "buck the system and build the rocket ship" (Day 2007a), embodying the message that "the conquest of space is good business" (Kilgore 2003: 95). As analyst Dwayne A. Day (2007a) describes, Heinlein's stories codify "both the excitement about spaceflight and the belief in the power of the free-market." It is therefore no surprise to see NewSpace actors find such affinity with Heinlein and his frontier imaginary.

American myths help to explain that NewSpacers' faith in the space frontier is inspired by historical figures not only from the mid 20th century, but as antiquated as the late 15th century. Christopher Columbus stands as a foremost symbol of the progressive adventurer, sailing bravely into the unknown to discover and "civilise" new worlds. In his postcolonial critique, Redfield (2002: 797) conveys the selective memory of Columbus as an explorer, nation builder and risk taker (as opposed to genocidal invader and exploiter of lands and peoples), to suggest contemporary space settlement advocates are "perhaps the last unabashed enthusiasts of imperialism." The recurring, seafaring figure of Columbus in NewSpace imaginations reaffirms the frontier as a subject of cliché, which further consolidates the sense of continuum about the Euro-American spaceflight imaginary. As both Redfield (2000: 156) and Eisfeld (2018) reflect upon, the re-positioning of stereotypical, earthly narratives of conquest to familiarise the extraterrestrial convey a problematic "refusal to learn" (Ibid: 103) from the violence and social injustices of the past. It may be just a word, but the word "frontier" signifies how the language used to talk about outer space "matters" (Messeri 2017c), particularly concerning possible futures and their potential for social, cultural and economic alterity. There is a curious irony about the frontier representing the boundless promise of outer space. These enduring values in thought and practice, that are implicitly and explicitly referred to by colonial language, already project a sense of closure onto the infinite expanse of the cosmos.

Nostalgia

They say history repeats itself, but history is only his–story.

— Sun Ra

So embedded is the frontier myth in American society and culture, it generates a powerful feeling of nostalgia that moves in opposing directions: into the past, down on the ground and skywards, into the future. The frontier both stimulates and is supported by nostalgia, as it forms a bridge between the memory of bygone eras and the anticipation of things to come. Catherine L. Newell (2013) finds an interesting material instance of this bridge by chronicling the history of the Disneyland theme park in Florida, which opened in 1955. Two sections of

the park, "Frontierland" and "Tomorrowland," were *edutainment*[17] attractions set respectively in the old American West and a spacefaring future, complete with a rocket landing on the Moon. As Newell (Ibid: 416) conveys, these past and future representations created a "mirror image" of each other: both depicting the conquest and settlement of open wilderness in a very American tradition of "westering" (Launius 2005: 131). The frontier is a myth through which Anglo-American NewSpace actors understand the past, make sense of the present and dream of things to come. Or in other words, it is the "deeply flawed" foundation upon which "space advocates have built their plans" (Limerick 1994: 13). Limerick and FitzGerald's notion of "history as straight line" is also embodied by the bridge found by Newell in Disneyland. In the minds of space settlement advocates, the line neatly bridges technological projects from the 15th century to the present and into the future. Here, a cultural memory of Columbus' discovery of the New World resonates with the "pioneering spirit" of the Apollo program — a spirit later manifest in the contemporary spectacle of the SpaceX-enabled Launch America.

Nostalgia also helps to explain the cultural power of Apollo which, in a so far unparalleled manner, crystallised the promise of a future in space by recreating frontier imagery on another world. Rhyming with the cinematic direction of Stanley Kubrick in *2001: A Space Odyssey*, planting the flag in lunar dust creates an imaginary match-cut to colonial gestures of the distant past. Through this gesture, the space frontier is made recognisable. Andrew Smith (2006: 239) agrees that the past and future share a "curious identity… [where] living in one is not so very different from living in the other." The frontier is a site of multiple conflations, where the temporal overlay represents the "distorted view" of history mentioned by Limerick (1994: 13) above. Planting the flag returns to the "complex dialectic" that Jasanoff and Kim (2015: 21) find at play in the sociotechnical imaginary. Their ideas of excavation and reinterpretation from history resonate with notions of a selective, distorted memory at the heart of NewSpace visions of the future. Apollo is again particularly meaningful here, for the way the programme's technological accomplishment has become increasingly abstracted and separated from its socio-political history. In an image that aligns with Benedict Anderson's ideas about nations as imagined communities, these private space settlement advocates appear bound as much by their capacity to remember the Space Race as their capacity to forget (Anderson 1983: 201, 204). As David Valentine (2017: 194) concisely reminds:

…the promise of a "giant leap for mankind" took shape as both the American Indian movement and the civil rights movement were coalescing, seeking to remind white American of what it refused to remember: the role of Native dispossession and African enslavement in the US state's founding and the exclusion of Black and Native people from the very constitution of "mankind."

17 A form of entertainment designed to be educational.

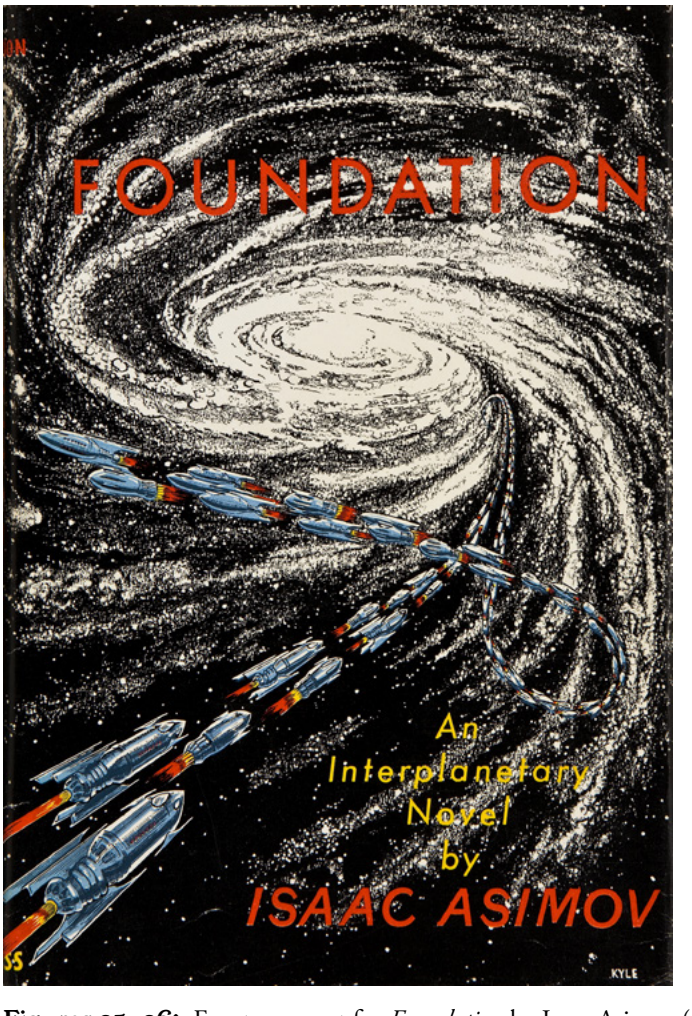
Figure 24: *Destination Moon* (1950) directed by Irving Pichel. Still. Credit: Eagle-Lion Classics.

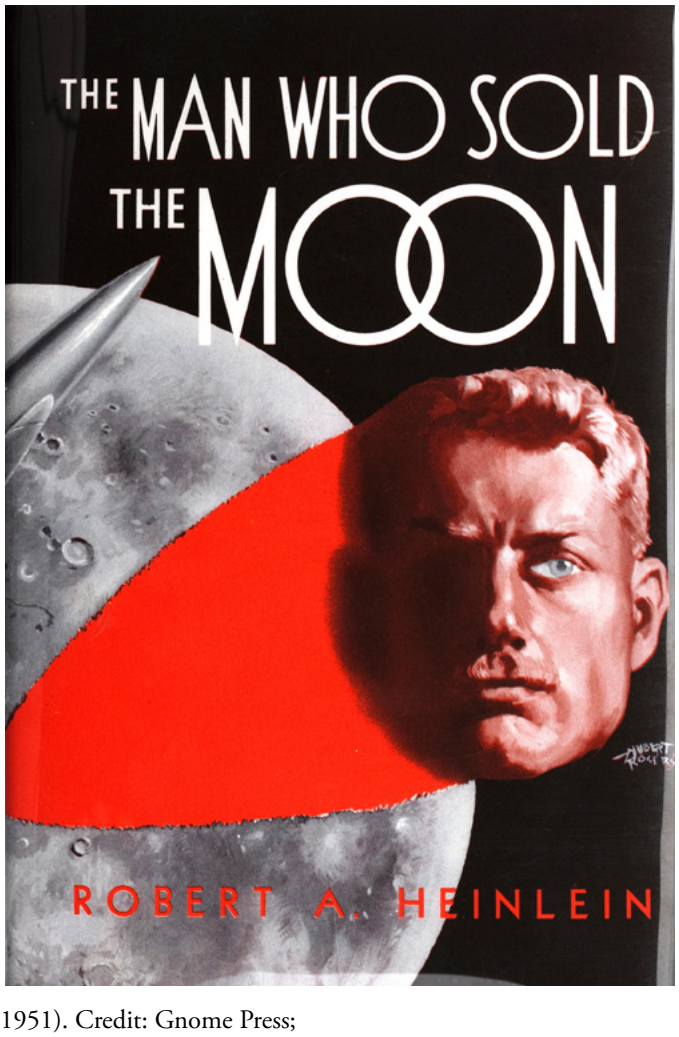
The civil rights protests about the Apollo 11 launch by Black and Native Americans, in response to their racial discrimination and social marginalisation, offered a glaring contrast to the universalising language used by NASA (1969) and the state to frame the Moon landings as, in Neil Armstrong's infamous words, "a giant leap for mankind." The spatial and relational discord, separating footprints in the lunar dust from footsteps on the streets, was captured by the musician and poet Gil Scott-Heron (1970) in his words: "I can't pay no doctor's bill/but Whitey's on the moon." The protests and civil unrest are historical moments that many contemporary NewSpace actors, predominantly white Americans, evidently forget when mobilising Apollo for heightening the promise of space and motivating, among other ambitions, a return to the Moon. Into the present, there is a strange symmetry to be found between Apollo and events surrounding the recent "Launch America" mission. On the 30th of May 2020, as the SpaceX Falcon 9 rocket launched astronauts Doug Hurley and Bob Behnken from Cape Canaveral, with the President and vice President of the United States watching on, cities across the country were in the midst of a wave of protests, under the banner of the Black Lives Matter movement, against the continuing racial discrimination and oppression of Black Americans that is furthermore compounded by the effects of the ongoing global coronavirus pandemic. Describing a "cascade of crises," Ingrid Burrington (2020) addresses a far-future reader as she presumes that, along with the times of Apollo, the protests of 2020 will not be noted by any future history of "the momentous rocket launch."[18]

Science Fiction

Science fiction is arguably one of the most important influences on the designs and visions of NewSpace actors. Elon Musk proclaims, "I really want us to become a true space-faring civilization… and making true the things that one sees in sci-fi movies and reads in books about the future" (Musk in Valentine 2012: 1060). Space entrepreneur Peter Diamandis (2013) further describes "the future that I envision is a science fiction future." Musk, Diamandis, Jeff Bezos and other NewSpacers are avid science fiction readers (Economist 2019). However, it is important to consider *which* science fictions resonate the most with the NewSpacers in question, for their choice of references are by no means incidental. As David Valentine explains, the precedents found in science fictions build the premise of a space future that is already known to them: "a future past" (2012: 1064). The conceptual anchors of this particular space future were forged in the stories from the science fiction gen-

18 Burrington (2020) critiques a cowardly and "cynical" agenda of Bezos, Musk and other NewSpacers, arguing any "long-term anything that doesn't explicitly incorporate the work of dismantling white supremacy is, in fact, still short-term thinking."



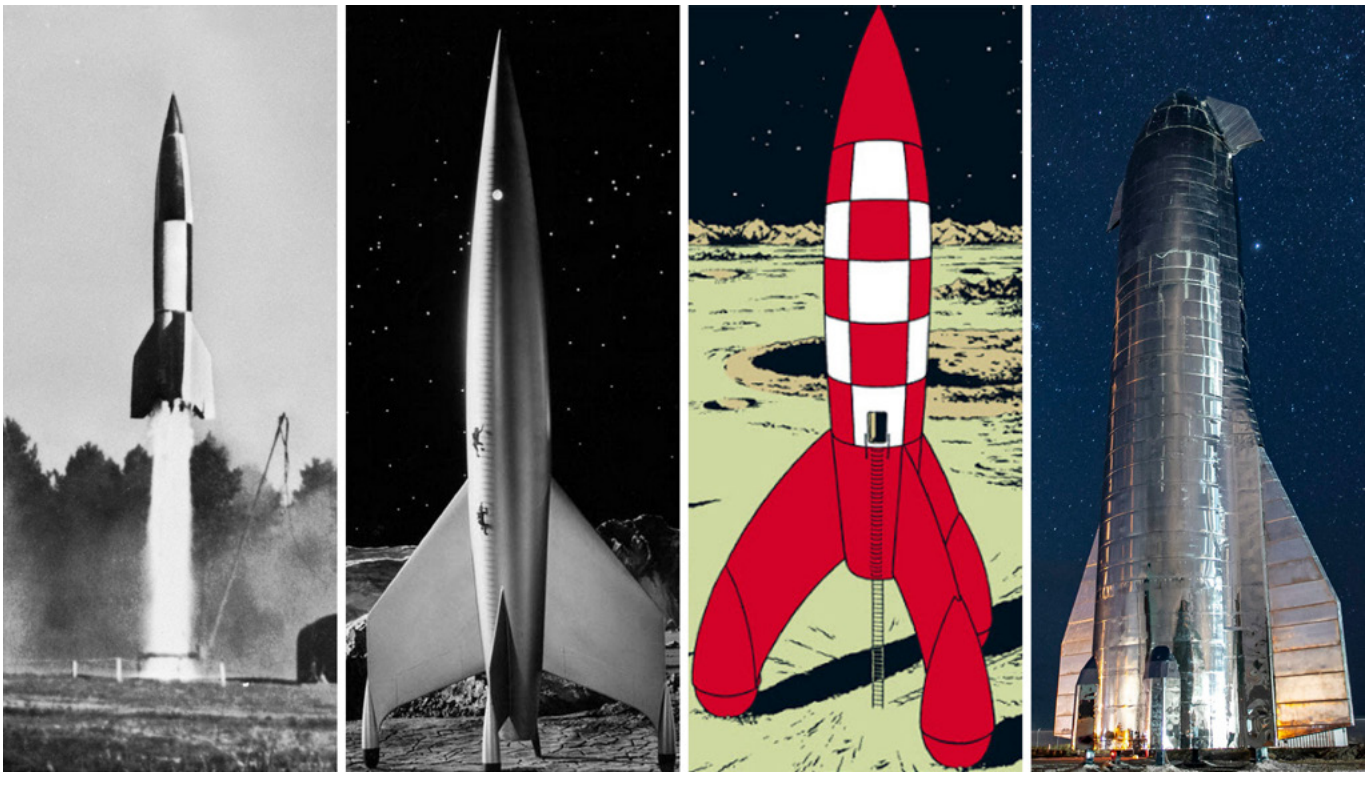


Figures 25-26: Front cover art for *Foundation* by Isaac Asimov (1951). Credit: Gnome Press; Front cover art for *The Man Who Sold the Moon* by Robert A. Heinlein (1950). Credit: Shasta Publishers.

re's supposed "golden age" (1930s–1960) and authors including Isaac Asimov, Arthur C. Clarke and Robert Heinlein. Many of their stories describe thriving space settlements, often led by visionary entrepreneurial figures, and continue to influence commercial space actors today. In novels such as *Foundation* (Asimov 1951) or *The Man Who Sold the Moon* (Heinlein 1950), pioneering individuals harness spaceflight to issues of human progress and survival, where social good goes together with capitalist wealth production. In rhetoric and in action, NewSpace actors are arguably materialising a 1950s vision of a spacefaring civilisation in the 21st century.

Complementing the foundational American myths, science fiction is another way to learn that the future central to commercial space settler ambitions today belongs curiously yet undeniably to the past. The genre also helps to connect the visions and values of the present NewSpace protagonists with a historical pro-space activism that predates the Apollo era. Kilgore's survey of the pre-eminent astrofuturists of the 20th century helps to trace the lineage of this spaceflight advocacy to the international rocket societies of the 1920s, 1930s and 1940s that housed Willy Ley, Wernher von Braun and Robert Goddard among others. Though north American history and north American protagonists are at the fore of this thesis, by drawing a European lineage of spaceflight enthusiasm, Kilgore helps to define the spacefaring civilisation as a *Euro*-American imaginary. Wernher von Braun was a German engineer who designed the V-2 rocket that was deployed by Nazi Germany in the Second World War, before immigrating to the US to later become chief Apollo engineer; developing the Saturn V rocket that sent American astronauts to the Moon. Namely in his collaboration with Walt Disney, von Braun extended is influence into popular culture through the television series *Tomorrowland*, which described optimistic and explanatory stories of an American future in space (Newell 2013). Von Braun was "heavily involved" (Grampp 2015: 16) in the series as a technical consultant and appeared on camera as a scientist moderator. His own enthusiasm for space travel was inspired by Fritz Lang's 1929 science fiction film, *Frau im Mond* (Woman on the Moon), which described a conquest of space motivated by material wealth and the promise of lunar gold (Redfield 2002: 798). From scientists to science fiction writers, the principles of astrofuturism were proliferated and reinterpreted by alternating figures throughout the 20th century and into the 21st. Mirroring the historic rocket societies, NewSpace can be read as a contemporary form of astrofuturism that is led by a core of increasingly powerful individuals.

Following the astrofuturist thread reveals a conflation of childhood dreams with unwavering positions on space colonisation, exploitation and the human place in the universe. David Valentine also notes the extreme time-horizons at play in the future visions of NewSpace actors, where human space travel is placed along very long arcs of human history. Reaching as far into the distant past as into the deep future, this long perspective is totalising, arguably exceeding the limits of the NewSpacers' own imaginations (Valentine 2012: 1055). Science fiction precedents help to understand where these time-horizons come from, and



Figures 27-30: *(Left to right)* A V-2 rocket launches, developed by Wernher von Braun for Nazi Germany (1945). Credit: Globe Photos; The rocket in *Destination Moon* (Pichel 1950). Credit Eagle-Lion Classics; In *Tintin: Destination Moon* (1953). Credit: Methuen; *The Starship* spacecraft prototype developed by SpaceX (2019). Credit: SpaceX.

how they work as powerful narrative devices for the spacefaring cause. Through a long view of history, NewSpace actors frame their technological projects in grander future narratives, unfolding along evolutionary arcs and historical cycles.

The science fiction authors Asimov, Clarke and Heinlein set many of their stories in scales of macrohistory, where empires can rise and fall; civilisations can begin and end; and actions can alter the course of history in grand scales of space and time. Asimov's *Foundation* Trilogy is a particularly noteworthy example. *Foundation* (1950) imagines a distant future where humanity has expanded into a spacefaring civilisation on a galactic scale. Most importantly, the plot focuses on a band of individuals acting to preserve and renew human civilisation in the midst of its inevitable decline and near collapse. The protagonists of the story foresee an ominous future path of humanity and work to build an alternative. The influence of Asimov is pervasive to NewSpace, resonating in the ideological positioning of many important actors. In an explicit nod to the inspiration of Asimov to Elon Musk, the *Foundation* trilogy were laser-etched onto a quartz disc and sent into orbit by SpaceX in the glove compartment of a Tesla electric car (SpaceX 2018). Heinlein was also subject to a similar gesture when his novel, *The Man Who Sold the Moon* (1950), was sent into orbit aboard Virgin Galactic's SpaceShipOne in 2003 at the request of Peter Diamandis (2013). This novel was also adapted into a science fiction screenplay for the film *Destination Moon* (1950), which was co-written by Heinlein and directed by Irving Pichel. The cyclic imagery of Asimov and Heinlein also resonates with the words of XCOR Aerospace founder Jeff Greason, who says, "I don't want to live in the last days of a declining, once great society. I want to live in the first days of the next great human adventure." (2012). Greason's words, in turn, echo the sentiment found in the closing sequence of *Destination Moon*, where after the rocket lifts off from the lunar surface to return to Earth, the title cards proclaim, "This is the End of the Beginning."

The impact of the *Destination Moon* (Pichel 1950) reverberates through other NewSpace materialisations and representations of human spaceflight. One of the more distinct examples is the SpaceX rocket Starship, which is "designed to carry both crew and cargo to Earth orbit, the Moon, Mars and beyond" (SpaceX 2020). The Starship has become SpaceX's top priority after the successful "Launch America" missions. It promises to be the vehicle serving multiple trips to Mars and ultimately the establishment of human settlements on the red planet. The Starship has been gradually publicised in a series of artist impressions and annual "update" press events that are hosted by Elon Musk, himself. The September 2018 event was held at night at the SpaceX factory in Boca Chica in Texas, beneath an enormous prototype of the rocket. The towering 120 metre Starship stood illuminated by floodlights below, its steel-plated shell gleaming. The video documenting the event is punctuated by drone footage circling the prototype from above, capturing the vehicle as if it were a metropolitan skyscraper. Gesturing towards the metallic leviathan, Musk (SpaceX 2018) opens the event by describing "the most inspiring thing I've ever seen."

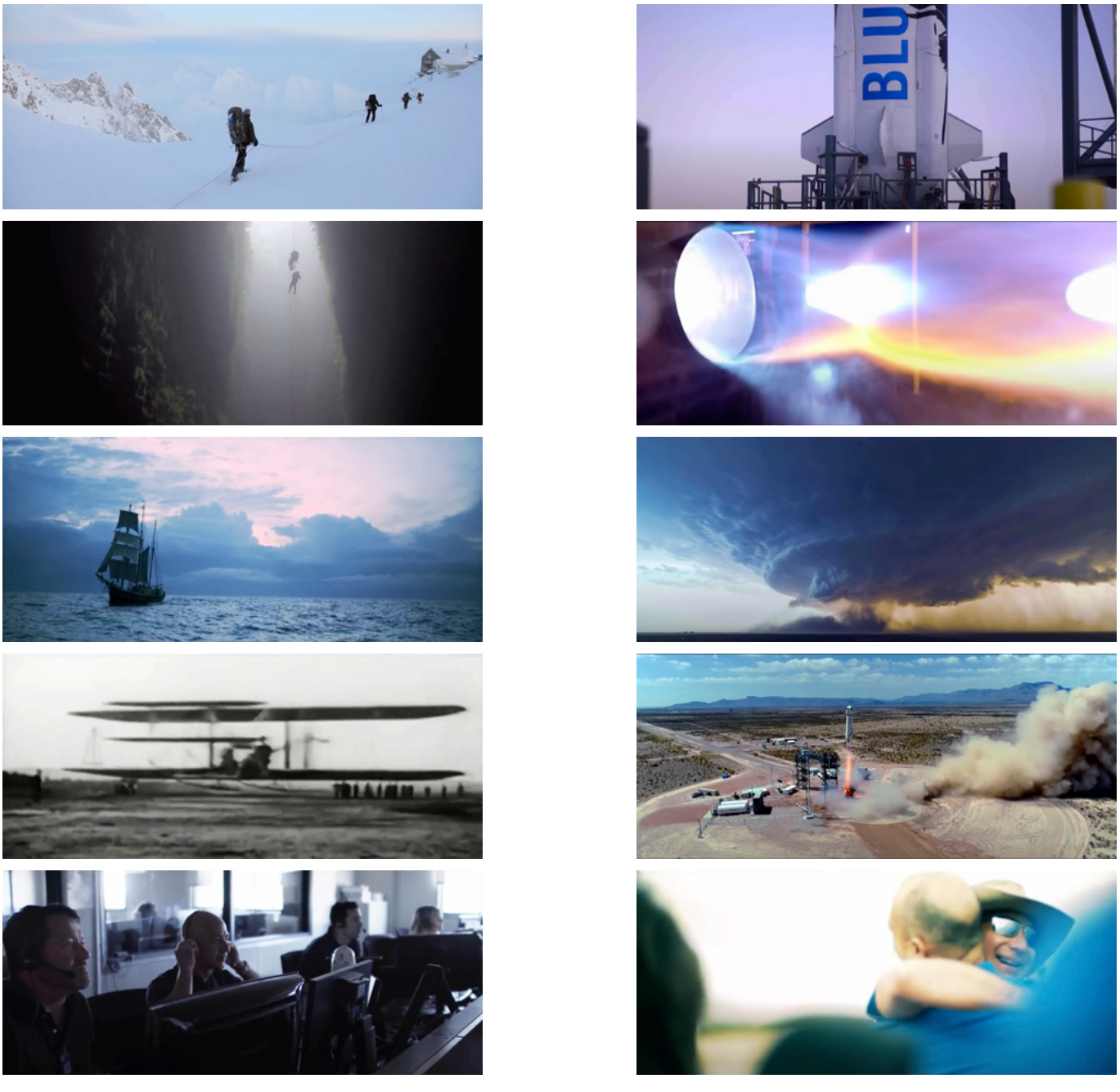


Figure 31–40: *Millions of People Living and Working in Space*. Stills from the video by Blue Origin (2018). Credit: Blue Origin.

In its iconic conical form, with a tripod of fins at the base, there is an uncanny resemblance of the SpaceX Starship to the rocket in *Destination Moon*, so much so that William Lempert (2020) describes it as a "Burning Man-esque homage" to the original. The two rockets are undoubtedly alike. However, there is another 1950s design that Musk refers to as his inspiration. "I love the Tintin rocket design, so I kind of wanted to bias towards that," says Musk, "if in doubt go with Tintin" (SpaceX 2018). The "chequered, cigar-shaped" rocket (Dunnett 2009: 593) in which Tintin, the famous comic strip character created by Hergé, travels to the Moon also closely resembles the Starship in form. By explicitly referencing Tintin, Musk also completes a curious triangle of rocketry aesthetics that is rooted in the 1950s and explains the "very strong parallels" found in their different visions of space travel (de Syon 2018: 191). Tintin's spacefaring adventures spanned two albums, *Destination Moon* (1952) and *Explorers of the Moon* (1954), after Hergé himself was inspired by the early photographic stills from the original *Destination Moon* film (Goddin 2011: 10). The rocket design thread connecting Musk to Hergé to Heinlein ultimately leads to Wernher von Braun and his profound influence on western public perceptions of space travel in the mid-20th century. George Rémi (Hergé) himself was dedicated to maintaining as much scientific grounding as possible in his outer space fictions. In his resolution for realism, Hergé drew upon material produced by astronautical science and rocket clubs, including von Braun's German Rocket Society (de Syon 2018: 192), for they were the primary source of pre-war representations of outer space (Dunnett 2009: 593). De Syon (2018: 190) describes a resulting "V-2 realism" in the designs of Hergé, where Tintin's Moon Rocket is a "spitting image" (Ibid: 192) of the weapon developed by von Braun. The V-2 itself, as "the first man-made object to actually penetrate space" (de Syon 2018: 190) can be read as one of the first iconic objects of spaceflight. The production history of *Destination Moon* (Pichel 1950) adds another link in the chain of popular outer space imagery, that emphasises a sense of continuum about spaceflight imaginations from the 1950s into the present. The artist and illustrator Chesley Bonestell worked with director Irving Pichel on the special effects art for the film. Bonestell would also later work closely with von Braun on a range of projects, most notably for an influential series of spaceflight articles for Collier's magazine entitled "Man Will Conquer Space Soon" (1952), which were instrumental in von Braun's attempts to change scepticism in the American public about missions to the Moon (Grampp 2015: 16).

Millions of People Living and Working in Space

The short promotional video by Blue Origin (2018), "Millions of People Living and Working in Space," reads as a sort of mission statement for the aerospace company. Just under two minutes long, the video brims with imagery and words that combine multiple American and astrofuturist myths together. Furthermore, the audiovisual story told here by Blue Origin narrates not only the vision and values of *their* mission but, in a broader sense,

Figure 41: A colonial-era ship in *Millions of People Living and Working in Space*. Still from the video by Blue Origin (2018). Credit: Blue Origin.

Figure 42: *Mayflower in Plymouth Harbor* (1882) by William Halsall. Credit: Pilgrim Hall Museum.

arguably represents those of the commonly held, Euro-American spaceflight imaginary. The video opens with imagery of exploration on Earth; the sequence moving from mountain climbers atop snowy peaks to divers venturing deep undersea. Bezos narrates the video himself, stating "the human need to explore is deep within all of us" (Ibid), playing to the myth of cosmic expansion as a biological imperative. He assuredly continues, "our ancestors crossed mountain ranges, sailed open oceans to map new lands, and sought out the unknown while always looking to the stars" (Ibid). The imagery then cuts sharply from desert plains to a colonial sail ship on open water; to the Wright brothers first flight; to Bezos in his seat in mission control as Blue Origin engineers inspect a rocket before launch.

Sequencing imagery of ships, aeroplanes and rockets, the video affirms a "technological determinism" (Messeri and Vertesi 2015: 80) about Blue Origin, where technology is held as the key to opening the space frontier. Through visual association, the film places spaceflight as the next logical step for human exploration and technological evolution. Marco Caracciolo (2015: 75) explains "metaphorical blending" as a narrative strategy for compressing temporally disparate events "into a single scenario… in order to outline changes over an extremely long timespan." In studying this strategy in *2001: A Space Odyssey* in both its media forms as film (Kubrick 1968) and novel (Clarke 1968), Caracciolo observes how, first, Clarke distils entire cultural histories into symbolic materials: "Stone gave way to bronze, and then to iron" (Clarke 1968: 38); or objects: "The spear, the bow, the gun, and finally the guided missile" (Ibid: 38). In both cases, Clarke's strategy concisely describes human evolution as augmented and shaped by technology in a "cumulative process" (Caracciolo 2015: 77). In Caracciolo's words (Ibid: 77), the metaphorical blend enables technologies to "fall on a continuum," and for the reader to "project them onto an imaginary timeline" — a timeline that is radically compressed by Stanley Kubrick in the film's iconic match-cut sequence (1968). In the first eighteen seconds of the Blue Origin video, a metaphorical blending strategy is very much at play. The imagery of ancestral migrations and consistent technological advance signify a natural, cumulative continuum for spaceflight to extend. This structure also echoes the episodes of Disney's *Tomorrowland* trilogy, where scientific explanations about space travel and dramatic adventure sequences are prefaced by a "decade-long or even millennium-long history of respectively the space-, moon- or mars projects […] retold through a cartoon" (Grampp 2015: 18). In another blend, the Blue Origin video collides imagery of rocket engines firing with footage of looming tornado clouds and rolling ocean waves, conveying a harnessed technological power comparable to forces of nature.

Pausing on the image of the sail ship in the first sequence, it is worth noting its uncanny resemblance to the Mayflower, the iconic ship that sailed the first pilgrims from England to the Americas in 1620. The Mayflower has also been used elsewhere as an historical analogy for future space settlement. Delivering a public lecture, Rick Tumlinson (2016) describes Blue Origin and

Figure 43: A painting of a space habitat concept by artist Rick Guidice for the Summer Studies at NASA Ames Research Centre. *Interior including human powered flight* (1975) / NASA ID Number: AC76-0628. Credit: NASA Ames.

SpaceX as "building the Mayflowers," tying their reusable rockets directly to settler-colonial precedents. The inclusion of this particular ship in the Blue Origin video, cast in a colour and light so close to the 19th century painting by William Halsall, implies a deliberate decision by the company to root their human spaceflight mission in American history and mythology. This feeling is persistent in other imagery in the video: Bezos is captured wearing a cowboy Stetson hat, another icon of the old West, as he embraces a colleague after a successful launch; and over imagery of a space capsule opening its parachutes and safely landing on the desert floor, Bezos echoes the infamous words of Apollo astronaut Neil Armstrong by saying "When they honour those first explorers who said, "let's go," they'll remember these bold steps." (Blue Origin 2018). In the concluding sequence of the video, the rhetoric shifts from extensions to cycles. Bezos states "now is the time to open the promise of space to all and lay the way for generations to come," (Ibid) positing Blue Origin as the pioneers of the space frontier, the first generation of space settlers to be remembered "from a rocky moon or colonies floating in open space" (Ibid). Further echoing the cyclic tone of Destination Moon (Pichel 1950), the video ends on the words "We are Blue Origin. And this is just the beginning." (Blue Origin 2018).

Suburbia in Space

Where exactly would millions of humans live in space? This question was posed by Jeff Bezos to his audience at the Blue Origin event, "Going to Space for the Benefit of Earth," on the 9th May 2019 in Washington DC. It was here that Bezos presented a vision for human futures in outer space, and also unveiled Blue Origin's first lunar lander prototype, *Blue Moon*. To answer his own question, Bezos promptly referred to Gerard K. O'Neill, Princeton physics professor and prominent space settlement advocate. In the early 1970s, O'Neill developed and promoted a vision of enormous artificial colonies floating in outer space; manufactured megastructures capable of housing thousands of people off-Earth. O'Neill's vision for floating space settlements germinated in an assignment for his Princeton physics students, where he posed the question: "is the surface of a planet really the best place for an expanding civilisation?" This educational thought experiment later developed into a larger NASA-funded study in the summer of 1975, which examined the possibility of offworld space settlement and produced a number of habitat designs. As architect Douglas Murphy (2016: 78) describes:

The colonies would take the form of large cylinders, potentially over a kilometre long, which would spin at a constant rate to create the effects of gravity within [...] The cylinders would be partially glazed to allow for sunlight to reach the interior, while large shades and baffles would protect the inhabitants from cosmic rays. Other variations involved spherical or ring-shaped environments, familiar from science fiction scenarios such as 2001: A Space Odyssey...

Later in 1976, the space settlement vision was popularised by O'Neill in a book — pointedly titled *The High Frontier: Human Colonies in Space* — that imagined life on the floating colonies and described their designs. The vision was described in a series of rich paintings depicting life on the settlements by artists Don Davis and Rick Guidice, which remain "some of the most familiar images of speculative space science" (Scharmen 2013: 541). The imagery of the book and the paintings helped to forge O'Neill's status as a visionary for large parts of the NewSpace movement. At the Blue Origin event, after briefly introducing O'Neill and his vision for space settlements, Bezos proceeded to share a series of speculative imagery created by his company to describe their version of the "O'Neill colonies." The series heavily tropes, to the point of "pastiche" imitation (Scharmen 2019b), the paintings by Davis and Guidice. In one Blue Origin image, the composition is foregrounded by an elk, standing high on a mountain ridge overlooking a natural park, where waterfalls cascade into a green, wooded valley. Behind the elk, a river runs to the horizon, passing grand cityscapes along its winding path into the distance. The scene is enveloped by a vast cylindrical architecture, placing the landscape in the interior of an enormous artificial habitat. Outside, the whole Earth rises to frame a spectacular vision of a splendorous space colony.

On stage, Bezos (Blue Origin 2019) enthuses about the desirability of these future space habitats. "These are beautiful," he says, "these are really pleasant places to live… people are going to want to live here." In the manner of an estate agent, he associates the settlements with Hawai'i to paint them as an off-world paradise: "These are ideal climates; these are shirt sleeve environments; this is Maui on its best day, all year long." (Ibid). The other images in the Blue Origin series depict urban landscapes that openly mimic or directly collage existing buildings and cityscapes on Earth, including Singapore, Florence and Beijing (Scharmen 2019b); another image foregrounds a farm house adjacent to a university campus, separated by mowed fields. In these enclosed environments, elks stand; drones and eagles soar; and trains run into the distance on raised tracks. If you look closely, you can find human settlers sparsely populating these imagined worlds, looking out from the balcony of a skyscraper or dining 'al fresco' at a hillside restaurant. However, they are ultimately rendered microscopic by the perspective of the imagery, which aims to capture the enormity of the megastructures they inhabit. Their inclusion is not to describe future ways of life in space, but to simply emphasise the vastness of these manufactured worlds. In a curious yet deliberate irony, these "pleasant places to live" are imagined rather lifeless. Imagined over a kilometre long, the empty interiors convey a promise in their vacancy, acting as blank screens for any potential settlers to project their desires. This quality is also observed by Fred Scharmen (2013: 543) in the original paintings of the O'Neill space settlements by Don Davis, who would "paint the colony interiors empty, as if just at that point in construction before the first people moved in." As I will expand upon in the second chapter, this promise of emptiness is further synonymous with imagery of desolation that constitutes the myth of the frontier.

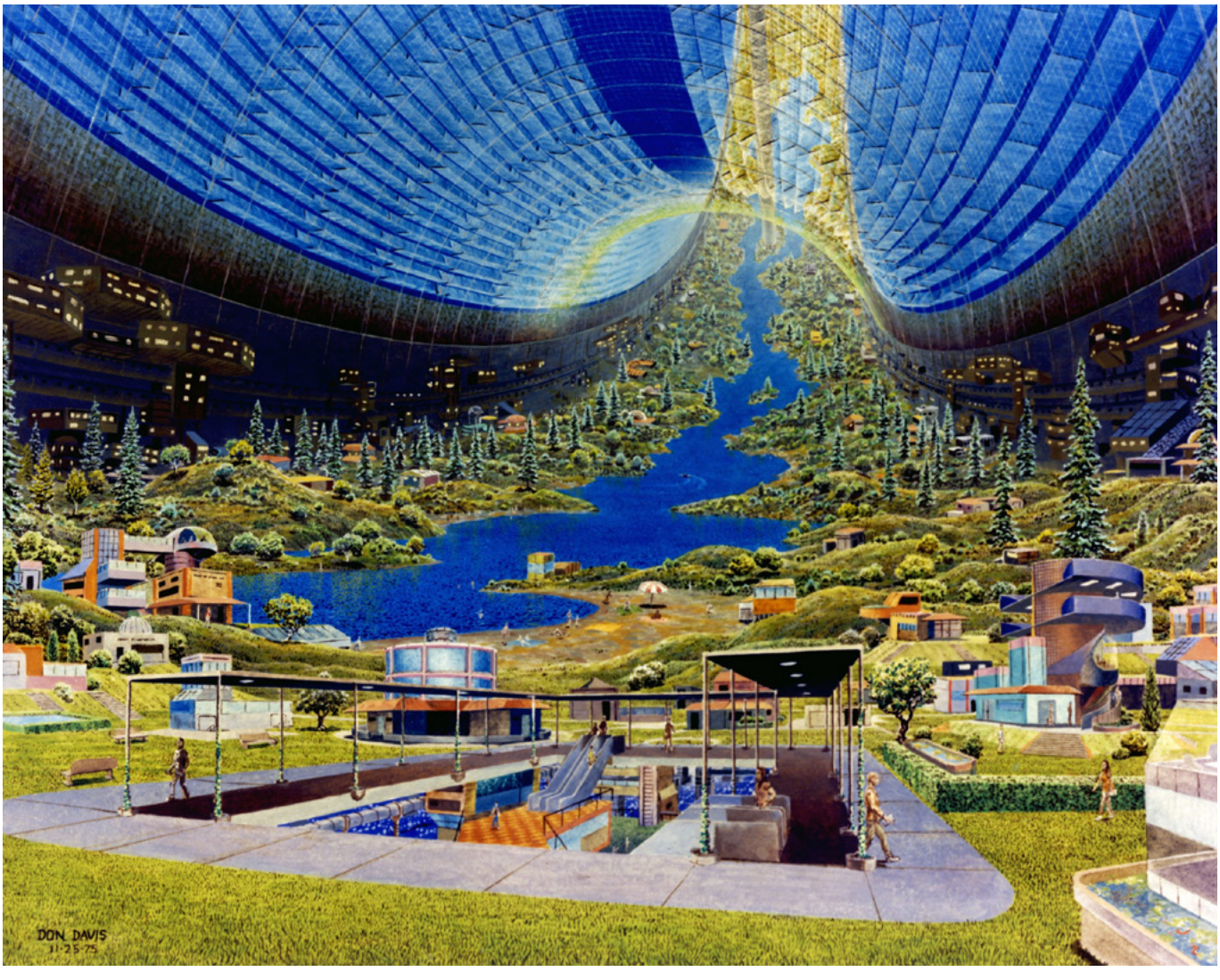


Figure 44: A painting of a space habitat concept by artist Don Davis for the Summer Studies at NASA Ames Research Centre. *Interior view* (1975) / NASA ID Number: AC75-2621. Credit: NASA Ames.

Figure 45: An artist's rendering of a space colony for Blue Origin (2019). Credit: Blue Origin.

Jeff Bezos happened to be a student of Gerard K. O'Neill at Princeton in the 1980s. As designer Fred Scharmen (2019b) conveys, the parallels between the space settlement visions of O'Neill and Bezos can be described as "note for note." For Scharmen (Ibid), the Blue Origin vision of floating space settlements imagines "nothing new." With this in mind, it is worth exploring the O'Neill designs in more detail along with their history, to consider what such a blatant copy-pasting by Blue Origin implies. If the images of space colonies by Blue Origin appear caught in a vacuum, the same cannot be said for the ones they imitate (Scharmen 2019). While O'Neill is held by Bezos and other commercial space actors as a visionary "dreamer" (Blue Origin 2019), Scharmen and De Witt Douglas Kilgore's critique demonstrate that his space settlement vision was far from a radical departure from a familiar, earthly way of life and its political and economic structures. Kilgore (2003) further articulates that the designs pertained to a way of life that belonged to a distinctly white, middle-class, 1950s America; a suburban, domestic ideal from O'Neill's past that renders Bezos' repetition of his vision, almost half a century later, even more troubling.

In examining the wider socio-political history around his vision, Kilgore (2003: 172) draws interesting parallels between O'Neill's vision for a "humanisation of space" and the "white flight" of the American middle-class in the 1970s, who escaped from heterogeneous cities to homogeneous suburban sprawls. Though O'Neill adopted an outwardly apolitical stance towards space futures (in the interests of garnering government and corporate sponsorship), Kilgore argues that he made space settlement desirable to a broadly middle-class audience, who had flown from the city where societal problems including poverty, violence and corruption were considered rife and also synonymous with racial diversity (Ibid: 172). For Kilgore, "The flight to the suburb becomes a metaphor for O'Neill's imagined retreat from public engagement into private Utopias of endless leisure and domestic bliss." (Ibid: 173). The suburbs in space and on Earth ultimately represent a failure of political imagination, "motivated by fear of alterity and a passion for homogeneity" (Ibid: 172). In appealing to the middle-class, the vision of life and social order in space projected by O'Neill is easily recognisable as a picket-fence ideal from mid-century America. As Kilgore infers, O'Neill assumed that the first human space settlers would embrace the familiar over the new and directed NASA artists Davis and Guidice to populate their colony paintings with "soft-green textures of a tranquil domesticity." (Ibid: 172). The desire to escape from the city and its perceived societal problems further resonates in other design choices by O'Neill and the artists, who frequently referred to the "pleasant" life of Italian villages or French hill towns, afforded by their low-density populations and separation from industry (O'Neill 1976: 65). In Washington, Bezos (Blue Origin 2019) repeated the idea of a suburban segregation of life from work, by proposing to exile heavy industry to Low Earth Orbit and enable Earth to be "zoned residential and light industry."

As Kilgore helps to understand, isolation forms the basis of O'Neill's vision for space settlement. The infinite expanse of physical space and abundance of material resources enabled him to imagine "open technological platforms whose content could be determined by their residents" (Kilgore 2003: 170), where colonists can not only build their own frontier but their own utopias. O'Neill believed the space frontier to be capacious and plentiful enough to house all peoples, cultures and beliefs in a human civilisation free from conflict. Yet this belief is founded more upon a faith in technological infrastructures than in human nature. If disagreements or unrest were to arise, O'Neill argued space colonists could avoid conflict by simply adding another independent colony to the diaspora: "moving ever outward from the Sun." (Ibid: 169). This sense of parted individualism is found in another NewSpace settlement design, albeit one bound to a planetary surface. In projecting a future settling of Mars, SpaceX produced a series of architectural renders describing an expanding Martian city, that were presented by Elon Musk at the International Astronautical Congress in Adelaide in 2017. Surveying the city's composition of different modules "sprawling across a rough grid," Scharmen critiques an imagined social existence based on "solipsistic" isolation: "If we are isolated in our own bubbles," Scharmen (2019c) says "we are not sharing space." Whether imagined on the surface of Mars or floating in space, this is diversity maintained by separation.

O'Neill's technological optimism is described by Kilgore (Ibid: 185) as ultimately a "defensive" political position. Kilgore thus probes beyond the immense and impressive scales of the floating megastructures and the rich renderings by Davis and Guidice to find no utopian, socio-political experiment but a paradoxical closure of political imagination in open platforms, manifest in the "endless extension of contemporary life and customs" (Kilgore 2003: 175). Echoing the "white flight" of middle-class America in the 1960s and 70s, the space colonies embody an endless retreat in an infinite cosmic expanse, where diversity is negated or deferred in an array of homogeneous island utopias. O'Neill is echoed by Bezos and other NewSpace advocates in their fixation on space resources and the potential to evaporate human conflict, almost instantaneously, through their exploitation (O'Neill 1976: 11). However, just as when white America fled from societal problems and the heterogeneity of the metropolis, evaporating social problems means something very different to resolving them.[19]

From reading Kilgore, the overriding impression of O'Neill is of a futurist who deferred to techno-centrism and sought comfort in the past. In drawing upon the domesticated, suburban experience of a privileged, mid-

19 O'Neill's space settlement vision is also recognisable — along with Kilgore's critique — in the dystopian science fiction film *Elysium* (Blomkamp 2013). The film describes a future social and spatial divide between Earth citizens living in poverty on Earth and a wealthy elite inhabiting an enormous wheel-shaped megastructure floating in Earth's orbit.

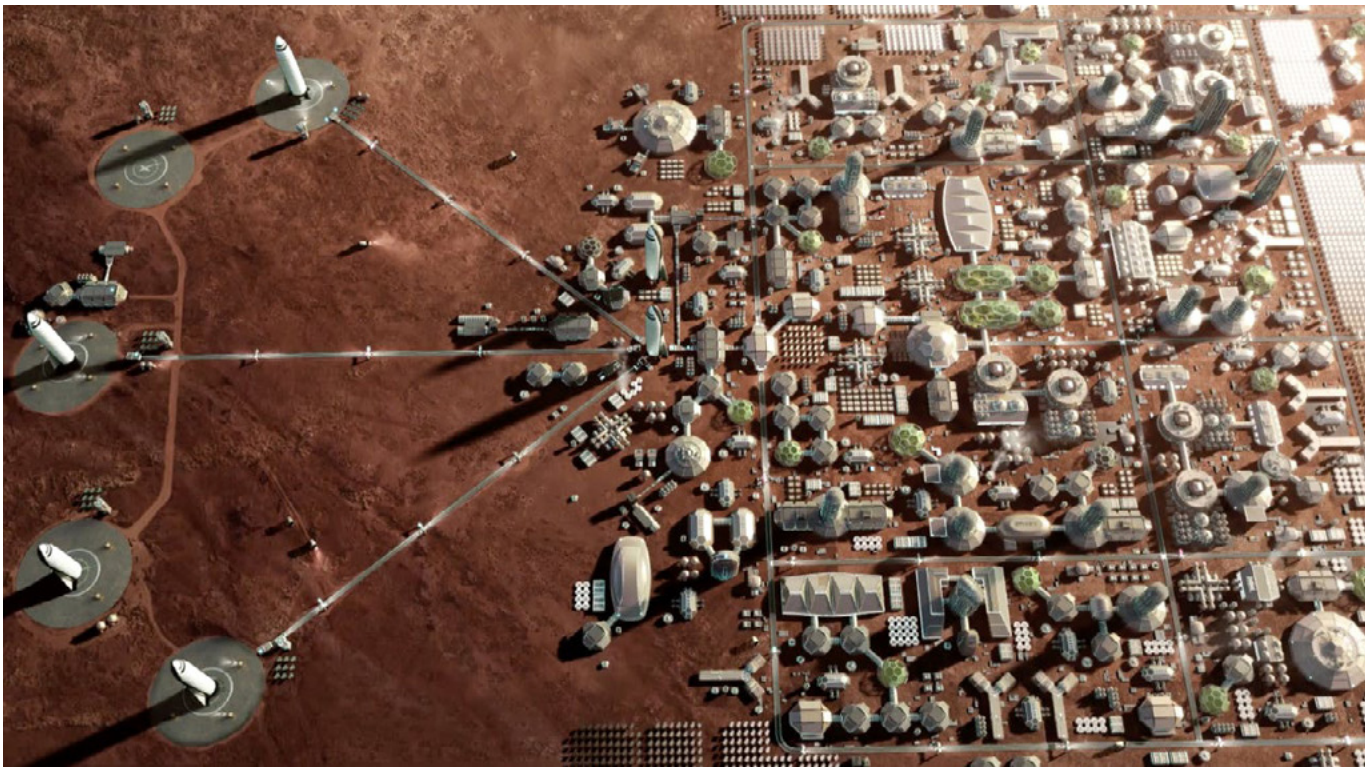


Figure 46: An artist's rendering of a Mars city for SpaceX (2017). Credit: SpaceX.

Figure 47: An artist's rendering of a space colony for Blue Origin (2019). Credit: Blue Origin.

dle-class America, he aligns with the first generation of astrofuturists — such as von Braun, Heinlein and others — who proposed "the conquest of space would reinforce the familiar status quo with new wealth and provide it with an eternal frontier of expansion" (Kilgore 2003: 150). In Kilgore's words (Ibid: 172), "the regenerative promise of a new frontier falls before business as usual." That Jeff Bezos and Blue Origin reproduce O'Neill's space colony vision so closely, nearly fifty years on from their original production and publications, poses further implications. From Scharmen's critique of Bezos to Kilgore's of O'Neill, a straight line of imagination appears to be extending from a 1950s suburbia into a 21st century space future. This is continuity recurring, projecting another closure of the space frontier.

Very, Very Far Away

Science fiction informs NewSpace visions for human futures beyond Earth that span extreme time horizons and scales of civilisation. Projecting into futures that are very, very far away is clearly inspirational for the movement, yet also poses problematic implications. These visions are imagined so distant, the confident certainty in the promise of the space frontier meets a curious ambiguity regarding the shape of things to come. To examine NewSpace representations in detail is to confront the limits of NewSpacer imaginations, that are often exceeded by the scale of their projections (Valentine 2012: 1055). Phrases such as "doing amazing things in space" (Space Frontier Foundation 2012) are regularly found in popular rhetoric, yet without much substantiation of what these things might be. The limits of imagination are exposed in NewSpacers' use of myths and metaphors, where space settlement advocacy is found raiding the "cultural storehouse" (Robertson 1980: 21) for familiar placeholders for the future, to stand in for what they cannot or will not imagine. This recurring tactic is also described as "troping" (Kilgore 2013: 28): of reorienting existing stories and images about other meanings, including the regular and aforementioned borrowing from the monolithic American myths of progress and the frontier. Apollo imagery also becomes a regular preface to a simplistic amplifying of possibility with a diminishing of impossibility, as employed by Bezos and Blue Origin at their press event, "Going to Space for the Benefit of Earth," in May 2019. Understandably, such tactics are useful for rendering grand concepts of space settlement relatable and tangible to an audience. However, by projecting their visions into deep futures, Bezos, Musk and others are also negating any critical exploration of these futures in high detail; kicking their complex uncertainties into the cosmic long grass.

The reliance on tropes by space settlement advocates, to explain their activities in terms of national histories and science fictions, ultimately exposes an inescapable vagueness about the space futures they imagine. When presenting SpaceX designs for an expanding city on Mars at the International Astronautical Congress in 2017, Elon Musk was unable to offer

any meaningful insight into its workings, only to say it would "get bigger… and bigger… and bigger…" (SpaceX 2017). As aforementioned, this did not stop Fred Scharmen (2019c) from finding "solipsistic" implications about the city's proposed arrangement of isolating modules, nor researcher Tamar Shafrir (2019) from critiquing the design as superficial and architecturally naïve. She argues the design is not for living in, but "to be seen from a satellite image downloaded to a computer on another planet." Here, Shafrir's notion of interplanetary distance mirrors the temporal gaps separating present space settlement advocates from futures near and far. They attempt to bridge these chasms by using imagery and stories that are plainly both Earthly and historic; of the here, but barely now.

The finer details of human space futures are described vaguely by NewSpacers, just as the floating colonies and Martian cities they imagine are empty of social life. However, as with myths, the fallibility of these images of the future belies their power, particularly in combination with technological artefacts and other materialisations. After Bezos' presentation in May 2019, the Blue Origin visions of "O'Neill colonies" were again presented in Washington DC by CEO Bob Smith, this time in a plenary at the International Astronautical Congress in October the same year, where Blue Origin also exhibited a one-to-one scale model of their Blue Moon lunar lander. In the plenary, Smith paused on an image of the colonies that was foregrounded by an elk, which appeared to stand in an artificial nature reserve enclosed within an enormous, manufactured world. To the audience, Smith (2019) wryly offered the space elk as "a thing we can actually have." Returning to the projectory, the elk is a peculiar "material instantiation" (Messeri and Vertesi 2015: 56) of a future that Blue Origin and large swathes of the private space industry use to project their ambitions and justify their work in the present (Ibid: 80). However, as Richard Tutton helps to decipher, this shared vision is more "desirable" than "hopeful," in that this future has no substantial grounding in the achievable (2017: 5). In other words, the floating space colony also floats free from any tangible path towards it.

Though without a path, the speculative imagery also serves a purpose. It performs as a kind of "projectory," by orienting the conference audience towards not only a vision of human expansion beyond Earth, but a belief in a social and technological progress to be catalysed by the infinite potential of outer space. The space elk is therefore a metaphorical placeholder for the dynamic, thriving space future of "amazing things" promised by Bezos and other NewSpace actors. In presenting their space settlement images and the Blue Moon lander prototype, Blue Origin projected two very different space futures from the same International Astronautical Congress in Washington DC. The disparity of imagined worlds and material hardware crystallises what Dickens and Ormrod (2016: 18) describe as the gap separating "real" and "ideal" outer space. And yet, this gap works for the spaceflight imaginary. Borrowing from Gaonkar (2002:4), I find the void separating near and far futures to be just as constitutive in this imaginary's "structuring matrix," in maintaining another tension that is

productive for the spacefaring cause. Whereas the lander works to materialise a "road to space" grounded in affirmative demonstrations of technological mastery, the space elk and the colony represent the "amazing" promise of a space frontier opened up to entrepreneurial enterprise. As infrastructure, the imaginary elevates the anticipatory discourse of the "and then…" that commercial roads to space are speculatively building towards. This means lunar landers and space elk are not only meaningful but complementary in the imaginary that holds space settlement advocates together, bound by a confident certainty in the unforeseeable and unimaginable. The space elk and the lunar lander work together to direct the movement of an industry reaching beyond the Earth.

In Straight Circles

This chapter explores a shared, Euro-American vision of humankind as a spacefaring civilisation, examining the core themes and critical functions that define it as a particular, powerful and problematic sociotechnical imaginary. I argue the imaginary can also be considered a form of infrastructure, demonstrating the capacity to hold a community of space settlement advocates together (Ormrod 2016: 385) and direct the movement of large swathes of the space industry. Studying various material manifestations has led me to encounter the "social thickness" (Jasanoff and Kim 2015: 3) laden in different NewSpace media representations of a future beyond Earth, which are replete with metaphors, myths and master narratives tying their dreams of space settlement indelibly to the "ideological bedrock" (Billings 2007: 485) of Americanism. Learning from various scholars, the imagery and stories that constitute an overarching sense of American exceptionalism also become ways of apprehending the imaginary's "structuring matrix" (Gaonkar 2002: 4).

The spaceflight imaginary moves in straight circles, a metaphor that describes the "special kind of logic" (Robertson 1980: 21) at the heart of a shared image of the future. This logic combines continuity and contradiction to render a common vision of a human spacefaring civilisation distorted and fallible yet also monolithic. The first half of this metaphor relates to the straight line, an image that emerges as a primary theme. The straight line describes a common perspective of history, bridging memories of the past with future speculations, that demands continuity; an extension of the status quo by expanding earthly ideas, practices and socio-political hierarchies beyond our planet's atmosphere. This continuum also helps space settlement advocates to emphasise a natural and necessary "forward" directionality about moving offworld, imbued with a sense of moral urgency. Circles, the second half of the metaphor, pertains to the spaceflight imaginary's cyclic nature. Space settlement advocates source from science fiction, American and other settler-colonial histories for imagery to abstract and replay

on heavy rotation.[20] Whereas Jeff Bezos, Elon Musk and other NewSpace actors project their visions of space settlement in extremely long timespans, the hardy individual; the intrepid explorer; the visionary entrepreneur; the transcontinental railroad; and other metaphorical symbols ultimately render outer space "strangely exotic yet beckoningly familiar" (McCurdy 2011: 324). Borrowing from Timberlake (2018: 4), these "fragments of the future" are also fragments of circularity.

In their "special" logic, that both compounds and reconciles the contradictions in their assemblages of things from the "cultural storehouse" (Robertson 1980: 21), myths and metaphors produce tension: a word that can describe both an emotional feeling and a structuring state. As McCurdy (2011: 318; emphasis in original) suggests, the dependency upon imagery and symbols to explain space futures in simple and familiar terms "*promotes gaps between expectation and reality*," or a chasm separating "ideal" and "real" outer space that appears to be widening (Dickens and Ormrod 2016: 19). Nevertheless, there are two ways in which this gap produces tensions that productively maintain NewSpace and space settlement advocacy as mutually influential socio-industrial movements. First, the dissonance of Apollo's seismic spectacle, and the comparatively underwhelming space programmes of NASA thereafter, created a driving disillusionment among private space advocates and activists, who remain determined to shift human space activities away from government control. The governments' perceived failure to fulfil Apollo's promise conflates an ambition for a spacefaring future with anxiety about an opportunity missed (Dark 2007: 556). Second, the gap also forms an important part of the spaceflight imaginary's infrastructural matrix. Here, the tension constitutes an anticipatory discourse that coheres the different material fragments that punctuate a sociotechnical projectory that stretches far beyond the limits of the projectors' imaginations. In this way, for example, the tension holds contemporary technological demonstrations together with speculative imagery of space colonies populated by millions of people. The gap thus gives the artistic pastiche, as figured by the space elk, a power complementary to the reusable rocket engine.

The Euro-American spaceflight imaginary is evidently distorted, inconsistent and fallible to critical scrutiny. However, reflecting the constituting myths and metaphors, its "special kind of logic" assimilates tangible contradictions and paradoxes into a formidable narrative infrastructure. In Steven J. Dick's words (2018: 30), the shared vision of a multiplanetary human civilisation is "a real force with real-life consequences." The force binds and fuels a community of space settlement advocates, united in the promise of "amazing things" that will happen on the space frontier, if only the road to space is built. And yet, the contradictions and paradoxes consolidating this imaginary also pose

20 For the orphans of Apollo, the multidimensional history of Moon landings is one that has arguably *degenerated* into a myth (Kermode 1967: 39).

troubling implications. The ideological values laden in recycled imagery, symbols and stories expose a sense of continuity recurring in imaginative and socio-political dimensions. These extensions and expansions of the status quo ultimately imply a failure of imagination above any encounter with its limits (Kilgore 2003: 172). To end, this *failure* ultimately brings about a certain irony, where the futures envisioned by space advocates promise a closure of the space frontier before it even opens.

Chapter 2

Magnificent Desolations: Imagining Ambition, Anxiety and Indifference in Outer Space

Beautiful view!
Isn't that something! Magnificent sight out here.
Magnificent Desolation.

— Buzz Aldrin

Magnificent Desolations

On July 24th, 1969, as Apollo 11 astronaut Buzz Aldrin took his first steps on the surface of the Moon, he surveyed the alien landscape before him and described a sight of "Magnificent Desolation" (NASA 1969). In doing so, Aldrin broadcast his first impression to millions of people watching and listening to the mission on Earth. From the late nineteenth century and into the present, planetary desolation remains a powerful visual and rhetorical theme shaping collective imaginations of outer space. The word "desolation" can mean destruction or emptiness, and both images interact together to heighten a sense of agency and urgency among contemporary space industry actors and others, who support the colonising and commercialising of the cosmos. In their many forms, desolations figure limits that stir anxiety in their encounter and ambition for their escape. By surveying contrasting images of futures on and beyond the Earth, this chapter describes the stabilising role that desolations play in a predominant Euro-American spaceflight imaginary. Fears of existential threats meet the promise of alien landscapes, whose ecological complexity is reduced to matter that is considered meaningless unless exploited for human agency. Imagining desolation is then explored as a disruptive force, pivoting on an inversion of a human indifference to nature. Here, cold and lethally ambivalent space environments expose troubling contradictions in common narratives of space futures that are rendered both dated and flawed.

Studying examples in space industry media together with science fiction film and literature, desolation can be found tying multiple myths and metaphors of spaceflight together — from the frontier of settler colonialism to the asteroid as extinction event. By pairing triumph with catastrophe, or the future with the past, leading figures of a contemporary space settlement movement, such as Jeff Bezos and Elon Musk, create imaginary double exposures that are productive for the cause. The double exposure (a juxtaposition of time, place or imagery) and inversion (a reversal of positions or relations) form two concepts central to this exploration of desolation. Interpreted here as aesthetic gestures, they inform readings of how space colonisation advocates imagine planet Earth, humankind and outer space respectively and, more interestingly, in relation to each other. Double exposures and inversions are also found in the artistic methods of artists and filmmakers, who reframe desolate landscapes to reimagine the human place in outer space and explore other ways of life on planet Earth. Throughout the study, the desert emerg-

es as a key figure for describing imagery of ambition, anxiety and indifference; assuming the role of a test site for human experimentation and a screen for projecting dreams of spaceflight. The desert then becomes a process of desertification, where extreme environments ultimately render humans as the social experiment (Timberlake 2018: 161).

Existential Threats

From time immemorial, the Earth has been bombarded by objects from outer space. Bits and pieces of the Universe piercing our atmosphere in an invasion that never ends [...] In every moment of every day they come from planets belonging to stars whose dying light is too far away to be seen. From infinity they come. Meteors! Another strange calling card from the limitless regions of space.

—The Monolith Monsters (1957)

A first image of desolation is one of destruction, rooting real fears for the survival of humankind and shaping catastrophic future scenarios that haunt the present. In such scenarios, Earth is imagined as a small, fragile and dying planet; subject to disaster by human, environmental or extraterrestrial forces. Desolation represents different "existential threats" (Morton 2019: 178) to the future of humankind, which can also be framed as the end of the world happening at different speeds: a slow or fast apocalypse (Gomel 2019). A number of space settlement advocates, who are influential in the wider space industry, use different imagery and rhetoric to render these threats tangible.

There is a notable tendency for the advocates to depict a vulnerable Earth in the face of a catastrophic extinction event. The prospect of a dramatic, planetary disaster helps many to reason that becoming multiplanetary is necessary to ensure humankind's survival in the very, very long run. SpaceX founder Elon Musk (2017) is a chief proponent here, suggesting there are "two fundamental paths along which history will bifurcate," where humanity either spreads out into the universe or is wiped out altogether. His reasoning centres on the eventual probability of an asteroid colliding with the Earth, which is an image tying multiple nuances of space settlement advocacy together. The asteroid is a perpetual horror in the Euro-American imagination, grounding an acceptance that "if we stay [on Earth] eventually we will die" (Chris Welch, personal communication, 22 October 2019). More interestingly, such contemporary expressions of anxiety further tie the asteroid to the atom bomb, and humanity to the prehistoric. The dinosaurs lack of a space programme is, however wryly, suggested by some to have contributed to their demise.[1]

1 As science fiction author Larry Niven says (cited in Scharmen 2019a: 232): "The dinosaurs became extinct because they didn't have a space program. And if we become extinct because we don't have a space program, it'll serve us right!"

Whether manmade or extraterrestrial, the representation of a singular, monolithic threat to human existence is arguably a legacy of the Cold War era. This continuation is evident when comparing speculative imagery of sublime impact devastations. Recent depictions of large asteroids colliding with Earth, such as the impact simulation in the Discovery Channel's *Miracle Planet* documentary series (2005) closely resemble the paintings by Chesley Bonestell of nuclear disasters across international cities for *Collier's* magazine in 1948.

In the early 1950s, the words of science fiction author Arthur C. Clarke (1951: 19) set a precedent for space settlement advocacy by reasoning "as long as it was confined to Earth, humanity had too many eggs in one rather fragile basket." As historian Robert Poole (2012: 255) infers, Clarke's perspective belongs to a generation profoundly influenced by "the European experience of World War I and to the coming of the atom bomb". Returning to the film *2001: A Space Odyssey* (Kubrick 1968), co-written by Clarke and director Stanley Kubrick, Poole (2018: 124) also conveys a tension at the heart of the film that reflected a wider societal anxiety around the dangerous potential of nuclear energy meeting a violent human nature: "that, with the atom bomb, technology had breached the limits of what could be safely entrusted to a semi-evolved primate on a small planet." Into the twenty-first century, the image of Earth as a "fragile basket" continues, where the asteroid emerges for contemporary space colonisation advocates as a foremost symbol of an extinction event that compels an exit strategy. In other words, "something is going to hit us, we need to survive" (Valentine 2012: 1062). Together, the asteroid and atom bomb become interchangeable as harbingers of Earthly abyss.

Another existential threat comes from resource finitude in the midst of unrelenting, unsustainable human activity. Blue Origin founder Jeff Bezos (Blue Origin 2019) states simply, "the Earth is no longer big, humanity is big" to convey the planet's incapacity to support the exponential growth of the human population and corresponding levels of material consumption. When unveiling a Blue Origin lunar lander prototype in May 2019, Bezos based his argument on basic arithmetic and statistical extrapolation to reason "we will reach the end of the Earth's energy" (Ibid). This projection repeats one given by a group of scientists, economists and industrialists named The Club of Rome in their seminal book *Limits to Growth* (1972), published nearly fifty years ago. However, foregrounded in Bezos' concerns are what these limits imply for ways of life in the "developed world" (Blue Origin 2019) as we know them, where the end of energy means rationing, stasis and the prospect of our grandchildren living worse lives than us — in his words, "a bad path" (Ibid).

For Bezos, Musk and others, outer space represents the sort of "spatial fix" our present condition demands (Valentine 2012: 1052), answering cultural; material; and ideological needs while safeguarding against the

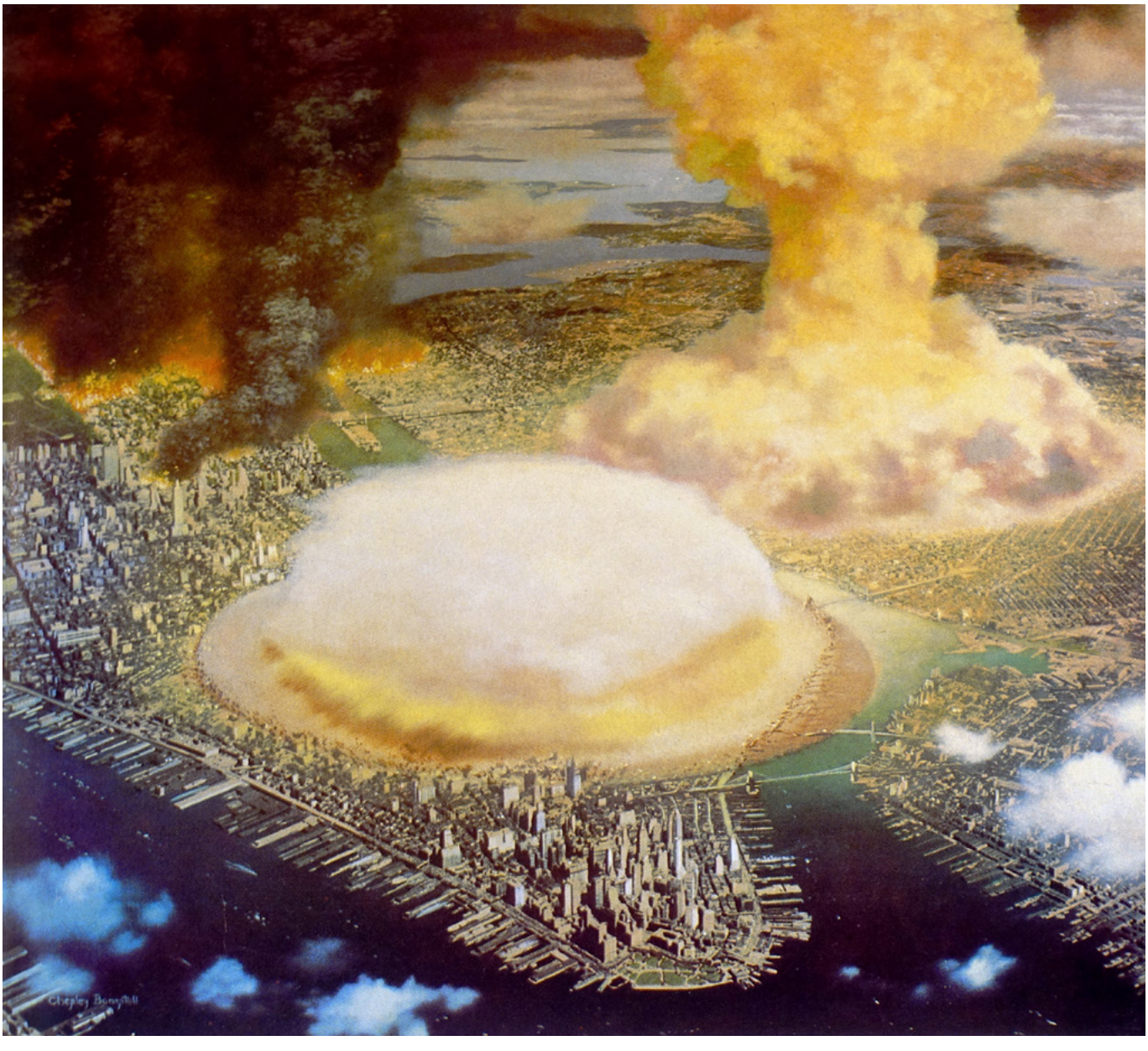


Figure 48: *The atomic bombing of New York*, art by Chesley Bonestell for Collier's magazine article 'Rocket Blitz from the Moon' (1948). Credit: Chesley Bonestell.

Figure 49: Large asteroid impact simulation still from the *Miracle Planet* documentary series (2005). Credit: Discovery Channel.

existential threats to civilisation that are posed by multiple kinds of finitude. "If we move out into the solar system," says Bezos (Blue Origin 2019), "for all practical purposes, we have unlimited resources," positing a spacefaring civilisation as the solution to the problems threatening future ways of life in the developed world. This sentiment is echoed by Robert Zubrin, founder of the space advocacy organisation The Mars Society, who connects material finitude with endless conflict by claiming "only in a universe of unlimited resources can all men be brothers" (Zubrin cited in Eisfeld 2018: 102). The space entrepreneur Peter Diamandis (2008) further describes Earth as a "crumb, in a supermarket filled with resources." Both Zubrin and Diamandis align with Bezos by using Earthbound finitude to frame outer space as the key to a future of endless energy, economic growth and nothing less than universal peace. Here, the "horizon of extinction" (Rowan 2015: 1) serves the promise of outer space as an open frontier of infinite material potential, waiting for human exploration and exploitation. This turn signifies a double exposure of triumph over catastrophe, where, as sociologist James S. Ormrod (2016: 390) conveys, "the horrific element" of the disaster fantasy "is brought into being only in relation to its solution."

The anxiety of material finitude extends from resources to land, where the vanishing of uncharted and unclaimed territory on Earth represents a closure of the terrestrial frontier, and with it an existential threat to a pervasive and powerful American ideology. For Robert Zubrin, the presence of a frontier is essential; to not go about colonising outer space represents a cultural and intellectual inertia in the absence of an untamed expanse. "Without a frontier from which to breathe life," Zubrin says, "the spirit that gave rise to the progressive humanistic culture that America for the past several centuries has offered to the world is fading" (Zubrin cited in Eisfeld 2018: 101). However, the harnessing of expanse to progress is not strictly an American idea. British author Arthur C. Clarke (1946: 72-73) offers the image of Earth as a "planetary goldfish bowl" to justify interplanetary travel as a necessary means to escape an endless circling and eventual stagnation of the human mind, a stagnation that rhymes with NewSpacer concerns about limits to material growth. Returning to the myth of progress as a forward movement in a desirable direction (Billings 2007: 485), this movement inherently demands space to expand and explore in a physical sense. This demand ultimately transforms the desolate landscapes of other planets, or the black void of outer space are transformed into a "green promised land" (Kirby 2018: 307), an alien wilderness in which to move forward and outward into with a sense of urgency. As De Witt Douglas Kilgore (2003:1) suggests, imagining outer space as the *last* or *final* frontier invalidates "the closure of the western terrestrial frontier." Outer space becomes the screen "onto which manifest destiny" (Ibid) continues to be projected.

The Promise of Emptiness

The frontier myth, and a correlating faith in the material plenitude of outer space, lead to another main image of desolation — one of emptiness, imagined magnificent by a promise of transformation through human technological intervention. Looking out beyond the Earth, anxiety for human survival turns readily into ambitions bound to notions of progress. In space settlement advocacy, alien landscapes are imagined as empty screens for projecting visions that are rooted in Euro-American histories and ideologies. A foremost example is the settler myth, inspired by fictional characters such as Robinson Crusoe, where wilderness is there to be found and transformed by the technical ingenuity and industry of enterprising individuals. Anthropologist Peter Redfield (2000: 8) conveys Crusoe as the symbol of a mobile and modern man, engaging in "confrontations between technology and nature," an image that rhymes with what Ormrod (2016: 388) defines as fantasies "about control: owning, consuming, taming or conquering something."

Fantasies of control further reflect a recognisable indifference to nature by space settlement advocates, that is evident in both historic and more contemporary space projects. This indifference undergirds the promise of the space frontier by consolidating a sense of desolation about alien worlds that are rich in resources, orbiting in wait for human intervention. Such a perspective manifests in the proposal of floating space colonies that was envisioned by physicist and futurist Gerard K. O'Neill in the early 1970s, who later led an interdisciplinary team to design the habitats in a dedicated design study, held at Stanford University and the NASA Ames Research Center in the summer of 1975. Into the twenty-first century, O'Neill remains a seminal guiding figure for contemporary space settlement advocacy; described by Jeff Bezos among others as one of the "great dreamers" (Blue Origin 2019). The 1975 summer study was organised at a time when problems of global material scarcity were becoming increasingly prominent, as articulated by the Club of Rome. In response, O'Neill countered that these issues were "ultimately a question of space," reasoning that "if Earth does not have enough surface, humans should simply build more" (Scharmen 2019a: 91). For O'Neill, outer space provided the answer for every human need — be it material, energy or physical space, a future beyond Earth can offer them ad infinitum.

In his book *Space Settlements* (2019a), designer and researcher Fred Scharmen offers a valuable and comprehensive analysis on the summer study designs, including their sociopolitical history and their architectural legacy. Most interestingly for the concerns of this chapter, Scharmen conveys that realising manufactured settlements in the void of outer space incites a shift in common understandings of *space* and *ground*. Building megastructures beyond any planetary surface requires materials that must be sourced from somewhere. In this case, planets and asteroids — the "raw matter of a whole solar system" (Scharmen 2019a: 111) — become primary resources. The summer study de-

Figure 50: An illustration from the 1895 version of *Robinson Crusoe* by Daniel Defoe. Credit: Culture Club/ Getty Images.

signs proposed mining the Moon for materials as a first step for constructing the floating settlements, prior to extracting resources from nearby asteroids. Reflecting upon this plan, Scharmen notes "there's an implication here about what planets, and by extension *grounds* are for" (2019a: 111; emphasis in original), that "the matter of uninhabited worlds has no meaning unless it is shaped by some intelligent and active agency" (Ibid). Here, the promise of their emptiness infers an ambivalence of O'Neill and the other design study participants towards alien terrains, reduced to matter, to *stuff*; meaningless if not exploited for human benefit.

The premise of manufacturing a frontier in the abyssal blackness of outer space signifies a critical inversion at play in O'Neill's space settlement imaginary. Scharmen (2019a: 115) describes that, "in this system, planets are not solids. Space is solid, and planets are holes." Transforming a vacuum into a habitat therefore "displace[s] the void: from site to non-site, from present space to absent planet" (Ibid: 116). O'Neill (1976: 93 cited in Scharmen 2019a: 115) imagined a metaphor of humans as animals "at the bottom of a hole," where a land of green grass, sunshine and flowers await on the outside. Here, the image of Earth as a hole compels some form of escape. Furthermore, displacing the void and turning space into a solid also conveys another problematic perspective: the conviction to build an artificial frontier, in the image of the old Western terrestrial expanse, reframes the original terra firma on Earth as material to mobilise in outer space; as a resource to use up. In enabling humanity to reach the high frontier, Earth joins the other planets in ultimately becoming expendable.

In his book *The Natural Contract* (1995), philosopher Michel Serres calls for a radical change in the human relationship to the natural world, where nature replaces the social in a contract that holds humans to account as respectful inhabitants of Mother Earth; enacted by practices of "symbiosis and reciprocity" as opposed to those of "mastery and possession" (Ibid: 38). Serres lambasts a human culture that today "abhors the world" (1995: 3). Only interested in human spectacle, this culture is defined by an ambivalence to the nature and rights of its *whereabouts*. The world here is rendered "thick with humanity and purified of things" (Serres, 1995: 3) by an anthropocentric perspective. I find Serres' argument relevant for addressing and countering the values projected by the O'Neill space colony plans and wider space settlement advocacy. I also find Serres particularly interesting here, for the metaphor of the "stage set" (Ibid: 11) he uses to describe Earth reduced to merely an empty backdrop for human events. Returning to O'Neill, the space colonies project not only displaces the void but arguably displaces the stage for human culture. Here, the purified vacuum of outer space becomes the notional perfect screen for projecting and performing ambitious visions of human progress. Shifted from solid ground to negative space, Earth and the planets can be read in this system as a kind of backstage from where the materials of space settling productions are taken from.

Naming his project "the high frontier," Gerard O'Neill further consolidates the image of space as an extension of the historic Western frontier. In doing so, he tethers the floating space colony firmly to the American ideological "bedrock" (Billings 2007: 485). As Scharmen (2019a: 129) notes, the design and narration of space settlements convey a "lineage of thought" where "older patterns of thinking and behaviour begin to reassert themselves." Here, Scharmen emphasises another critical point that to build colonies in space demands "more of the same: more building material for more people and more growth" (Ibid: 91). In contrast to the constraint and careful planning advocated by the Club of Rome, the space colony vision legitimises an "unchecked continuation of the industrial revolution" (O'Neill 1977: 22 cited in Scharmen 2019a: 129), undisturbed to extend and amplify historical practices into the solar system. These notions of problematic continuity further align with the perspective of critical geographers Jason Beery (2011: 25) and Fraser MacDonald (2007: 610), discussed in Chapter 1, who apprehend outer space practices as a form of geopolitical "infrastructural maintenance." Their interpretation is also shared by poet Wendell Berry (1977), in his commentary of O'Neill's designs. Berry is as succinct as he is withering in his critique. He describes the project as "an ideal solution to the moral dilemma of all those in this society who cannot face the necessities of meaningful change" on Earth; those who are also, he argues, "the chief beneficiaries of the forces that have produced our crisis" (Ibid: 36)[2]:

For what is remarkable about Mr. O'Neill's project is not its novelty or adventurousness, but it's conventionality.
If it should be implemented, it will be the rebirth of the idea of Progress with all its old lust for unrestrained expansion, its totalitarian concentrations of energy and wealth, its obliviousness to the concerns of character and community, its exclusive reliance on technical and economic criteria, its disinterest in consequence, its contempt for human value, its compulsive salesmanship.

In his commentary, Berry hammers home the negative implications of an "unrestrained expansion" of more of the same, exposing the problematics of frontier values that are ignored by O'Neill's "salesmanship" (Ibid: 36). In identifying a distinct conventionality, Berry finds extractive, expansive practices at the heart of the space colony project that are also the root of an energy crisis overshadowing the 1970s. In his words, Berry strips away any associations of "glamour" and "romantic escapism" (Ibid: 37) from the space colony project to expose a "shallow and gullible morality" that obeys the "moral law of the

2 Berry (1977: 36) names the "corporation executives, bureaucrats, militarists, political operators, and scientific experts…" as the chief beneficiaries, here.

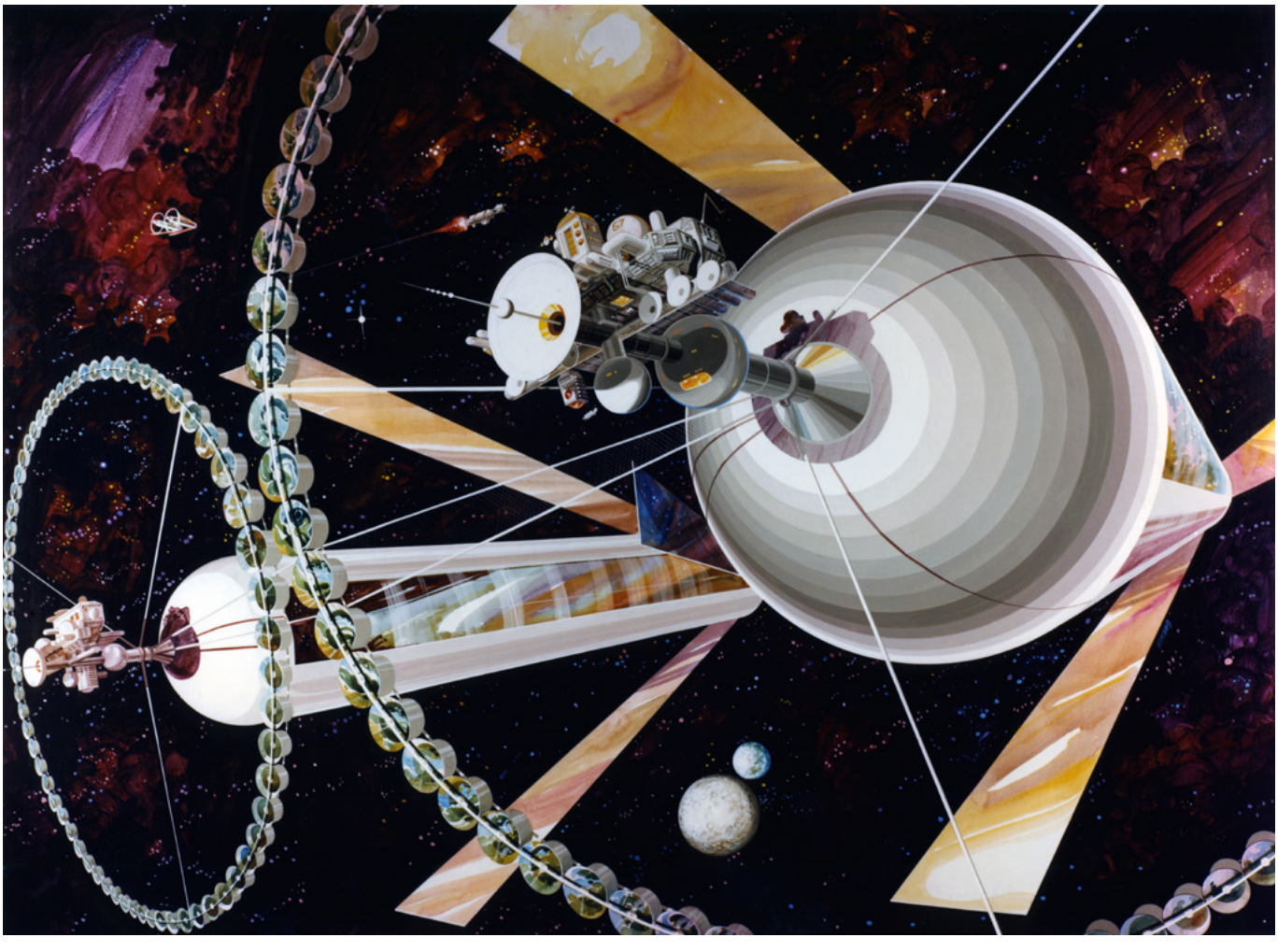


Figure 51: A painting of a space habitat concept by artist Rick Guidice for the Summer Studies at NASA Ames Research Centre. *Exterior view of a double colony* (1975) / NASA ID Number: AC75-1085. Credit: NASA Ames.

frontier" (Ibid: 36).[3] Such obedience enables Berry to trace a historical straight line in O'Neill's rhetoric, associating his manner with a seventeenth or eighteenth-century European, who is "privileged to see American space and wealth as conveniently distant solutions to local problems," while ignoring the ruinous "inheritance from the frontier" (Ibid) in the twentieth century.

Berry posits the 1970s energy crisis as a moral crisis, and a problem absurdly misunderstood by O'Neill. Just as De Witt Douglas Kilgore (2003) finds a failure of political imagination in his vision of segregated space suburbia,[4] Berry (1970: 37) also points to O'Neill's stifling claim that "people do not change." Whereas Kilgore focuses on the implications of O'Neill's position for a sociopolitical inertia, Berry (Ibid: 36) highlights what this stance means for the landscapes and worlds that human beings continue to exploit, damage or destroy. Returning to Stanley Kubrick's image of the violent human in *2001: A Space Odyssey* (1968), outer space is reframed by Berry from "spatial fix" (Valentine 2012: 1056) to a "moral escape valve" (Berry 1977: 36), where the infinite abundance of the space frontier promises a proportionate capacity for infinite destruction (Ibid). This innately brutal human tendency is further compounded by a technocentric perspective, a "violence of the specialist"[5] (Ibid) that is found by Berry at the heart of the space colonies project (Ibid: 37), raising the absurdity of a spacefaring solution based on existing technology for problems made by the very same technology. Furthermore, the focus by O'Neill and associates on economic and technical feasibility reflects a distorted vision that negates any moral standard, despite the manifold implications it poses for human values and planetary futures.

Fast forward to 2019, Jeff Bezos (Blue Origin 2019) stands on stage in Washington DC and poses a "easy choice" for the future of humankind: "do we want stasis and rationing, or do we want dynamism and growth?" For Bezos and others, space is the place where our grandchildren's grandchildren can enjoy more of the same — maintaining a recognisably Western, wealthy and desirable quality of life based upon exploiting the unlimited resources promised by expanding beyond the Earth. As I discuss in chapter 1, Bezos and Blue Origin continue Gerard O'Neill's legacy by envisioning a future space proposal that repeats the original summer study designs "note for note" (Scharmen 2019b). So close are their visions, nearly fifty years apart, that withering critique from the 1970s continues to apply. To paraphrase Berry about O'Neill here, Bezos arguably

3 "This kind of thing is familiar enough. What is new here is the scale." (Berry 1977: 37).

4 As I discuss in Chapter 1.

5 Through its evacuation of morality, Berry (1977: 37) ties the O'Neill project to other human abominations: "Strip mining, fire-bombing, electronic snooping, various forms of genocide and political oppression – all have been technically feasible, and usually economically feasible as well."

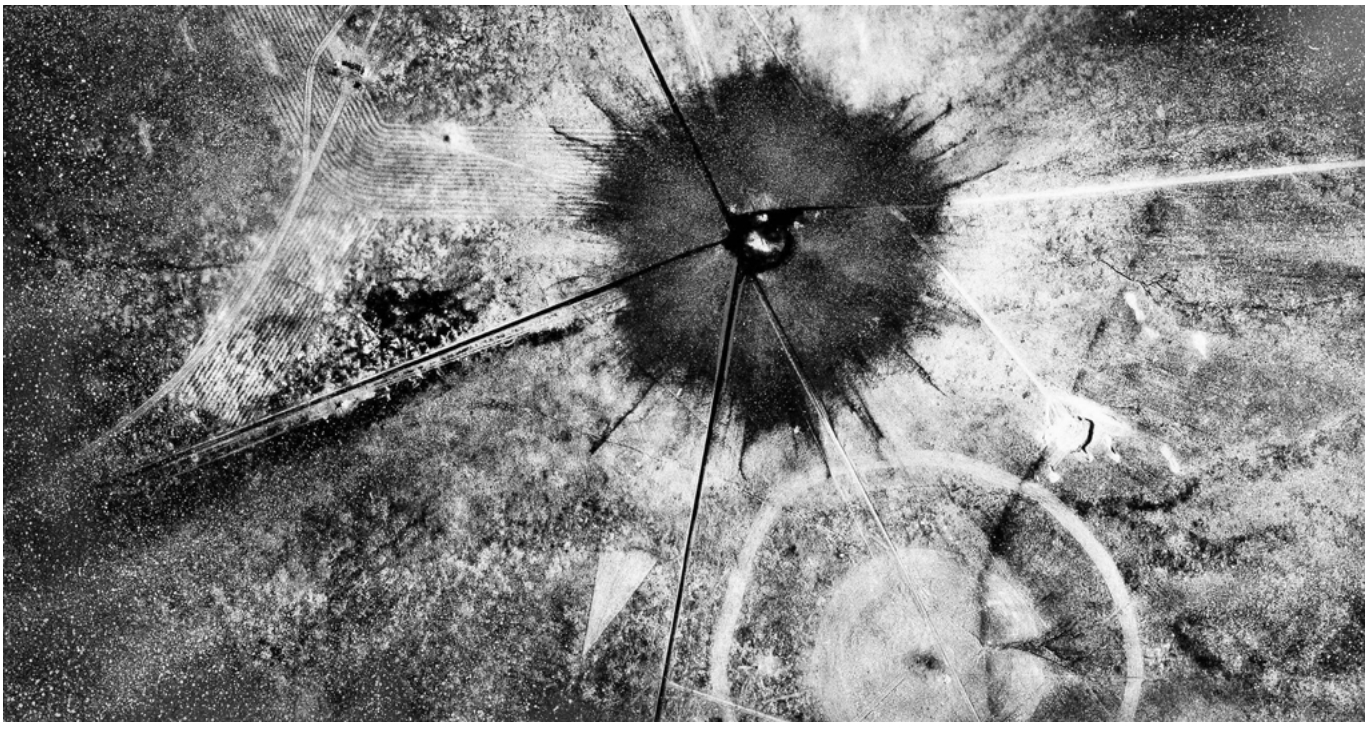


Figure 52: An aerial view of the aftermath of the first atomic explosion at the Trinity test site in New Mexico (1945). Credit: Associated Press.

Figure 53: The European Spaceport in French Guiana. Credit: ESA.

does not speak *as a twenty-first century American*; he is also "privileged" to see the promises of space and wealth beyond Earth "as conveniently distant solutions to local problems" (Berry 1977: 36). The resonance of Berry's historical critique into the present furthers the notion that the commercialised visions of space futures are founded upon more of the same, whether in visual, rhetorical, sociopolitical or material terms. The unambiguous continuities of the space colony images, half a century apart, suggest the human future in space promises to be the same as it ever was.

Useful Wilderness

In other historical and contemporary space exploration projects, representations of emptiness manifest an indifference to nature that is embodied by their materialisations in diverse landscapes on Earth. First, focusing on the missile testing sites of the mid-twentieth century, John Timberlake (2018) conveys the American desert as a landscape of particular significance for technoscientific projects and their interactions with a science fiction imaginary. An historical lineage of technological outposts — from White Sands Missile Range to the Trinity Site in Alamogordo, New Mexico — helps Timberlake describe the desert as a test site for large-scale experiments in a terrain that offers supposed seclusion and sterility. Here, this perception of the desert aligns with Serres' notion of the purified world. Trinity Site endured the first detonation of the atom bomb in 1945, part of a legacy of measured, explosive violence that furthers the image of the desert as a "wounded landscape […] finely balanced ecologies that those who thought of them as sterile places simply chose not to see or investigate" (Timberlake 2018: 154).

Such a selective perception of landscape is also found in the tropics of Kourou in French Guiana, home to the Guiana Space Centre, founded by the European Space Agency [ESA] in 1964. Peter Redfield describes how the strategic choice of French Guiana for a European Spaceport suggests a thought process comprising certain values and perspectives, where technological ambitions of reaching outer space imply "consequences on the ground" (Redfield 2000: 124). According to Redfield, "wilderness has its uses" (Ibid: 182), where ESA "found value in the openness of the land itself, in its marginal status relative to human networks, and in its specific geographic position" (2000: 182). Most interestingly here, the equatorial position of French Guiana exposes what Redfield calls "a technological irony of rocketry: the more remote a location, the better suited it is for explosive experiments. Thus when one is seeking to leave the globe, wasteland becomes valuable, and underdevelopment can appear a virtue" (Redfield 2000: 125). In this way, the remote status ascribed to the Guianese tropics rhymes with the American desert: both landscapes are framed as marginal and therefore *useful* by standards that are anthropocentric and ultimately reductionist. Here, complex ecologies are interpreted through a specific lens, or simply chosen not to be seen.

The evacuation of ecology from landscape helps to affirm an anthropocentric perspective to alien worlds in a more bombastic instance. Elon Musk has repeatedly proposed to "nuke Mars" as a way to transform the red planet into a more hospitable world for humans to colonise, as part of a wider mission for SpaceX to make humans multiplanetary and ultimately ensure the survival of the species. Elaborating on his idea, Musk (2019) describes the detonation of thermonuclear weapons over the Martian poles in a "continuous stream of very low fallout explosions above the atmosphere to create two artificial suns." The heat produced by these suns would then release carbon dioxide stored in the poles, generating a rise in Martian temperatures and instigating a self-sustaining process of planetary terraforming. Musk (2015) has wryly called Mars a "fixer upper of a planet," as one might a house in a state of disrepair, domesticating an extreme wilderness ready for a visionary and radical revamp. However, recent scientific research has found there is not enough carbon dioxide remaining on Mars to provide significant greenhouse warming, were the gas to be released into the atmosphere (Jakosky and Edwards 2018). Though his theory of explosive terraforming has been discredited, turning weapons of mass destruction onto another planet demonstrates an unwavering faith by Musk and SpaceX in the promise of technology and the prioritising of the human right to life firmly above any other. In describing Mars as a dilapidated home, Musk in effect compares the planet with the American desert as another test site, a "tabula rasa" (Timberlake 2018: 153) for technological experiment and a screen for projecting space settlement aspirations. Turning thermonuclear weapons towards Mars also flips the fear of nuclear apocalypse that Timberlake (2018: 153) finds figured by the desert in the mid-twentieth century: a landscape imagined as peripheral and barren in contrast to the cosmopolitan centres "in perpetual anticipation of […] instantaneously becoming peripheralised deserts." In 1949, upon his repatriation to the United States after World War II, Wernher von Braun retrospectively claimed his motivation for designing the lethal and devastating V-2 rocket was always space travel. "It's a success," said von Braun, "but we're hitting the wrong planet" (von Braun cited in Poole 2012: 256). For Elon Musk, Mars appears to be the "right" planet. His explosive proposal inverts the bomb as a source of annihilation anxiety on Earth into one of ambition for environmental and societal renewal on another world.

The nuclear terraforming of Mars arguably belongs to the "omnipotent" fantasies of control that are described by sociologist James S. Ormrod (2016: 388), where space colonisation actors and advocates offer spacefaring solutions in close proximity to human existential problems. In such fantasies, a "complex dialectic" of utopian and dystopian imagery is found at play (Jasanoff and Kim 2015: 21), where "catastrophe" can instantaneously become "triumph" (Ormrod 2016: 390). Terraforming Mars further resonates with a science fictional trope of deliberate, decisive and radical acts transforming the path of human history. As I discuss in Chapter 1, the novels of Isaac Asimov and Robert Heinlein set a precedent for visionary, entrepreneurial individuals taking affirmative action in outer space on behalf of humankind.

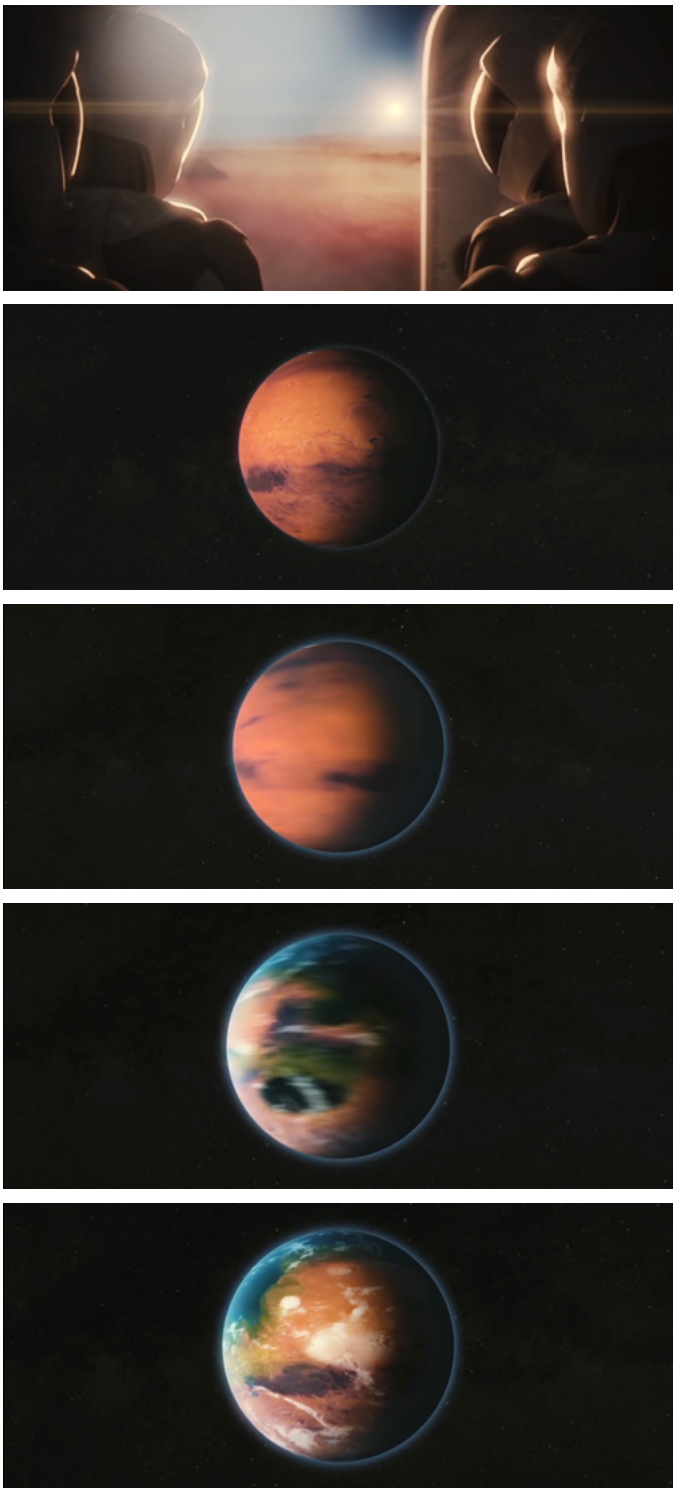


Figure 54–58: Image sequence from a SpaceX video imagining the terraforming of Mars, presented by Elon Musk at the International Astronautical Congress in Adelaide, Australia (2017). Credit: SpaceX.

Imagining decisive acts is found in both NewSpace media and arguably the most influential science fiction film of the Space Age. In *2001: A Space Odyssey* (Kubrick 1968), an animal bone thrown by a hominid transforms into a spaceship, in a match-cut that traverses the entirety of human evolution — from apeman to spaceman — in a single film frame. As Marco Caracciolo (2015: 78) explains, by combining temporal discontinuity and spatial continuity, the cut blends the bone and spaceship together in the "same, human history of domestication and exploitation of the physical world." The match-cut is part of what Robert Poole (2018: 122) describes as the films general "mythic structure," where our evolution is externally assisted by a mysterious, unseen alien intervention — figured only by the appearance of a black monolith at critical junctures in human history. As Poole infers, this balance of affirmation and ambiguity enabled *2001* to imbue space travel with a sense of evolutionary progress and "quasi-religious" associations (Ibid: 123), in a narrative appealing to both scientific audiences and the Catholic church. In 2017, a similar cinematic structure was employed by SpaceX in envisioning the first missions to Mars, in a video presented by Elon Musk at the International Astronautical Congress in Adelaide. In the video, when the astronauts first step out onto the Martian surface, the camera zooms out to a whole Mars image, where the red planet spins into a future, greener world complete with oceans and atmospheric clouds. Echoing Kubrick's match-cut in *2001*, the sequence renders the complexity of terraforming an entire planet into ten seconds of film; explanatory narration is absent to serve a greater myth of progress, based on the assumption of humans defining ability to master and manipulate natural worlds through the powers of science and technology.

Inverting Indifference

The indifference of humans to the nature and the rights of their whereabouts can also be found inverted as a disruptive force, bringing contradictions of the Euro-American spaceflight imaginary to the fore in a glaring and troubling friction. Here, desolation represents the cold, dark and lethal ambivalence of hostile space environments to human life and human dreams. When the first humans land on Mars, for example, freezing temperatures and unbreathable air present the first of multiple, immediate existential threats. The designing and inhabiting of actual space stations since the 1970s reveal outer space as a harsh and unforgiving place, where living becomes a series of unglamorous and painstaking productions (Peldszus 2018: 250). As Fred Scharmen surveys (2019c), near and far future designs illustrate keeping humans alive as the primary purpose of any extraterrestrial architecture. Habitat structures often resemble soap bubbles at different scales which must isolate their inhabitants from the deadly atmospheres beyond their shelter. Through its depiction of a future space mining crew, the science fiction film *Alien* (Scott 1979) is also symbolic of what designer Regina Peldszus (2018: 250) describes as a pragmatic post-Apollo turn, where outer space is experienced not as a

frontier of dynamism, but a dangerous state of "stasis" (Peldszus 2018: 248) to mundanely and cautiously endure — a stasis similar to what Jeff Bezos, Robert Zubrin and others are pitching to escape by building towards futures beyond the Earth.

The ambivalence of a hostile nature is also found in another image of the desert landscape as a process of "desertification" (Timberlake 2018: 155). Here, the desert is alive and active. It "spreads, appears or encroaches" as a recurring, relentless force (Ibid). Furthermore, Timberlake (Ibid: 156) conveys that desertification signifies "a fundamental division between the timescales and needs of living creatures on the one hand and the relentless geological and meteorological processes on the other." This notion of wilderness as an ominous and active process further resonates with different cultural histories of the "frontier," as Arlin Crotts (2014: 151 cited in Reid 2021) conveys, "The Australian outback was a trackless wilderness to absorb you. In other lands the jungle is a vast ecosystem to digest you." In highlighting the activity and agency of a landscape, where complexities have been historically and selectively ignored by different projects[6], Timberlake reframes the images of Robinson Crusoe and a settler-colonial "confrontation with nature" (Redfield 2000: 8). Here, the terms of the confrontation are significantly altered: nature is imagined ominously powerful and dangerous again, and furthermore indifferent to humans needs and wants.

It's substance unknown, its secrets unexplored.
The meteor lies dormant in the night, waiting.
—The Monolith Monsters (1957)

The science fiction film *The Monolith Monsters* (Sherwood 1957) tells a story based upon a process of desertification that is imaginatively sped up. A large meteorite crashes in a Californian desert and explodes into hundreds of black fragments, which grow very large and tall when exposed to water. The fragments then petrify the inhabitants of a nearby town, mysteriously extracting the silicon from their bodies to fuel their own growth. Catalysed by rainfall, the fragments transform into a wave of rocky monoliths that encroach upon the town and threaten to destructively expand across the country. This is a tale of confrontation, of human survival in the face of a seemingly unnatural disaster — unnatural in the sense that the meteorite is extraterrestrial, and in the strange acceleration of geological processes to a pace that is tangible to a human experience of time. What is most interesting about this film is the reversal of positions its narrative affords, in this nightmare shaped by destructive ambivalence and a fundamental division of needs.

6 Projects that include the White Sands missile range in New Mexico or the European Spaceport in French Guiana.

Figure 59: *The Monolith Monsters* (1957) directed by John Sherwood. Still. Credit: Universal Pictures.

Figure 60: *Alien* (1979) directed by Ridley Scott. Still. Credit: 20th Century Fox.

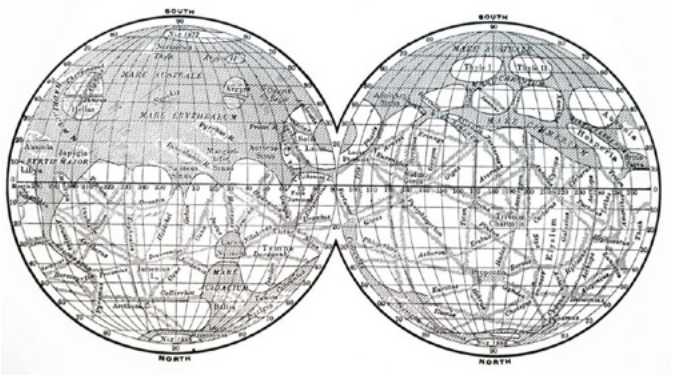


Figure 61: A map of Mars by astronomer G.V. Schiaparelli (1877). Credit: Unknown.

Imagining desertification is also found in speculations of intelligent life on Mars from the late nineteenth century. In 1878, astronomer Giovanni Schiaparelli observed and drew a network of canals crisscrossing the surface of Mars. Schiaparelli's observations were later popularised by astronomer Percival Lowell, who imagined the canals to be irrigated by a Martian master race to connect the last remaining water reserves left across the planet. Looking out from Earth, the canals were interpreted as an intervention by the Martians to avoid the collapse of their environment, and with it their civilisation. Mars was thus imagined as a drying, dying planet where an advanced society found itself increasingly desperate. The scientific accuracy of Lowell's canal theory was debated by his contemporaries and has been long since discredited over time. However, the analogies posed by a desiccated Mars for Earthly ecological concerns mean the "mythic appeal" (Carter cited in Markley 2005: 21) of the canal builders on a dying planet persists through twentieth century science fiction and into contemporary space settlement advocacy. For academic Robert Markley (2005: 15), the impact of the Lowell canals can be found in science fictions that imagine Mars as a future Earth and therefore a "harbinger of humankind's fate" in narratives positive and negative. On the one hand, the Martian canals "determined a course of sociocultural as well as planetary history: the response of an advanced civilization to a dying world" (Markley 2005: 22). Given further weight by the severe droughts that were widely experienced on Earth in the nineteenth century, the canals were envisioned as an "object lesson in harnessing political will and technological expertise in the service of a larger social good" (Ibid: 13), ensuring the survival of humankind in the face of ecological disaster. Markley further helps to interpret how, as an example of decisive and technical intervention on a planetary scale, the canals further inform the future of "human settlements and terraforming technologies" (Ibid: 23) desired by space colonisation advocates. On the other hand, however, Markley suggests the analogy of Mars as an older, dilapidated Earth is also the subject of grim, dystopian narratives that expose a "dark underside of modern myths of social and technological progress" (Ibid: 22). Here, the canal builders join a science fictional lineage of alien civilisations lost in the face of environmental collapse.

As a different "object lesson," the ghosts of lost Martian societies in science fiction offer "a refracted image of humankind's efforts to live on an Earth disfigured by industrialization, pollution, and resource depletion" (Ibid: 14). A short story of particular note here is *Survey Team* (1954), by Philip K. Dick, which describes a human crew "driven by the nuclear annihilation of Earth to attempt a desperate colonisation of Mars" (Ziser 2013: 32). On arrival, however, the humans find a useless planet, a wreckage abandoned by another civilisation conspicuously absent yet in many ways familiar to them. The human colonists learn the Martians had deserted Mars 600,000 years earlier, having spent the planet's entire natural resources: "They've *used* Mars up. Used up everything. Nothing left. Nothing at all. It's one vast scrap-heap" (Dick 1954: 89). The moral twist to the tale occurs when the humans later discover that the absent Martians had targeted Earth itself as a planet to colonise; ultimately real-

ising that they belong to an interplanetary species responsible for the devastation of two hospitable planets. Their return in desperation further marks the closing of a circle. "Two are enough!", protests one of the crew, "Let's not destroy a third world!" (Ibid: 94).

The scholar Michael Ziser (2013: 32) also uses the term "harbinger" to describe *Survey Team* as a portent for a manmade planetary catastrophe. Ziser further conveys the science fictions of Ray Bradbury and Philip K. Dick as important references, as stories looking beyond technologies to reflect upon an internal, ideological "threat" (Ibid: 32) that determines human "imaginative horizons and material infrastructures" (Ibid: 32) pertaining to possible futures. This analysis further consolidates the notion of co-production (Jasanoff and Kim 2015: 337), where any technological future is also inherently value-laden — in this case, with troubling implications. As Markley (2005: 8) helps infer, these ideological threats amplify in science fiction analogies where Mars is perceived as an Earth-like planet and Earth, in turn, as "a Mars-like planet." A harbinger for the future of Earth and humankind, Mars as a dying world returns in irony to the concerns of resource finitude on Earth espoused by Bezos, Diamandis and Zubrin among other NewSpacers. Most interestingly, Earth-Mars analogies flip the reading of desertification from a geological process back to a distinctly human one.

Lessons of the Wild Blue Yonder

A planet in our solar system.
Wide mountain ranges, clouds; a land shrouded in mist.
The first creature we encountered tried to communicate something to us.

—Lessons of Darkness (1992)

Desertification, a merciless indifference of and towards nature, and cycles of civilisation are distinct themes that are present and interacting in the films of Werner Herzog. Two of Herzog's films, *Lessons of Darkness* (1992) and *The Wild Blue Yonder* (2005), are particularly interesting for thinking through the potency of desolation imagery for imagining outer space and ascribing it meaning. Both films are made by reframing found footage of earthly landscapes, where fictional interventions render Earth as another planet. The most prominent intervention in both films is arguably a single alien character, who is the primary narrator of each story. Herzog describes these films as science fictions, to explain that "not a single frame of footage can be recognised as our planet, and yet we know it must have been shot here" (Herzog in Cronin 2002: 248). To this end, burning oil fields in Kuwait and under the ice in Antarctica are reimagined as landscapes of alien worlds. In *Lessons of Darkness*, an alien visitor to an unnamed planet (voiced by Herzog, himself) encounters a civilisation that continuously tends to a landscape they

Figure 62–63: *The Wild Blue Yonder* (2005) directed by Werner Herzog. Stills. Credit: Werner Herzog Filmproduktion.

Figure 64–68: Image sequence from *Lessons of Darkness* (1992) directed by Werner Herzog. Credit: Werner Herzog Filmproduktion.

have themselves destroyed. The original footage focuses on a crew of human firemen — described by the alien as "creatures" — working in the devastated oil fields of Kuwait which are burning in the aftermath of the Gulf War. However, the historical context is evacuated from the film by Herzog to reflect upon the strange, "grandiose splendour" (Herzog 1992) of a landscape utterly and catastrophically transformed. The imagery depicts enormous plumes of black smoke erupting from the desert terrain that stretch beyond the horizon. The apocalyptic grandeur of the inferno is enough to envelope or divide even the widest camera angles shot from a circling helicopter. In combining the imagery, the theatrical musical score and the dislocated, deadpan delivery of Herzog's narration, the mood of *Lessons of Darkness* shifts from humour to horror in describing a planet completely and spectacularly ruined by war. A lens from outer space, the alien character changes the reading of the original footage by extending an imaginative, critical distance from imagery that is recognisable from newsreels and other documentary media. Seeing Earth and the destructive capacity of humans through alien eyes destabilises perceptions; it performs a kind of estrangement. Here, Herzog unsettles audience perceptions to question a human desire for perpetuating destruction as a particular sort of madness. This idea is most prevalent in a scene where the alien observes the firemen reigniting the oil fire they only just extinguished:

Two figures are approaching an oil well, one of them holds a lighted torch. What are they up to? Are they going to rekindle the blaze? Has life without fire become unbearable for them? Others, seized by madness, follow suit. Now they are content. Now there is something to extinguish again.

Both *Lessons of Darkness* and *The Wild Blue Yonder* reimagine Earth as a dying alien planet, materially exhausted by fictional civilisations who render a once rich and life-bearing world inhospitable. Borrowing from Buckminster Fuller (1981: xvii), the films describe the consequences of an advanced society spending all of its "cosmic energy savings account."

Whereas *Lessons of Darkness* describes an alien observing another civilisation destroying their own planet, *The Wild Blue Yonder* tells the story of aliens who come to Earth from a watery world they have also exhausted. The story here is told by another lone extraterrestrial, who shares its despair as it sees humans making the reverse journey to their home planet which has already met the same fate. Echoing Dick's short story, *Survey Team*, another form of symmetry is being completed with human protagonists closing the circle.

Both found and filmed by Herzog, different desolation imagery plays an integral part of *The Wild Blue Yonder* to varying effects. The alien also relays the story of its civilisation's journey to Earth and their failed attempts to impress the native humans by building their own capital city. Whereas the human explorers float in the technological confines of a traveling space spacecraft, the alien — another interplanetary traveller — tells its story amidst the

dilapidated ruins of a forgotten town; the place where the space settler dreams of its species died, kicking up the dirt road dust in anger:

…we aliens all SUCK. Look… we're failures.

Stories of failure serve to disrupt popular imagery of the intelligent alien and, furthermore, the transcendent evolutionary narratives projected by visions of a spacefaring civilisation. Returning to the atom bomb, Stanley Kubrick (1968 cited in Poole 2018: 110) offered an existential paradox of nuclear energy to reason with "virtual certainty" that any intelligent life found traveling through space must be advanced enough to discover and harness it. Nuclear energy and the bomb were therefore interpreted as "watershed" moments for the evolution of any civilisation (Ibid: 111). However, the alien in *The Wild Blue Yonder* is "unremarkable"; unsuccessful; ultimately "de-exoticized" (Battaglia 2018: 237) — far from the technologically and socially advanced species so regularly imagined in science fiction. This historic, progressive ambition of traveling beyond the home planet is reframed as a futile and ultimately degenerative act. Found-footage from a diving expedition in Antarctica is then reimagined as Andromeda, the watery alien world reached by the human spacefarers in the final scenes of the film. Here, the landscape they encounter is another sparse, barren wilderness — an underwater desert. Borrowing from the colonist's words in *Survey Team* (Dick 1954: 89), the desolation is further evocative of a world used up.

11. We ought to be grateful that the Universe out there knows no smile.
—Werner Herzog, The Minnesota Declaration (1999)

Human confrontations with nature abound in nearly every Werner Herzog film. However, contrary to the fantasies of control embodied by Robinson Crusoe and the settler myth, his imagery and stories together frame this confrontation very differently. Timothy Corrigan (2011: 112) describes Herzog's "excursive essay film[s]" as struggles to know amidst the "ecstatic violence of the natural world" (Ibid: 106); encounters with a harsh and indifferent nature: a "Yawning Black Void" (Ibid: 122). Corrigan further conveys a "continual compositional showdown" in Herzog's encounters "between the very large and the very small" (Ibid: 125), the comparative diminishing of the human figure in massive and dismissive geographies represents an antithesis to the Crusoe image of technological mastery. This shrinking isolation also serves a poetic purpose through another showdown of large and small, where the diminution of the human characters works to amplify the grandeur of their visions in a "theatrics of desire" (Ibid: 125). In Herzog's films, whether human or alien, the dreams are as big as the dreamers are small; their aspirations appearing so ridiculous in their whereabouts, they are rendered almost as "hallucinations" (Ibid: 123). Staged in extreme environments, the collisions of grand desires against an ambivalent nature also form another important Herzog motif, resulting in inevitable failures

and sometimes fatal consequences.[7] Consistent with his ideas about earthly nature, Herzog reminds that outer space is a place that "knows no smile" (Herzog 1999); a place unforgiving, deadly and indifferent to the needs and desires of human beings wishing to travel there.

The films of Werner Herzog help to contemplate the realities of outer space settlement from an ambivalent if incredulous position. Reflecting upon his characters, compositions and narratives they render the popular fantasies of control and prosperity that are projected onto the solar system as ultimately absurd. Following Herzog, the extreme environments of outer space, and the practices of basic survival they entail, further expose the master narratives of space settlement advocacy as simple "retellings of North American and European colonial and frontier narratives as analogues: the adventures of white men of the last 500 years replayed in a cosmic context" (Tutton 2018: 527). These analogues are then disrupted by a cosmic indifference, framing them as not only out of time but out of place. Films such as *2001: A Space Odyssey* further expose a cosmic "mediocrity of the human" (Caracciolo 2015: 82), with a body "maladapted" (Ibid) to any world or place beyond its home planet. The right to a life without limits, or to be ruggedly individual in the image of Robinson Crusoe, is therefore irreconcilable with the likelihood that — on the surface of Mars or floating in a manufactured space colony — every molecule of air you breathe will be subject to a form of transaction (Angelo Vermeulen, personal communication, 23 October 2019), and any architectural exterior space will be "simply more interior" (Scharmen 2019b). In other words, contrary to cosmic ambitions of escaping limits, the ambivalent natures of outer space determine constraint and containment as the defining characteristics of sustaining human life anywhere but Earth.

Slow Action and Heterotopia

Whereas desolation imagery is oft-used by space settlement advocates to consolidate their vision of a spacefaring future, the found footage science fictions of Werner Herzog and the artist Ben Rivers reframe desolate landscapes to stage imagery and fictions that counter the Euro-American spaceflight imaginary in different ways. In his moving image work *Slow Action* (2011), Rivers imagines idiosyncratic societies inhabiting fictional island utopias. Presented as a multichannel video installation or a single channel film, *Slow Action* describes four stories from four future islands, which were created by rising sea levels and led to different experimental societies evolving in isolation. The work as a whole describes a particular impact of desertification, where extreme envi-

7 See *Grizzly Man* (Herzog 2005) or *Aguirre, The Wrath of God* (Herzog 1972).

Figure 69–71: *Slow Action* (2011) directed by Ben Rivers. Stills. Credit: LUX.

ronments generate radical social projects. Here, a nature that is ambivalent to human needs shifts the role of the test site from the landscape to its inhabitants, "the desert no longer subject to human experimentation as much as desertification tests what has become a human experiment" (Timberlake 2019: 161). However, in this case the desert of *Slow Action* is not made of sand but of water.

My primary interest in *Slow Action* focuses on the essential diegetic role performed by the desolate island landscapes, each belonging to disparate and distinct geographic locations.[8] Rivers (2015) has said that *Slow Action* is greatly influenced by another Werner Herzog film, *Fata Morgana* (1971), yet also functions in a similar way to *Lessons of Darkness*. The four stories are narrated by two unidentified voices, whose words are also delivered in a deadpan and dislocated tone.[9] As Herzog's alien observes the firemen in the oilfields of *Lessons of Darkness*, there is an impartial distance assumed by Rivers' narrators as they survey an imaginary other. The societies described are largely absent from view apart from on the last island "Somerset," where they appear ghostly and hauntingly inanimate behind handmade masks. Empty of any dynamic human life, the landscapes fill the screen to perform as screens themselves for projecting alternative visions of future island societies are projected. For example, the first island in the sequence, "Eleven," is played by Lanzarote. Eleven's inhabitants are driven to sleep in the day by the extreme heat. They possess eyes evolved for stargazing and approach lovers with mathematical equations as sexual propositions. In this case, Lanzarote's volcanic terrains augment a story of imposing desert forces that generate idiosyncratic biological evolutions and unique cultural behaviours.

Both narrators in *Slow Action* refer to the chronicling of a Great Encyclopaedia, that catalogues fading or lost societies from an unspecified position in a "posthuman, posthistory situation" (Rascaroli 2017: 88). Rivers himself (2015) has also conveyed that the landscapes of each island exist "outside of time." Here, the island desolations afford a multiplicity of imaginary spatial and temporal scenarios to simultaneously emerge out of their ruinous terrains.[10] This potential further resonates in Rivers' artistic choices for *Slow Action*, where "a work set in the future […] is visually constituted by contemporary footage" and shot on 16mm anamorphic film, which is "modelled after the look of a 1970s idiom (and with sound directly appropriated from older [science fiction] films" (Paterson 2011). As art historian Dominic Paterson conveys (2011), the

8 The volcanic island of Lanzarote; on Tuvalu, a Polynesian island nation; on Gunkanjima, a Japanese artificial mining island; and in the English county of Somerset (Rascaroli 2017: 87).

9 The tone supposedly also silently mocks the colonial traditions of historic ethnographic films or travelogues (Lee 2017a; Rascaroli 2017: 89).

10 This simultaneity rhymes with descriptions of the American desert, which has figured as an apocalyptic Earth and the surface of the Moon (Leonard in Timberlake 2018: 151).

spatial ambiguities and temporal discontinuities found in the islands of *Slow Action* mean they can be thought of as examples of what philosopher Michel Foucault terms *heterotopias*.

Foucault (1986: 22) sets the scene for heterotopia by describing the era we live in, and the spaces we inhabit, in terms of "simultaneity" and relationality. He draws upon the efforts of structuralism (establishing connections and relations between elements) to highlight the "heterogeneous space" in which we live, that is constituted by "a set of relations that delineates sites which are irreducible to one another and absolutely not superimposable on one another" (Ibid: 23). Together with utopias, heterotopias emerge from this multiplicity of sites for Foucault as those "absolutely different from all the [other] sites that they reflect and speak about." At the heart of Foucault's heterotopia concept is a framework for addressing the set of relations defining conventional sites and their practices (Sudradjat 2011: 34). Both utopias and heterotopias are thus presented here as "counter-sites" for reflection and contestation of realities from a critical distance. However, whereas utopias are determined as "fundamentally unreal spaces," or "sites with no real place," that perform as direct or inverted analogies of "real" society (Ibid), heterotopias *are* locatable in reality. Foucault (1986: 24) argues they "do exist" as a constant in every culture or civilisation as "effectively enacted utopia[s]." In Kilgore's words, "heterotopia is distinguished by always being somewhere at sometime" (2003: 227).

Heterotopias are described by Foucault according to six principles, that together inform my reading the films I discuss here and, furthermore, help to articulate the meaningful promise of the concept for thinking through artistic methods of imagining outer space, with an emphasis on imagining otherwise. First and foremost is the capacity of heterotopias to juxtapose "in a single real place several spaces, several sites that are in themselves incompatible." Here, Foucault (1986: 25) offers a richly concise example of the rectangular theatre stage, where "one after the other, a whole series of places that are foreign to one another." This idea ties into other notions of the landscape as a form of theatrical stage, aforementioned in this chapter. However, whereas Serres (1995: 3) problematizes an anthropocentric stage set "thick with humanity and purified of things," in *Slow Action*, Rivers' camera purifies the majority of the islands *of humanity* to renew their imaginative potential as stages for idiosyncratic utopias.

Foucault (1986: 26) also highlights the temporal element of heterotopias, that are "most often linked to slices in time," or in his words: "heterochronias." Furthermore, he conveys heterotopias function at "full capacity" in an "absolute break from […] traditional time" (Ibid). Described as "outside of time," (Rivers 2015) the island societies of *Slow Action* are in many ways as dislocated from "reality" as the tone of the films' narration. This framing also rhymes with the role of the desert in Herzog's *Lessons of Darkness* and *Fata Morgana*, in what film theorist Laura Rascaroli (2017: 85) describes as a temporal layering of past, present and future: "as if […] located both before and after

civilisation – simultaneously a primeval land and an apocalyptic, postindustrial landscape…" There is a unifying spatial and temporal ambiguity about Herzog and Rivers' films, as "slices" of sometime and somewhere that are recognisably earthly yet distinctly otherworldly. Working with Foucault, it is arguably this ambiguity that positions the burning oilfields and remote islands as heterotopian counter-sites, constituted by a set of relations and characteristics to "suspect, neutralise or invent" depending on where or when they "happen to designate, mirror or reflect" (Foucault 1986: 24). For Herzog and Rivers, what is negated by the camera lens is also critical in framing their chosen geographies, where they evacuate any established histories and expose different stories onto empty and isolated landscapes. Broken away from time, their ambiguity is also arguably what generates the landscapes' fictional potential and the films' critical power as cinematic thought experiments.

Foucault (1986: 26) also emphasises the undistinguished yet "certain gestures" that render heterotopias accessible, as simultaneously open and closed spaces; isolated yet penetrable. In the cases of Herzog and Rivers, a critical gesture is found in their films' narration as their way of opening their respective heterotopias to the audience. In discussing found footage science fiction films, scholar Roger Luckhurst (2008: 181) coins the term the "found" fantastic" to describe "the notion that bits and bits and pieces of the world might already be in some ways fantastic and science fictional, or that it would only take a change of framing to render these objects or experiences broadly fantastic." In *Lessons of Darkness*, *The Wild Blue Yonder* and *Slow Action*, it is their distinct narration — voiced by unseen characters — that changes the framing of the landscapes found by Herzog and Rivers. The alien visitor is a diegetic intervention that renders these sites science fictional, transforming recognisably earthly landscapes into other, possible worlds. Whether in terrestrial ruins or alien wilderness, the capacity to stage multiple spaces and times emerges as a critical function of desolate landscapes and an essential function for Herzog and Rivers in producing their science fictions. Here, heterotopia aligns closely with the concept of the "found" fantastic, for both arguably represent places that are "always […] somewhere at sometime" (Kilgore 2003: 227) and accessible by imaginative gestures that change the framing or reconfigure their relations.

For better or worse

Whether imagining the horror of devastating destructions for Earth and its human inhabitants, or the promise of alien worlds that are t*here for the taking*, magnificent desolations juxtapose visions of ambition and anxiety, creating tensions that are productive for the space settlement cause. Desolations also constitute common and interrelated perceptions of Earth, outer space and humankind. Shared imagery of the human is of particular interest, for the way different ideas distinguish the nuances of spaceflight advocacy. Here, a critical aspect is arguably the mastery of science and technology, with its manifold im-

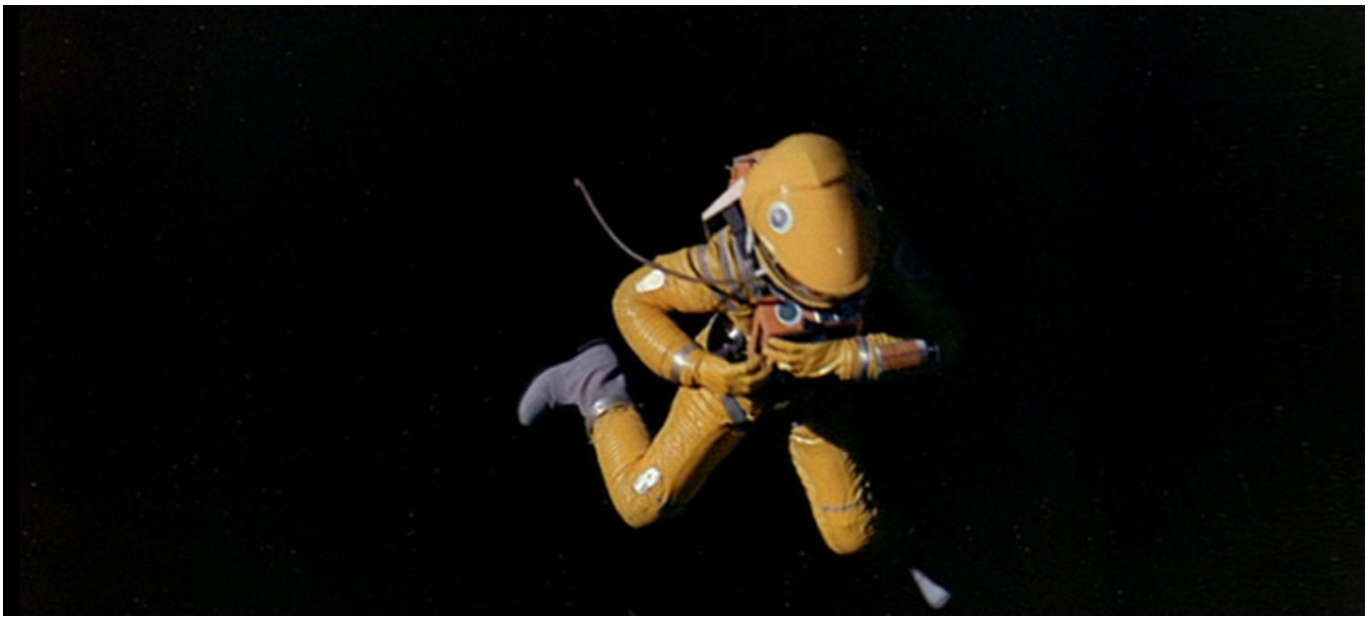


Figure 72–73: *2001: Space Odyssey*(1968) directed by Stanley Kubrick. Stills. Credit: Metro-Goldwyn-Mayer Studios Inc.

plications and consequences. In its promising and haunting guises, on Earth or elsewhere in outer space, the desolate landscape reflects the human in both optimistic and pessimistic light.

On the one hand, the human is portrayed as a "progressive" being (Zubrin cited in Eisfeld 2018: 101) that is temporarily bound to a planet whose frontiers it has already transcended. For many space settlement advocates, the continuing presence of the frontier is critical for human progress in a forward, outward movement. Arthur C. Clarke (1946: 72-73) and Robert Zubrin both warn of a "goldfish bowl" effect in the absence of unexplored lands, pertaining to cultural inertia, stagnation and decline. In fact and fiction, colonial explorers personify the settler myth that imbues outer space with the promise ascribed to old earthly frontiers — the promise of landscapes rich with abundant material resources to find and transform for human benefit.[11] Based on mining space resources, Gerard O'Neill and Jeff Bezos propose floating space colonies as technological platforms for releasing an infinite human potential in the open space frontier, unchecked in the endless expanse. "We can have a trillion humans in the solar system," says Bezos, "which means we'd have a thousand Mozarts and a thousand Einsteins" (Blue Origin 2019). For space settlement advocacy, outer space is the "spatial fix" (Valentine 2012: 1052) for an expansively dynamic civilisation in material, spatial and cultural terms. In the logic of space projects shaped by values of acute anthropocentrism, the material plenitude of asteroids, moons and planets become expendable matter for the cause of human progress. Here, imagery of empty wilderness materialises selective perceptions of alien landscapes (Timberlake, 2018: 154), whose complex ecologies are reduced to useful matter and means for liberating the exceptional human from multiple forms of finitude.

On the other hand, the human is imagined as a weaponised animal, "a semi-evolved primate on a small planet" (Poole 2018: 124), that is inherently bound to its primeval past and whose technologies surpass the limits of what it can be trusted with. It bears repeating Robert Poole's observation that the first generation of astrofuturist authors — whose science fictions remain so influential to the space industry today — were profoundly affected by wartime experience and the rise of the atom bomb (Poole 2012: 255). The spectre of nuclear catastrophe is a lasting one that fuels existential fears founded upon the human capacity for destruction of peoples and planets. By stating "only in a universe of unlimited resources can all men be brothers" Robert Zubrin (cited in Eisfeld 2018: 102) conveys humanity in a state of perpetual conflict so long as it remains grounded on one, small planet. Contrary to any evolutionary "watershed moment," as hypothesised by Arthur C. Clarke and Stanley Kubrick, the advent

11 Whereas Robinson Crusoe embodies the enterprising, technical man who prospers in his encounters with nature, Elon Musk exaggerates a technological hubris in his proposal to terraform Mars by thermonuclear detonations.

of nuclear energy only seems to increase the existential threat from historic cycles of violence. In his films *Lessons of Darkness* and *The Wild Blue Yonder*, Werner Herzog imaginatively strips away the glamour and romance[12] of space travel to expose humans' cosmic "mediocrity" (Caracciolo 2015: 82). Seized by "madness" (Herzog 1992), they tend to planets they have themselves destroyed, or repeat the journey of other interplanetary species in search of another world to colonise and ultimately use up. Here, it is worth returning to Robert Markley's study of Mars in science and science fiction. The varying imaginations of a distant, desolate and dying planet become an "object lesson" (Markley 2005: 14) for extending current industrial and technological practices into the solar system. Facing perpetual violence and irrepressible exploitation on social, industrial and planetary scales — forming desolations of the past, present, and future — space settlement represents not only a material "spatial fix" in the eyes of the advocates, but arguably an existential "escape valve" (Berry 1977: 37) to ultimately save human beings from themselves.

Whether progressive or primeval, shared images of the human join together under a broader, problematic idea anchoring the Euro-American space imaginary. This is the underlying presumption that, for better or worse, "people do not change."[13] Returning to historian Frances FitzGerald's idea of history as a "straight line" (1972: 9), the remarkable "conventionality" of popular space settlement designs (Berry 1977: 36) manifest an accepting and affirming of the status quo: "this is the way it was […] this is the way it is, and this is the way it ought to be." (Robertson 1980: 17). However, imagery of a violent and extractive human poses troubling implications to this position. As Berry (1977: 36) states in his critique of the space colonies project, this position enables them to be the "ideal solution to […] those in this society who cannot face the necessities of meaningful change," where outer space becomes the perfect vacuum for evacuating moral standards in favour of more of the same. In the different science fictions this chapter describes, from Philip K. Dick to Werner Herzog, the human is described as brutal, mediocre and at times degenerate when measured by a cosmic scale; a being bound not only to the surface of Earth but to the limits of its "imaginative horizons" (Ziser 2013: 32). As Michael Ziser and others infer, human limits pose another kind of "harbinger" (Ibid) for possible futures shaped by planetary desolations. Desertification is ultimately described as a distinctly historic and human process, with acute implications for the future of *where* spacefaring humans choose to land and, furthermore, from where they seek to depart.

12 To paraphrase Wendell Berry, here (1977: 37).

13 In the words of Gerard O'Neill (cited in Berry 1977: 37).

Double Exposures and Inversions

This conflicted image of the human relates to what Dickens and Ormrod (2016: 4) describe as a "confused" outer space: somewhere envisioned both sacred and profane, and subject to processes of enchantment through evolutionary rhetoric and disenchantment by, for example, a thorough invasion of human technologies (Ibid). Through this sense of confusion, the authors contribute another double exposure in a juxtaposition of positive and negative imagery. As this chapter describes, double exposures form a critical gesture at the heart of the Euro-American spaceflight imaginary, where combining images of hope and fear conflate ambitions for a spacefaring future with anxiety about a prospect of Earthbound stasis. Here, desolations are important for figuring different forms of limits which, in their encounter, fuel a sense of agency and urgency in space settlement actors to pursue means of their escape.

Borrowing from Ormrod (2016: 390), the various existential horrors of finitude on Earth are constantly imagined in relation to their solutions in the abundant infinity of outer space. Furthermore, outer space is imagined not only infinite but *empty* — desolate of life yet rich in raw matter to exploit for human benefit. For the space settlement movement, desolations here embody a promise of emptiness, through what can be read as a distinct evacuation of *context*.[14] Whether by ignoring extraterrestrial ecologies or the hostile conditions of extreme environments, imagining desolation in outer space enables another exposure of historic, settler-colonial narratives onto distant terrains, where heroic characters can conquer and control alien natures by technical ingenuity, in the image of Robinson Crusoe. Such an evacuation transforms the "yawning black void" (Corrigan 2012: 122) into a "green promised land" (Kirby 2018: 307) — into a *frontier* — and this gesture is a typical one of many inversions at play in the Euro-American space imaginary. Whereas, in designing floating megastructures, Gerard O'Neill (1976: 93) flips common understandings of space and ground to justify the "unchecked" extraction and exploitation of earthly and cosmic environments, Elon Musk (2019), in his proposal to "nuke Mars," turns the atomic bomb from an apocalyptic threat into a force for human redemption on another world.

True to a general "special kind of logic," (Robertson 1980: 21) the double exposures and inversions of the Euro-American space imaginary comprise aesthetic gestures that are inherently contradictory and distorting yet also *stabilising* for the space settlement cause,adding another layer to a sense of closure about human futures in outer space.Here, picturing desolations and, in turn, the human in positive and negative light forms a central and critical theme.

14 See also the contextual problematic raised by David Valentine (2016: 518), as I discuss in the Introduction.

And yet, desolations can also promise something else; furthermore, when imagined through very similar aesthetic gestures. In the films of Werner Herzog and Ben Rivers, desolate landscapes form the stages for imagining humans differently — isolating and transforming found environments in ways that resonate with heterotopian ideas, where pieces of the world are reimagined to glimpse somewhere else and some other time.Here is another type of imaginary evacuation going on: borrowing from Serres, their films *purify* these places of their historical signifiers, positioning them outside of time as "counter-sites" (Foucault 1986: 24) for reflecting upon the present. However, as opposed to extending normative ideas and histories, the cinematic techniques of Herzog and Rivers reinterpret the desolations of earthly landscapes for exploring alien otherness.

Herzog and Rivers' films also depict spectacles of an ambivalent and hostile nature that is unambiguously indifferent to human life. Off Earth, human survival means conditions of confinement, constraint and stasis — each irreconcilable with the figure of Robinson Crusoe and the settler-colonial narratives he symbolises, such as unbound individualism and mastery of the natural world. This dissonance returns to the notional "gap" described by Dickens and Ormrod (2016: 19) separating "real" from "ideal" outer space. So disparate are the dreams of space settlement from the hard, harsh contexts of outer space they project upon, the future plans of leading space industry actors are rendered almost *hallucinatory*.[15] Furthermore, Herzog inverts imagery of space travel as a transcendental technological project. Through the story of the alien in *The Wild Blue Yonder*, becoming interplanetary is imagined as a desperate and degenerate act of escaping a misused, dying home planet. In Rivers' *Slow Action*, planetary desolation forms a catalyst for changing social practices, with rising sea levels and climate extremities shaping the idiosyncrasies of different stranded societies; rendering the human, rather than nature, as the experimental site. Through spectacles of change and destruction, Herzog and Rivers highlight the potential of imagining magnificent desolations for directly and indirectly disrupting a common vision of human futures in outer space. Their films reframe deserted, desolate landscapes to imaginatively unsettle the primary narratives of space colonisation and also envision other ways of life on planet Earth, exposing the monolithic frontier imagery at the heart of the Euro-American space imaginary as out of time and out of place.

15 To paraphrase Tim Corrigan (2011: 123) describing Herzog's dreamer characters.

Chapter 3

Colliding Fragments: Essaying Outer Space on Film

One notices montage, and one does not notice editing.
— Harun Farocki

Prologue

In the preceding chapters, I convey leading space settlement advocates doing their utmost to render a space-based future enticingly and "beckoningly familiar" (McCurdy 2011: 324). Fastened to the North American ideological bedrocks of progress and the frontier, spacefaring master narratives are recognisable as "the adventures of white men of the last 500 years replayed in a cosmic context" (Tutton 2018: 527). In this third chapter, problematics of a predominant outer space imaginary interface with practices and processes of the essay film. Here, I focus on the promise of artistic methods for disrupting normalising visions of the future — methods which manifest in films that join together in making planet Earth and outer space strange. Through the course of this PhD project, I produced a series of short experimental films which can be described as "essayistic." The films are all made from found-footage and use different montage techniques to critically engage with particular aesthetic and conceptual themes I identify about the Euro-American spaceflight imaginary. The films further complement the writing by offering alternative perspectives for reflecting upon the thesis concerns — articulating and exploring its theoretical ideas through moving image.

In the Introduction to this thesis, I claim the essay film to be a form of artistic research through finding mutual and essential characteristics in the theories of Borgdorff (2012), Huurdeman (2018) and Cotter (2019). Informed by these ideas, I argue that artistic research, the essay and the essay film can be described collectively as experimental, discursive and hybrid cultural forms; embodying a pluralistic approach to research concerns, fields and methods. These related forms also practice an emphatic articulation of "unfinished" thinking (Borgdorff 2012: 173; Cotter 2019: 21) in communicating an open-ended "*pursuit of knowledge*" (Huurdeman 2018: 62). It is through their dialogical gestures, from spaces of "essential incompleteness" (Cotter 2019: 12), that a radical potential emerges, where artistic research and the essay films summon their audiences into critical and "unfinished reflection" (Borgdorff 2012: 173) which, in turn, can combine to produce destabilising effects upon "reality" (Cotter 2019: 12). The ideas of Borgdorff, Cotter and Huurdeman resonate throughout my subsequent descriptions of the essay film. Nevertheless, in this chapter, I stay in the bounds of film theory for exploring essayistic practices and processes with a specific focus on filmmaking.

This chapter builds in four interrelating stages. First, I introduce the essay film as a distinct if ambiguous cultural form — as a "quasi-genre" of film (Warner 2016: 28). Exploring its different aspects, I expand upon the essay film's imaginative and discursive potential as an audiovisual form or research and vehicle of critique. Most importantly, the essay film is recognised by artists, filmmakers and scholars as a *form that thinks*: a "figuration of thinking or thought as a cinematic address and a spectatorial response" (Corrigan 2011: 30). Here, the active role of the spectator infers a discursive and reflexive nature that places a dialogical "*staging* of ideas" (Reid 2004: 60; emphasis in original) over any didactic or linear storytelling. The cinematic address further refers to a playful and provisional atmosphere about essay films, where the notion of the *attempt* is stressed as another defining characteristic — a characteristic tying the essay film to its literary origins.[1] Though I focus on film here, these common traits together resonate an "activity of essaying" (Warner 2016: 34) that transgresses disciplinary boundaries as a verb, and furthermore points towards a broader philosophy of essayism (Dillon 2017: 20).

The chapter then focuses on montage as an essential method of essayistic filmmaking. Montage provides a cinematic vocabulary — an armoury of "weapons" (Alter 2018: 8) — for producing synchronic or disjunctive relations between discrete elements of image and sound. It is this multidimensional capacity for generating audiovisual cohesions and collisions that enables essay films to "produce theory" through moving image (Ibid: 10). Here, I expand upon three particular montage techniques which are described in terms of movement: in vertical and horizontal directions, as well as the folding of images together. Each technique derives from different filmmakers who were influential in the cultural shaping of the essay film. Though they are complementary in emphasising the potential of a multiplicity and simultaneity of filmic materials, the techniques perform different approaches and attitudes to combining audiovisual fragments in varying structures.

Through his concept of "found-footage science fiction," Roger Luckhurst (2008a) brings the essay film closer to science fiction. Indeed, the films of Werner Herzog and Ben Rivers, described by Luckhurst as such, were

1 As Elizabeth A. Papazian and Caroline Eades (2015: 3) explain, "The film essay's origins can be traced back to its literary antecedents, starting with the work of the sixteenth-century statesmen and writer, Michel de Montaigne (1533–1592), whose choice of the term for his book, *Essais* (Essays, 1580), reflects, even more clearly in French than in English, the notion of an attempt or test and, at the same time, the search for a new form." After Montaigne, film theorist Nora Alter (2018: 8) finds a "relatively small number" of literary essayists referred to by essay filmmakers and scholars to contextualise the ambition, interpretation or history of a given film. These include, "Theodor W. Adorno, Roland Barthes, Walter Benjamin, Max Bense, Aldous Huxley, Georg Lukács, Siegfried Kracauer, Robert Musil, and Jean Starobinski."

important catalysts for my interest in this film form. In the third chapter section, I describe an important linkage made by montage from the essay film to "science fictional" practices, which adopt aesthetic methods and critical approaches of science fiction beyond the genre itself (Frost 2013). In particular, the essay film joins the science fictional through an interdisciplinary concept of *estrangement*. Here, estrangement means another *destabilising* of perception and relates to different aesthetic strategies for producing this effect. These strategies create a sense of critical distance from lived presents, in order to reflect upon and explore other, possible ideas. Complementary to the science fictional, montage represents one of the primary ways the essay film can "perform a kind of estrangement" (Alter 2018: 13).

This guide through ideas of the essay film, montage and estrangement then contributes to a close reading of my three short essay films. The films each address specific concerns about the Euro-American spaceflight imaginary and diverse montage techniques inform their essayistic gestures. *In Straight Circles* (Popper 2020) imagines a metaphorical double-movement about this predominant imaginary, as I describe in Chapter 1, where actors and advocates project space settlement along straight lines of history and in circular retellings of Western imagery and stories. The film engages with the imaginary's pervasive sense of repetition, where imagery and fiction extend historical, North American myths and metaphors into the solar system. The film figures this metaphorical double-movement using the iconic wheel-shaped space station, forging a circular trajectory of rotating megastructures from an assemblage of speculative science and science fiction films from the twentieth- and twenty-first century. *Clear Ideas* (2019) and *Columbus* (2020) both deal with desolation, centring on apocalyptic and otherworldly landscapes as critical sites for imagining human futures on Earth and in outer space. As I describe in Chapter 2, magnificent desolations are mobilised by space settlement actors through *double exposures* and *inversions* of positive and negative imagery, creating a sense of urgency about their spacefaring cause. Here, my films play with similar aesthetic gestures to imagine different, disrupting tensions. Both frame deserted and indifferent landscapes as stages for displacing contexts and reversing positions; performing estrangements to question whether space settlement is, as Jeff Bezos (Blue Origin 2019) and other advocates claim, such a desirably "easy choice."

Through describing the films, I find essayistic methods of filmmaking offer another "special kind of logic" (Robertson 1980: 21) for contesting the mythical structures that render this spaceflight imaginary so powerful. In other words, the fragmentary has the capacity to counter the monolithic. Complementary to the writing, the films together form an audiovisual critical response to a heteronormative and "hegemonic production of outer space" (Dickens and Ormrod 2016: 461). True to their essayistic approach, my descriptions of the films here are not designed to be deterministic but discursive. I articulate what they *try* to do in relation to the concepts and concerns motivating my aesthetic decisions in the production process.

On the Essay Film

In chapter 2, I discuss the films of Werner Herzog and Ben Rivers, who reframe earthly desolations on camera to imagine science fictions set in outer space and post-apocalyptic futures. *Lessons of Darkness* (Herzog 1992), The *Wild Blue Yonder* (Herzog 2006) and *Slow Action* (Rivers 2011) each create spatial and temporal ambiguities that transform landscapes into stages,[2] evacuating the terrains from history in order to project visions of elsewhere and elsewhen. Though they are made differently, the three films adopt a found-footage aesthetic[3] and therefore can be described together as "found-footage science fictions" (Luckhurst 2008a). The films further complement Roger Luckhurst's idea of the "found" fantastic" (2008b: 181), where the fantastic and science fictional potential of archival or documentary material is realised through imaginative changes of framing. Herzog and Rivers' films are important for this PhD project, not only for their unsettling reimaginings of planetary desolation but also for the artistic methods and approaches they share. Of further significance is the explicit reading of their films as *essay films* (Corrigan 2011, Rascaroli 2017); their mutual processes and critical functions are recognisably "essayistic" and therefore help to bring the essay film closer to the science fictional. In his critique of *The Wild Blue Yonder,* Luckhurst (2008a: 208) describes an interesting tension created by Herzog in the filmmaker's search for "autonomy through resignified found-footage." "If a found-footage sf [science fiction] can be conceived," he argues (Ibid: 193), "it is because the refunctioning of materials through various montage effects levers open a new temporality along the very seam of juxtaposition and the cut." Here, he places montage — in its refunctioning of filmic materials — central to a theory of found-footage science fiction, using the words of Soviet film director Sergei Eisenstein (cited in Aumont 1987: 150) to describe "an assembly of fragments constructed out of complete and autonomous parts." By foregrounding a montage aesthetic, and referring to Eisenstein in particular, Luckhurst situates found-footage science fiction squarely in a history shared by the essay film.

The essay film appears to be particularly difficult, or "impossible" (Bellour 2017: 236) to categorise as a cultural form or film genre. From reading different studies by film scholars, there is a general consensus that it is a hybrid media form occupying a liminal space of indeterminacy; possessing a "certain lightness" (Dillon 2017: 22) in undoing and redoing cine-

2 In a heterotopian manner (Foucault 1984), the landscapes are placed "outside of time" (Rivers 2015).

3 It is worth noting here that Rivers did shoot the island landscapes of *Slow Action* himself. However, the film footage is treated as if it is found — "modelled after a 1970s idiom" (Paterson 2011) — and the soundtrack is composed by appropriating scores from older science fiction films (Ibid).

ma forms (Corrigan 2011: 4), while negating traditional boundaries separating genres of fiction and nonfiction film (Alter 2018: 6). This "ambiguous" and transgressive approach (Bellour 2017: 229) has prompted more nuanced characterisations of the essay film, often in close relation to the literary essay, which regularly describe elements of the *essayistic* or *essayism*. For writer Brian Dillon (2017: 20), essayism means: "Not the practice merely of the [essay] form, but an attitude to the form – to its spirit of adventure and its unfinished nature..." Furthermore, scholar Raymond Bellour (2017: 229) adds that "essay" can be considered as a "quality or as a substance, such as water or air or light" that can vary in its proportions. From this idea, Bellour argues "to speak of *essayistic film* […] is itself more careful than to say overtly: *an essay film*" (Ibid: 237; emphasis in original). Rick Warner (2016: 54; emphasis in original) then builds upon Bellour's notion to frame essayism and the essayistic as "*modal* variants of the essay that can make their way into a variety of genres and idioms [...] without loss of reflective potency."

Today, in a *post-YouTube* era, the increasing accessibility of digital media and video editing software has also led to both a democratising of essay film methods and a disseminating of essayistic media across a range of online platforms (Álvarez López and Martin 2014; Arsenjuk 2016: 292). These developments created further artistic and academic "transmutations" of the quasi-genre under the umbrella label, "video essay" (Lee 2017b).[4] Such technological transformations mean the essay film is currently understood to be "a full-blown global phenomenon" (Alter and Corrigan 2017: 17) that is seemingly everywhere yet nowhere. However, the impossibility of defining essay films can also go some way to explaining why they can be "so productively inventive" (Corrigan 2011: 4). Furthermore, there are particular and recognisable "essayistic principles and procedures" (Warner 2016: 28) which help to distinguish the essay film and its "floating logic" (Bellour 2017: 232). Nora Alter and Tim Corrigan (2017: 3) find "the blending of fact and fiction, the mixing of art- and documentary-film styles, the foregrounding of a personal or subjective point of view, a focus on public life, a dramatic tension between audial and visual discourses, and a dialogic encounter

4 Though difficult to classify, the video essay is also arguably recognisable by some basic principles. First is a primary concern with the study and criticism of film and media via audiovisual means, where video becomes the medium to share understandings with a wider audience. Video essays display a specific focus on particular interests about cinema; television; social media and related social, historical or political issues. They are often shorter form than essay films and are primarily uploaded to social media platforms (such as *YouTube*) along with other online sites more dedicated to film culture and production (*Vimeo*) or academic media studies (*[in]Transition*). Video essays can thus be read as both formal and informal objects of research, which also use montage for critical commentary on found footage. However, while they join the essay film in their methods of production, video essays can be distinguished both for what they focus on and also for where they are screened and accessed. Media reflexive, video essays embody the type of media forms that they critique, as they return their critical contributions to the participatory media platforms where they source their materials.

with audiences and viewers" to be signature traits. In the following paragraphs, I expand upon my claims from the thesis Introduction, which help to characterise the essay film as not only a particular film type but an audiovisual form of research. The essay film *thinks* and *tries*; it *critiques*, and also remains *unfinished*. Borrowing from Huurdeman (2018: 62) and Warner, these critical characteristics further inform what *to essay* means as a verb, describing an "activity of essaying" (Warner 2016: 34; emphasis in original) that joins the essay film to artistic research and other essayistic cultural forms and practices.

The essay film thinks. It is a type of film that "explicitly reflects on the materials it presents, to actualise the thinking process itself" (Lee 2017a). As early as 1940, artist Hans Richter (2017: 91) recognised an ambition for a new type of filmmaking "to visualise thoughts on screen." In stating the essay film as a "primary vehicle through which critique is developed in audiovisual practice," Alter (2018: 10) highlights a tendency to address subjects and issues that are arguably "too big to fathom" (Ibid: 2). This emphasis on complexity is important, for it shapes not only how the essay film thinks but also the expression of its thought process in audiovisual forms. First, though it may respond to existing cultural or social concerns in the "real world," the intangible or multidimensional natures of particular subjects implore essay films to stray from direct documentary practices and negate any boundary separating fiction from nonfiction. Both historical and contemporary theorists anticipate this need in different ways. For example, Richter (2017: 90–91) chose the stock market as one "object" whose complexity escapes simple documentary photography and entices filmmakers to "switch from objective representation to fantastic allegory and from there to a stage scene" in order to render it understandable. For Richter (Ibid: 92) the essay film can "use everything that exists and what can be invented — as long as they serve the purpose of making visible the fundamental idea." Corrigan (2011: 30) further describes an interaction in essay films "of a fragmented subject and a shifting enunciation," that also points to a particular thinking process and its actualisation. From the literary essay, Corrigan charts the pronounced presence of the filmmaker or a fictional persona, in voice or on camera, to be "one of the most recognisable signs of the essay film" (Ibid). This persona thus becomes a foremost vehicle for the essay filmmaker to enunciate their search or investigation in a form of "expressive subjectivity" (Ibid); relaying different encounters with the world as "experienced through a thinking mind" (Ibid: 35).[5] More importantly, Corrigan (Ibid: 30) also notes the essay film's enunciation can be performed in other "various formal or technical ways, including editing and other representational manipulations of the image." As I discuss later, montage

5 Corrigan (2011: 34) further understands the essay film that "produces ideas and a process of thinking that extends subjectivity through an outside world." Raymond Bellour (2017: 229) further conveys a "closeness between the cinema and the thought," which implies the filmmaker becoming equal to the philosopher.

forms a primary means of cinematic thinking and for the enunciation of thought on film. Here, the common use of complex layering, mixing and interplay of different audiovisual elements reflect the multidimensional complexity of the problems which the essay film can address.

The essay film tries. The notion of the attempt is another important conceptual thread tying the essay film to the literary essay, whose provisional and exploratory nature is found in the meaning of the word "essay" itself.[6] The writer Michel de Montaigne stands for many as the basic reference (Bellour 2017: 232) for using the term in his book *Essais* (1580), which has been interpreted as "the testing of ideas, of his own subjectivity […] and of society" (Alter 2018: 8; see also Corrigan 2011: 33). In his book *Essayism* (2017), Brian Dillon finds an essay by Montaigne, "Of Practice" (cited in Dillon 2017: 18), where he sets about creating spaces to experiment and play:

What I write here is not my teaching, but my study; it is not a lesson for others, but for me. And yet it should not be held against me if I publish what I write. What is useful to me may also by accident be useful to another. Moreover, I am not spoiling anything, I am only using what is mine. And if I play the fool, it is at my expense and without harm to anyone. For it is a folly that will die with me, and will have no consequences.

The idea of parting effort from expectation continues into the contemporary, where film scholar Luka Arsenjuk (2016: 276) separates the "essay-attempt" from any insufficient binary of success and failure. For Arsenjuk (Ibid), this sort of trial is "better grasped in relation to a different opposition, namely that of the possible and the impossible." This idea returns to the image of the essay film as a form that negates generic boundaries and undoes cinematic conventions.[7] In practice, this transgressionary tendency also grounds a "possibilist" approach by essayists towards the film medium (Warner 2016: 30). Here, Warner (Ibid) echoes Richter's earlier ideas by using this term to describe those who "appropriate and test out whatever forms they believe can enrich their own reflections." Later in this chapter, I expand upon how the provisional nature of the "essay-attempt" resonates in montage, particularly in the essayistic films of artist Harun Farocki.

The essay film critiques. For artist Kevin B. Lee (2017a), the essay film is "distinctly self-aware" and dedicated to a critical exploration of "me-

6 Nora Alter (2018: 7; emphasis in original) states "To essay" means "to assay," "to weigh," as well as "to attempt," suggesting an open-ended, evaluative search. The verb is also linked via the Latin *ex-agere* to *agens*, referring to the problem of human agency."

7 Arsenjuk (2016: 276) further emphasises an "essayistic desire to emancipate" cinema from its "typical divisions," towards renewing its very conception.

dia itself." His own and other film essayist practices are reflective and reflexive,[8] where images constantly and explicitly "interrogate" their potential meanings and relationships (Rascaroli 2008: 24; Tracy 2013). Lee further articulates a common and tangibly political position of discontent that is shared by many of his contemporaries regarding the images they work with. In writer and filmmaker Kodwo Eshun's words, "the essayistic is dissatisfaction, it's discontent with the duties of an image and the obligations of a sound" (Eshun cited in Lee 2017a). From this position, Lee and Eshun align with media theorist Rob Coley (2018: 305), who apprehends a multimedia "narrative infrastructure" mediating our perceptions of the world[9] and emphasises the "political force" of stories, which possess, in his words, a "constitutive and material agency" (Ibid: 305). In his survey of the films of Adam Curtis,[10] Coley (308) argues that not only can essay films be dialogical but *diagnostic*: inhabiting "the rhythms and vectors of contemporary media" and reflecting the present social conditions it generates. Hito Steyerl, artist, furthers this idea by noting the resemblance of essay films today with other media competing on digital platforms: "They now look amazingly similar to the collaged daily schedule of any contemporary working mom, to a zapping spree with a voiceover, or maybe just to a Sunday afternoon remix contest on YouTube" (Steyerl 2017: 278). Coley and Steyerl also complement a wider ambition for the essay film to sharpen a collective critical awareness of "how media functions in our lives" (Lee 2017a), where films can expose "the image as part of a matrix of meaning that extends beyond the screen" (Tracy 2013).[11] Together, the authors here convey the essay film not only actualising a thinking process but also articulating a position of discontent. Though they share an explicit concern for the nature of contemporary media — its political mechanisms and the effects of its popular dissemination and consumption — in a broader sense, their ideas present the essay film as an important and contemporary audiovisual vehicle of critique.

The essay film is unfinished. By enunciating a thought process, broaching intangibly complex subjects and foregrounding the possible and provisional, the essay film adopts a dialogical and discursive position to any form of knowledge it may produce. The multidimensional structures of essay films — described in turn as "kaleidoscopic" or a sort of "labyrinthe" (Alter 2018: 27)

8 Borrowing from Nora Alter (1996: 171 cited in Rascaroli 2017: 69), who describes essay films as "self-reflective and self-reflexive."

9 Lee (2017a) complements this idea by describing the screen that shapes relations to "a world it has done as much to distort or distract us from as it has revealed and connected back to us."

10 Including *All Watched Over by Machines of Loving Grace* (Curtis 2011) and *Bitter Lake* (Curtis 2015).

11 Such an ambition further rhymes with the dual "world-constituting and world revealing" powers of art and artistic research, as defined by Borgdorff (2012: 173).

— also reflect a decidedly fragmentary and open-ended nature, where meanings can multiply in relation audience interpretations. As Alter (Ibid) claims, these characteristics are what "makes them dialogical […] what makes them essayistic." Warner (2016: 47) also finds a mutual ambition of film essayists Harun Farocki and Jean-Luc Godard to engage and empower the spectator: to "free up […] cultivate and test [their] associative, imaginative and constructive faculties…" The dialogical address can therefore be understood as one of the core tenets of any essay film. Arsenjuk (2016: 293) is also important for concisely describing an essayistic removal of knowledge from "the position of authoritative agency, subordinating it instead to a discursive position, from which it may stop explaining and begin registering the truth of an irreducibly disjunctive, conflictual and disputable desire." As Arsenjuk conveys (Ibid: 292), this subordinating gesture raises the *poetic* over the *didactic*, while underlining an epistemological approach of the essayistic towards ideas of truth — an approach traceable to the theoretical foundations of the essay form. In "The Essay as Form", philosopher Theodor Adorno (1984: 171) claims "heresy" as the law of the essay's innermost form, defending its fragmentary and transgressionary nature for disrupting any assumed "giveness of totality" (159) and "orthodoxy of thought" (171). For Adorno (Ibid: 159), "the desire of the essay is not to seek and filter the eternal out of the transitory; it wants, rather, to make the transitory eternal." Returning to film, these epistemological positions augment the potential of essay filmmakers to imagine and invent in visualising ideas that are "not necessarily grounded by reason or in reality" (Alter 2018: 18; emphasis in original). Richter (2017: 91) also anticipates an emancipation of film from documentary traditions, where "fantastic allegory" becomes just as meaningful as any "objective representation," particularly in encountering subjects and worlds of increasingly unfathomable complexity.

On Montage

Montage is found by artists and scholars at the heart of the essay film and its cinematic way of thinking.[12] As method, it shapes the "pursuit and provocation of ideas through the juxtaposition of concrete things" (Reid 2004: 60), combining image and sound in "unpredictable ways to produce theory" (Alter 2018: 10). As Nora Alter describes (Ibid: 11), it is through this interplay that montage deploys "tropes such as metaphor, metonymy, allegory, and doublespeak" to produce films that are "multivalent and multivocal."[13] Creating atmospheres of "contradiction and the collision of opposites," (Ibid: 8) montage

12 Warner (2016: 34) also describes a "cinematic thinking on a level of shot-to-shot relations."

13 Montage also represents a cinematic transformation of what Alter (Ibid: 8) considers the literary essay's weapons of "humour, irony, satire and paradox."

manifests a *fragmentary* nature of the essayistic — a nature that is found in the literary, where Adorno (1984: 164) claims the essay "thinks in fragments just as reality is fragmented and gains its unity only by moving through the fissures, rather than by smoothing them over." Adorno (Ibid: 161) notes the essay is made of "discreetly separated elements" that crystallise into "configuration[s]": what Huurdeman (2018: 60) summarises as "pieces of a puzzle which are not meant to be solved but could potentially hold a solution." Deriving from the literary essay, Dillon (2017: 68) consolidates Adorno's puzzle characterisation by inferring the fragments of an essay "must be made to speak by a reader, to the fragments that surround it."

The fragmentary also informs a countering by film essayists to linear storytelling, in response to the scale and complexity of subjects and questions they focus on. As Corrigan (2011: 30) has described, the essayist approach also pronounces a shifting and multiplying thought process. The notion of montage actualising thought is also offered by Dutch filmmaker Johan van der Keuken (1992: 36 in Bellour 2017: 231), who claims the method "corresponds to the trials and errors of consciousness, which effectuates movements of comings and goings between the different layers of reality." Thinking and working in fragments, montage forms a dynamic and experimental method for audiovisual and essayistic engagements with the world and its different layers. Facing the insufficiency of linear and documentary film forms for describing contemporary conditions, montage appeals to film essayists not only for its inherent possibility and unpredictability, but arguably as one of the only ways for film to deal with increasingly unfathomable objects and to relay irregular contemporary experiences.[14]

Adorno (1984: 164) is further important for conveying the significance of the "fissures" in-between fragments that the essay moves through. In doing so, he sets the scene for Rascaroli (2017: 21) to describe the essay film not only by how it works but *where* it works, as "a method of filmic thinking that exists and thrives in gaps." Building upon Adorno's ideas, Rascaroli (8) claims the "in-between spaces" are essential for the essay film as it produces dialectical tensions generated by discontinuity and disjunction in "constructed juxtaposition[s] of elements" (12). Gaps also appear in "textual and contextual framing," (20) which forms another critical part of the essay film's thinking process. "To frame," she says, "is ultimately, to detach an object from its background and, thus, to create a gap between object and world." Furthermore, this gap is one of "potentiality" (189) — a gap which Rascaroli underlines as the essay film's "philosophy" (Ibid). I find this philosophy enacted in the films of Werner Herzog and

14 Johan van der Keuken (1992: 32 in Bellour 2017: 231) further argues "the temporal fragments of a film correspond to the holes and irregularities of a temporal experience, which are created by our different states of consciousness."

Ben Rivers, which I discuss in Chapter 2. In *Lessons of Darkness* (Herzog 1992) and Slow Action (Rivers 2011), the filmmakers renew the potential of otherworldly landscapes by imaginatively *detaching* them from the world. By changing the framing, evacuating any original context, they render documentary footage science-fictional (Luckhurst 2018a) for exploring distant futures or reimagining space travel.

For Rascaroli (2017: 190), the essay film is a "distinctive method of interstitial thinking," moving in the fissures separating object and world, as well as object and filmmaker, who must reflect upon this distance and how film can "negotiate such a gap" (Ibid: 189). Furthermore, Rascaroli describes how gaps inform the essay film's radical potential — a potential that is moreover recognisable in characterisations of artistic research. Drawing upon philosopher Gilles Deleuze (1989: 180) and his concept of the "interstice" in cinema, she claims a "method of between" radically calls what we see and hear into question, repositioning us vis-à-vis an object, and opening the film to the new" (Rascaroli 2017: 190). This idea corresponds to the "constant tension" Rascaroli conveys about the essay film between its "disassemblage and reassemblage," an idea that further coheres with the "radical potential" described by Cotter (2019: 12) about the "essential incompleteness" of art. Borrowing from Borgdorff (2012: 143), the gap emerges as an essential method for the essay film's capacity to articulate forms of "unfinished thinking" and to invite "unfinished reflection." By producing and highlighting the crevices (Rascaroli 2017: 188), the essay film foregrounds the contingencies of its audiovisual compositions and discursive perspectives — open for undoing and redoing. In this way, it joins artistic research in producing *destabilising* effects on realities and our perceptions of them (Cotter 2019: 12).

Essay film theory and criticism highlight other interesting ideas about montage, where Sergei Eisenstein appears again as a seminal figure. The conceptual foundations of montage are broadly recognised in Eisenstein's notes for an unmade film based upon Karl Marx's *Capital*. In these notes, Eisenstein (1976: 17) articulates a way of thinking by visual association in arranging a metaphorical chain of images:

... Pepper. Cayenne. Devil's Island. Dreyfus. French chauvinism. Figaro in Krupp's hands. War. Ships sunk in the port. [...] It would be good to cover the sunken English ships [...] with the lid of a saucepan.

As academic Volker Pantenburg (2015: 151) conveys, Eisenstein's sequence here "assumes a trust in the collaboration of the viewer," who is able to translate the images into concepts and backgrounds "in order grasp the causal connection between foodstuffs, colonial history, and war." For Pantenburg (Ibid), montage reintroduces an "intellectual abstraction" of imagery, where memories and associations of the spectator render a sinking ship as "not simply a sinking ship but [an image that] leads to more abstract thoughts about war and international economic relationships."

Eisenstein is further influential for developing a particular concept of montage, forming one of three distinct types, or techniques, that I find most interesting. Each type corresponds to a certain directional movement, an emphasis of multiplicity and a distinct interplay of filmic materials. First, in his book *The Film Sense* (1957: 74), Eisenstein defines "vertical montage" as a polyphonic synthesising of multiple elements that simultaneously advance as a film progresses. Second, film critic André Bazin (2017: 22) then complements Eisenstein's notion with his idea of "horizontal" montage, coined to describe the essay films of Chris Marker, which infers a lateral motion across a films image and sound that highlights the relations of discrete elements *by playing with them*. A third type of montage is theorised by artist Harun Farocki and academic Kaja Silverman (1998: 142), who later use "soft montage" to signify an ambiguous folding of images and sounds together in "force fields" (Alter 2015: 152) in order to amplify their potential for connection and disjuncture in different arrangements. Studying the different types of montage has developed my understanding of essay films and their imaginative and discursive potential. Furthermore, these types are also found in my own essay films that I discuss later in the chapter and offer another means for describing them in greater depth.

Whereas, in a traditional sense, horizontal montage can mean images and sounds cut one after the other in a linear sequence, Eisenstein coins "vertical montage" to describe a simultaneous and synchronous combining of film elements. He explains his idea of montage using the metaphor of an orchestral score, with diverse instruments playing in harmony. The orchestra represents the interrelating parts of a film arranged in a "vertical structure" (Eisenstein 1957: 74), from "the simultaneous music, actor's gesture and voice, the choice of where to put the frame of the shot, the set, geometric composition in line, colour, arrangement…" (Reid 2004: 62). For Eisenstein, montage is an intricate combination of multiple, simultaneous elements in a progression that moves horizontally *and* vertically: if horizontal montage creates linear melody, vertical montage produces harmony, creating a polyphonic style "through a simultaneous advance of a multiple series of lines, each maintaining an independent compositional course and each contributing to the total compositional course of the sequence" (Eisenstein 1957: 75). This image also rhymes with another metaphor offered by Adorno (1984: 160), who describes the literary essay as a form where "concepts do not build on a continuum of operation, thought does not advance in a single direction, rather the aspects of the argument interweave as a carpet."

The film critic André Bazin contributes another important idea about montage, in his critique of film director Chris Marker[15] and his film *Letter from Siberia* (1957), which describes a multilayered form of correspondence from a trip through the region. *Letter from Siberia* comprises multiple filmic materials and styles. It shapeshifts from travelogue documentary to imaginary newsreel to advertising and animation, where the script flips constantly from objective to subjective, factual to fictional, from commentary to story and song. The atmosphere also readily changes from meditative to whimsical. This kaleidoscopic approach (Stob 2012: 42) enables Marker to form his correspondence from Siberia in response to imagined expectations of multiple film genres, adapting their different tropes in playful critique. In doing so, the film projects a distinct self-awareness, explicitly conscious of its own construction as much as any picture it paints of a distant land.

And now, here's the shot I've been waiting for, the shot you've all been waiting for. The shot no worthwhile film about a country in the process of transformation could possibly leave out: the contrast between the old and the new.

—Letter from Siberia (1957)

In reviewing *Letter from Siberia*, Bazin (2017: 22) finds the essayistic in an original, "horizontal" form of montage, where "the image does not refer to that which precedes or follows it, but refers more or less laterally to that which is said of it." This lateral relation is rendered primarily by the commentary of a dominant narrator, who articulates and maintains a critical distance separating the recorded images and his subjective interpretations of them. The guiding presence of an unseen narrator prompted Bazin (2017: 22) to describe the edit working "from the ear to the eye," denoting a then radical shift in "basic filmic hierarchy" (Stob 2012: 37). As film scholar Jennifer Stob (Ibid) explains, Bazin found a "profoundly decreased importance of the actual moving pictures in relation to their narration," where imagery is threaded "along and against an imposingly frictive soundtrack" (Ibid: 36). Bazin and Stob both highlight a particular passage in the film that repeats "the same fifteen-second sequence four times as the soundtrack provides four ideologically differing voice-overs to colour our perception of the scene" (Stob 2012: 43). Such a "dialectical juxtaposition" (Ibid) serves to not only emphasise the inherent visual articulacy of images but the radical capacity of words to change their meaning.

15 Chris Marker is considered by many as the "quintessential" essay filmmaker (Warner 2015: 29), whose films *Letter from Siberia* (1957) and *Sans Soleil* (1983) regularly serve as "blueprint[s] from which the attributes of the genre are taken" (Pantenburg 2011: 141). These films share Marker's "preferred cinematic motifs" (Stob 2012: 39), including "foreign travel, photographic memory, time's inexorability and the shifting meaning of community — themes that would later come to define his auteurship" (Ibid).

Figures 74—93: A repeating sequence in the film *Letter from Siberia* (1957) directed by Chris Marker.
The sequence plays four times consecutively to four different voiceovers, which each "colour our perception of the scene" (Stob 2012: 43). Screenshots. Credits: Argos Films.










Though Bazin names Marker's style a "horizontal montage," this term describes a style that is far from linear and closer to Eisenstein's concept of "vertical montage." The former's "ear-to-eye" editing continues the idea of film as an audiovisual score, with the image one of many parts in the orchestra: "succeeding each other and corresponding, according to their own laws, with the movement of the music – and *vice versa*" (Eisenstein 1957: 74; emphasis in original). However, Marker "pushes the dialectic process on film" (Stob 2012: 37) by not only composing harmony but *friction* — image and sound work with and against each other to create "internal contradictions that nevertheless manage to cooperate" (Ibid: 42). Writing about *Letter from Siberia* in the 1957, Bazin approaches a broader characterization of essay films by claiming their "primary material is in no way the image, but rather the *idea*: that is what organizes the montage, creates the text, and presides over their synthesis" (2017: 19; emphasis in original). By foregrounding their audiovisual combinations, order, and timing, it is arguably through montage that Marker and other film essayists manifest their films' "intelligence" (Stob 2012: 37). In other words, montage enables Marker and others to preserve "the process of thinking" (Good 1988: 20; emphasis in original) by orchestrating image and sound in fragmented and unpredictable ways — ways that produce *ideas*, that produce theory.

There is another form of montage forming a theoretical capacity of the essay film, while also connecting to the literary essay. Together, Farocki and Silverman (1998: 142) introduce "soft montage" as a cinematic technique for enabling images to comment on each other in a "general relatedness, rather than a strict opposition or equation." Soft montage is characterised by multiplication, simultaneity and ambiguity. Whether on a single-channel film or expanded in multiscreen installations, images are placed "into force fields" (Alter 2015: 152) where their interplay creates "serial and concurrent linkages that execute a variety of doublings, refrains, reenactments, side-by-side weighings and relays of motifs" (Warner 2016: 49). According to Alter (2015: 152), images in soft montage "do not collide with one another" but "are folded onto one another within the same spatial field, creating new configurations" in a nonlinear fashion.

Farocki and Silverman frame "soft montage" as a reimagining of a formal principle of *shot/countershot* they find in the films of Jean-Luc Godard, with a particular interest in Numero deux (1975). Rick Warner (2016: 30) describes the shot/countershot technique as a "the most common syntactical feature of popular cinema," most often used to envision a spoken dialogue and to ensure a sense of narrative continuity. However, Warner (Ibid) refers to the films of Alfred Hitchcock, such as *The Wrong Man* (1956), to highlight its potential to also create "a play of contrasts, tensions and affective sensations in the intervening space between characters." In terms of shot/countershot, Farocki (2001: 108 cited in Warner 2016: 48) argues that placing two, opposing shots side by side can also "yield *another image*, and that which exists between the images should become visible" (emphasis in original). In Warner's words (Ibid), Farocki frames

shot/countershot as "a fully-fledged operation of 'montage' instead of 'mere editing." This idea is consolidated by artist John Akomfrah (2015), who describes montage as the bringing together of discrete elements in pursuit of "the third meaning"; whereas Godard himself (cited in Pantenburg 2015: 152) claims "two images are necessary for the production of a context."

What further signifies "soft montage" is a "provisional tone and texture, as though the relations are still being essayed" (Warner 2016: 49). Here, montage is used "in a way that preserves […] *the sense of trial*" (Ibid; emphasis in original); refusing certainty about a film's meanings and connections. This sense is important, for it shapes an open-ended position that empowers the spectator, themselves, to "build up the associations in an ongoing way as the film unfolds" (Farocki and Silverman 1998: 191). Through soft montage, essay films thus create what Warner (2016: 49) terms "a kind of 'mutual galvanism' between the filmmaker and the spectator who must work constructively" to construct meaning out of ambiguity and possibility. Another essayistic gesture for communicating an essential incompleteness is the staging of the film editing process on camera as a thinking process. In Farocki's words (2004: 77), "One notices montage, and one does not notice editing." Here, the implicit or explicit presence of the editing room can emphasise the provisional aspect of any supposedly 'finished' film. Orson Welles' *F for Fake* (1973) is one example where the cutting table is foregrounded as a sort of *bravura* motif (Warner 2016: 53), yet it need not overtly appear. The editing room also presents itself whenever images are placed side-by-side: in single– or multiple–channel video formats, or in exhibition installations comprised of numerous projections, where images can construct different "temporal as well as spatial relationships" (Alter 2015: 152).

Whether imagined as horizontal, vertical, lateral or folding; as a carpet, orchestra or force field, the primacy of montage means the essay film can also arguably be defined by notions of movement; shaping a "simultaneous advance" (Eisenstein 1957: 75) of filmic materials and their multiplicity of combinations and meanings. Borrowing from Adorno and Eisenstein's respective metaphors, in *Letter from Siberia*, Chris Marker creates a kaleidoscopic film by traversing ceaselessly across the vertical structure of his audiovisual materials, as if weaving and unraveling threads together in a constant dialogue of imagery and sound. Concerning his "self-reflexive narratives" (Stob 2012: 43) and their lateral relation to documentary footage (Bazin 2017: 22), it is worth repeating the sense of distance that words can create from images — a critical distance that transforms perspectives on what and how we see.[16] Yet, as Lee conveys in his video essay, *Elements of the Essay Film* (2014), not only words possess the capacity for

16 The essay film is a "screen that lets us see in two directions at once […] exploring its subject and at the same time exploring how it sees its subject" (Lee 2014).

commentary on images, which furthermore need not be the only critical subject. Images can comment on words; images can interpret sounds; sounds can redefine words; and sounds can add meanings to other sounds. This kaleidoscopic image recurs in the "soft montage" of Farocki and Silverman, which entices filmmaker and spectator to construct meaning in serial, concurrent linkages that are destabilised by their ambiguity. Together, the multidirectional, multidimensional and transformational capacities of montage constitute the ability of the essay film to "perform a kind of estrangement" (Alter 2018: 13).

Estrangements

Estrangement can mean a destabilising of perception,[17] and montage is a primary method in which the essay film "denaturalises events, representations, and problems, thereby challenging accepted ways of viewing and understanding the world" (Alter 2018: 13). Estrangement is also a concept regularly found in discourse around science fiction, where it describes a cognitive effect and critical function which arguably define the genre. The writer and academic Darko Suvin (2017: 118) claims the necessary conditions of science fiction to be "the presence and interaction of estrangement and cognition, and whose main formal device is an imaginative framework alternative to the author's empirical environment." Rather than reaching for a precise and totalising definition of science fiction, estrangement highlights what I find most interesting about the genre in relation to the essay film and other practices: namely, the way science fiction performs as a particular and "privileged site of critical thought" (Kitchin and Kneale 2002: 4). Science fictions are further understood to function as hypothetical "thought-experiments" (Le Guin 1969), where fictions become playful vehicles for critical and reflective explorations of alternative, possible worlds.[18] These experiments arguably enable the transmission of "new wavelengths" that can transform authors and readers' perspectives about the worlds that they inhabit (Suvin 2017: 123). In other words, science fiction creates estrangement as a "constructive mode of alienation" (Stableford 2006: 18).

Though embedded in science fiction theory, estrangement is resolutely multidimensional and interdisciplinary. In turn, the concept extends from science fiction into the "science fictional": another cultural form occupying a liminal intersection of different practices that adapt similar aesthetic or dieget-

17 Or "de-automatization" of perception (Spiegel 2008: 376).

18 The science fiction author Kim Stanley Robinson (1994: 55 cited in Kilgore 2003: 238) champions the "thought experiment that attacks social problems and suggests solutions, utopian goals, or envisions societies that we might then work towards […] It can be playful, and it can be fun to read, and yet still be a way of increasing the meaning of our lives and sharpening our political will."

ic methods, and sharing a critical awareness towards the contemporary world, its multidimensional complexity and its technoscientific transformations (Frost 2013: 2). The science fiction scholar Istvan Csicsery-Ronay (2008: 2) further continues the science fictional into "science-fictionality" in terming an essential mode of thought for engaging with a technical world accelerating beyond our "conceptual threshold" (Ibid: 5).

From reading various authors, one of the defining critical functions of the science fictional appears to be a sense of critical distance generated from the lived present, where estrangement becomes a vehicle for reflection upon "reality" and explorations of otherness.[19] Suvin (2017: 120) refers to the author or reader's empirical present as "the zero world," the central reference point from which any fictional world relates to; a "factual reporting" back from these hypothetical thought experiments then becomes a means to confront existing norms with a very different set (Ibid: 117). Csicsery-Ronay also describes a pair of gaps, "two forms of hesitation," that are central to the approach of science-fictionality (2008: 3). The first gap extends between the conceptual entertaining technoscientific transformations a rational consideration of the ramifications to social life their actual realisation could imply (Ibid). The second gap arguably extends from immanent, rather than conceivable, transformations of the first gap, as means to consider not their plausibility but their more urgently ethical, social and cultural consequences (Ibid) In both gaps, hesitations extend a distance for critical reflection and imagining possibility in "virtual imaginary spaces" (Ibid: 5). Returning to the essay film, in Chris Marker and "horizontal montage," the *distance* created by lateral relations of image and word produces other spaces for criticality. In the repeated short sequence in *Letter from Siberia*, Marker made the image track "skip like a record" (Stob 2012: 43) to represent another form of hesitation about recorded images, destabilising our perception of the scene by bringing the films vertical structure to the fore, and emphasising the distance separating image and sound tracks. Through montage, any one meaning of this scene is displaced among many. This lateral motion is also dialectical. Furthermore, it helps to consolidate estrangement as a conceptual bridge connecting the essay film with the science fictional.

The film scholar Simon Spiegel's writing on estrangement is important for pluralising the concept in practice and in history. In practice, Spiegel (2008: 376) discerns the nuances of estrangement into "formal" and "fictional" types; in other words, what estrangement does and how. Estrangement

19 Frederic Jameson (2017: 217) also describes a science fictional distancing, where "imaginary constructs" cast the present as history: "in the form of some future world's remote past."

can mean making the strange familiar or the familiar strange,[20] and also can represent various diegetic elements — such as characters, images, objects and interventions — as estrangements that function "on the level of the story" (Ibid). In Werner Herzog's films, *Lessons of Darkness* and *The Wild Blue Yonder* exemplify both *familiar-* and *strange-making* processes by reframing documentary footage of landscapes through science fiction narrations. In both films, the narration, delivered by alien characters, "insistently resignifies the footage as an interstellar journey and arrival on another planet through simple vertical montage" (Luckhurst 2008a: 207). Here, recognisable landscapes on Earth are *made strange* by stories of interstellar travel, in a sort of formal process of "defamiliarisation" that Spiegel defines (2008: 376). In turn, the alien character acts as a fictional intervention that transforms the perception the original film material. In describing what estrangement can mean and do, Spiegel is precise yet also broad enough in conceptualising not only a cognitive effect, but the multiple aesthetic methods that can produce it — methods that span many practices, dimensions and media.

Spiegel also traces estrangement to particular historical figures including the German playwright Bertolt Brecht, whose theory of V*erfremdungseffekt* imbues estrangement with political motivation. From Spiegel (2008: 370), I learn that: "For Brecht, it is essential that estrangement leads to the realization that things do not have to be the way they are, that any current state of things is not a natural given but a product of historical processes, which can change and will be changed." Here, the world is seen as a historical construction that is changeable and therefore questionable. This non-affirmative positioning further aligns with the articulations of discontent that shape many film essayist ambitions to apprehend narrative infrastructures and to change societal relationships to contemporary media. Returning to science fiction, Spiegel (2008: 374) indirectly joins Brecht, Lee and Suvin together in their mutual interest in estrangement as a means of critical "examination of the present." Whether essayistic or science fictional, estrangement emerges as a critical means for encountering and engaging with constructed realities that demand a change of perception.

20 Also described by Spiegel in terms of "naturalisation" or "defamiliarisation" (2008: 376).

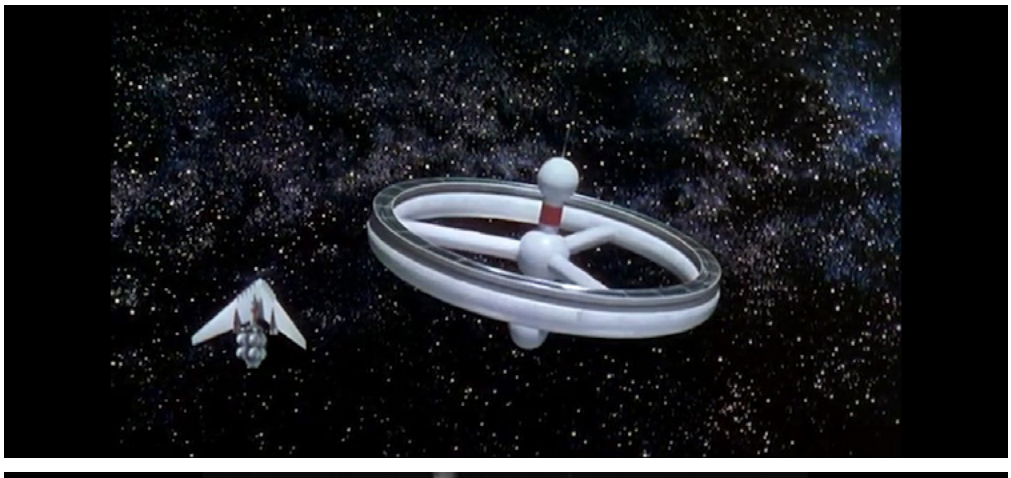
In Straight Circles

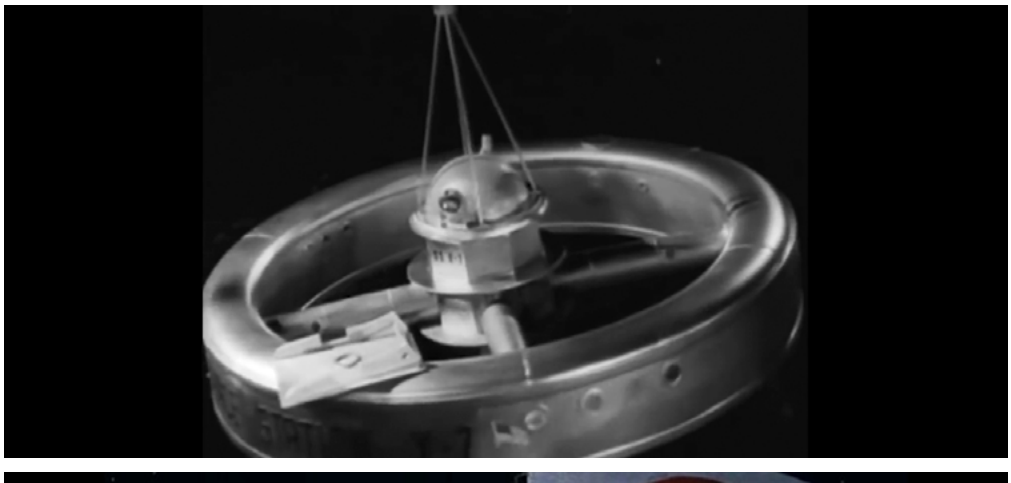
(2020) 6 mins, HD

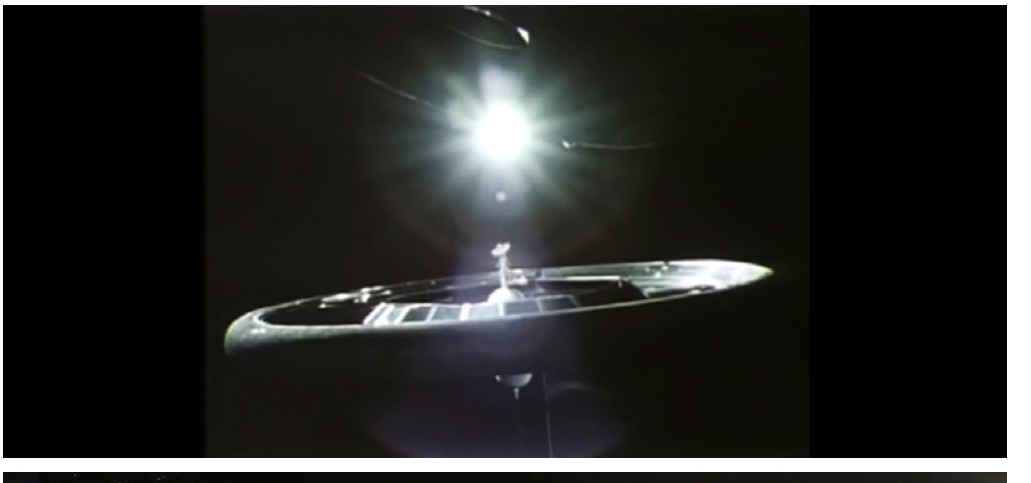
Joseph Popper

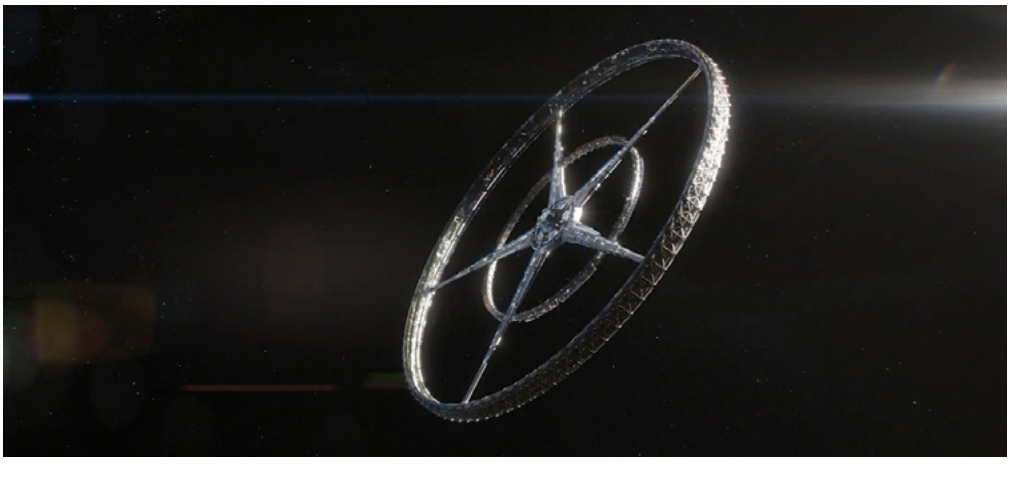
(Following pages) **Figures 94–109:** Film stills from *In Straight Circles* (Popper 2019).

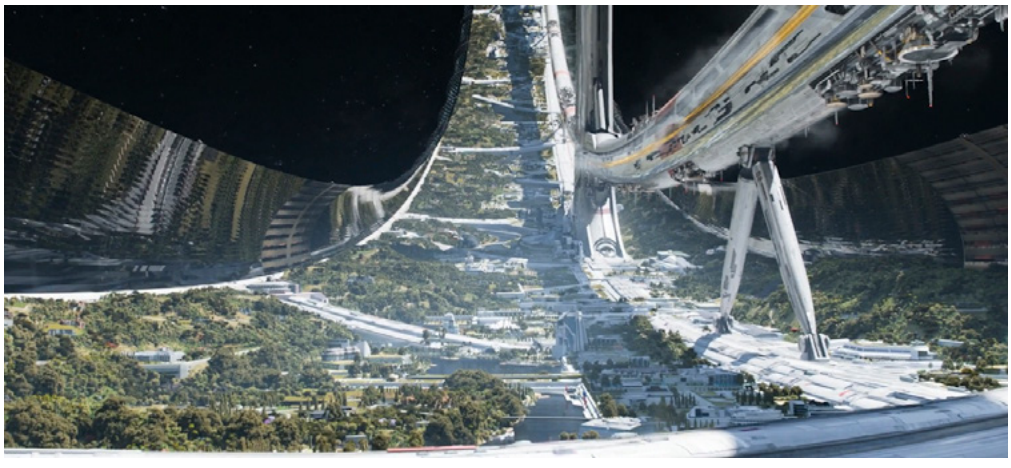

S-1

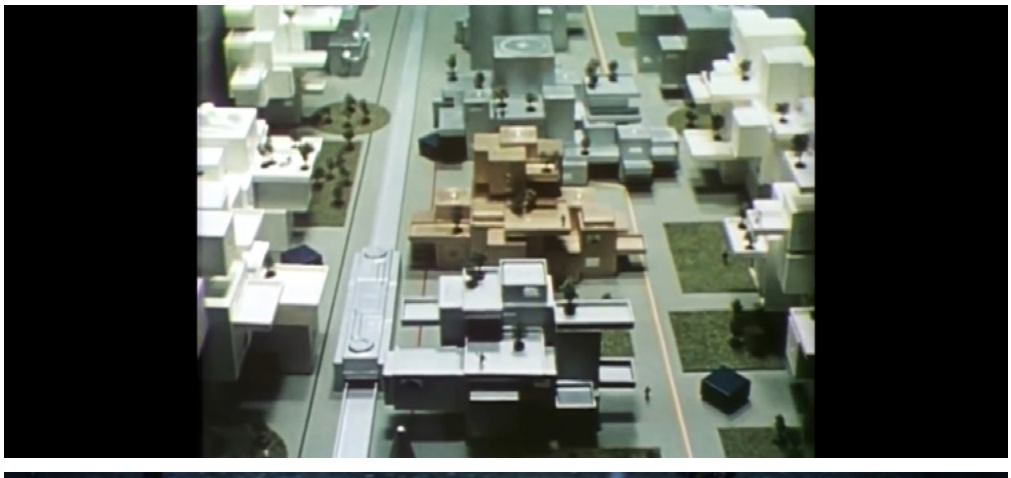


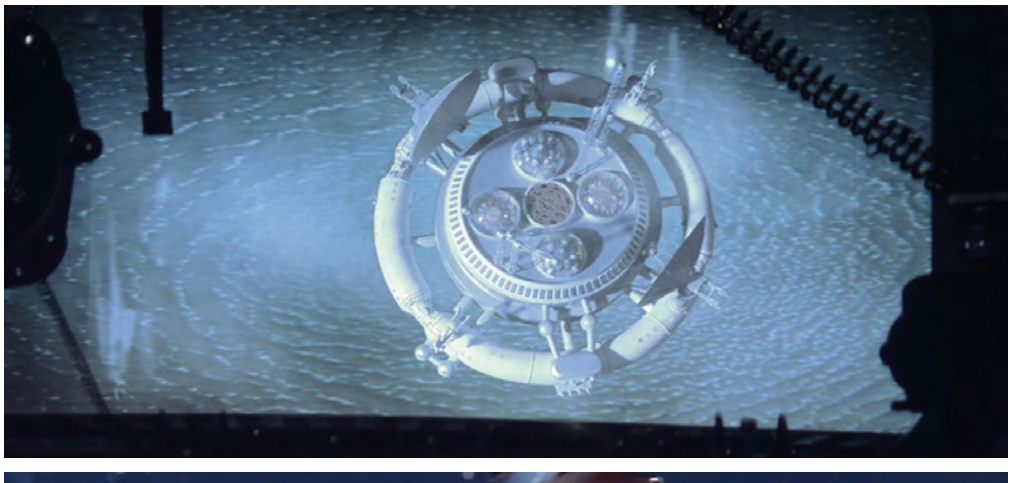


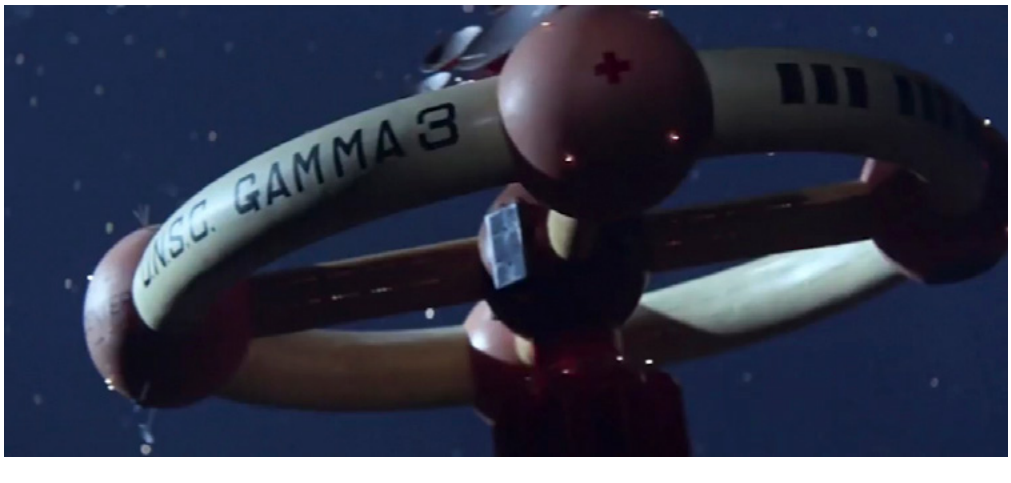








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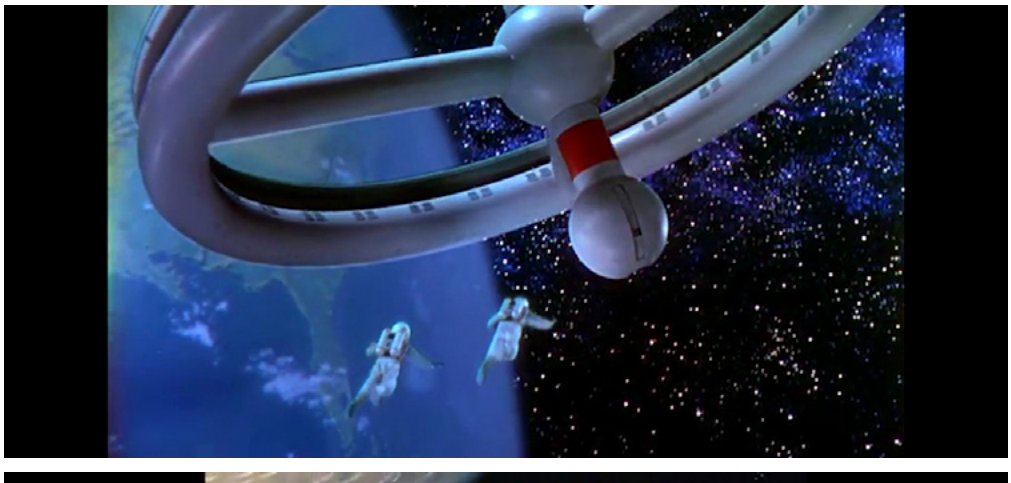

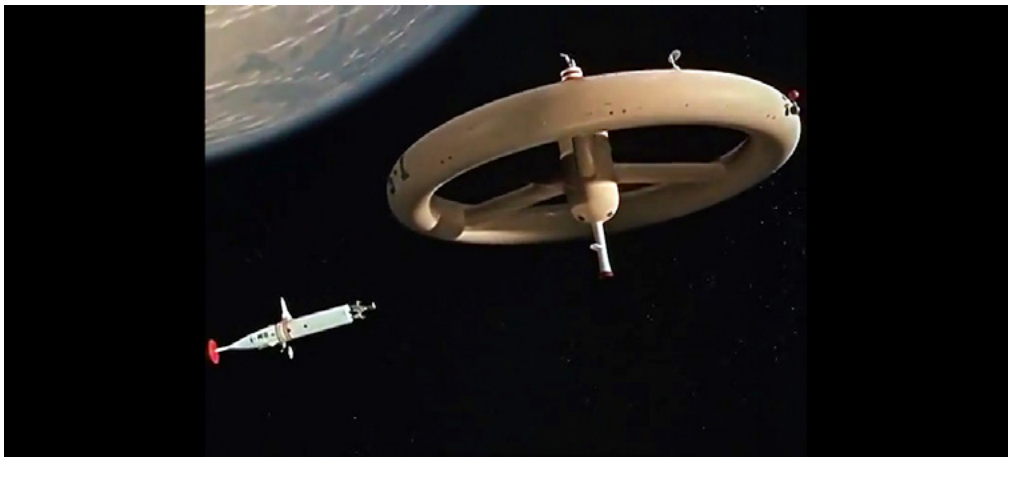

In Straight Circles

Montage techniques and estrangement effects play important roles in the three short essay films which I produced in the course of this PhD project. In the following paragraphs, I describe each of the films by interpreting their essayistic gestures in response to specific problematics I identify about the Euro-American spaceflight imaginary.

In *Straight Circles* (Popper 2020) traces a path of the wheel-shaped space station through a history of science fiction and speculative science film. The film is made from archive film material ranging from the 1950s into twenty-first century productions.[21] The collected space-wheels constantly rotate as the film cuts together a series of imagery comprising different space future scenarios, imagined in contrasting atmospheres and production values. To some extent, the montage sequence resembles a type of "supercut" video essay (Bateman 2016), for the way it arranges imagery of similar space stations from diverse films into a chronological order. The soundtrack is also punctuated by "expository lumps" in the compiled narrations (Robinson 1997 cited in Kilgore 2013: 2), typical of astrofuturist science fictions, that offer brief explanations of different functional aspects of the space wheel and also infer what this iconic structure represents in a popular space future imaginary. The interwoven imagery, musical score and narrations describe the space-wheel station in various guises as an imaginary infrastructure; as a strategic outpost or a gateway for exploring other planets, a site of "fruitful" industry (NASA 1975) or a sanctuary for a wealthy future elite. It is imagined productive, idyllic and guarded; a satellite turning about the world, or another moon generating its own gravity.

In *Straight Circles* begins with a clip from the Disney production *Man and the Moon* (Kimball 1955), where a space-wheel station turns into the foreground, framed by a distant Earth. The music of Johann Strauss' classical composition *The Blue Danube* — so prominent in *2001: A Space Odyssey* (1968) — underscores large parts of the film, and offers an arguably affirmative, grandiose tone about the different stations as speculative infrastructure. However, the appearance of *2001*'s Space Station V later signifies a shift to a colder and more ambivalent mood as the film progresses. Upon reaching the contemporary imagery of space station *Elysium* (Blomkamp 2013), the linear path of the film turns around, reversing the chronology of the scenes in a tour that returns to its

21 The film sources are: *Gog* (1954), *Conquest of Space* (1955), *Man and the Moon* (1955), *Mutiny in Outer Space* (1965), *War Between The Planets* (1966), *2001: A Space Odyssey* (1968), *The Green Slime* (1968), *Solaris* (1972), *NASA - Space Colonisation* (1975), *PBS Nova - The Final Frontier* (1978), *Elysium* (2013).

mid-century starting point.[22] This gesture completes a circular sequence and also implies that the entire film is ready to loop ad infinitum.

In *Straight Circles* shares its title with the first chapter of this thesis, for it also imagines the metaphor of a double-movement about the Euro-American space imaginary, where space settlement advocates align past memories and future speculations along a straight line of history and also render space futures relatable through a simple recycling of earthly imagery and stories. The film complements my analysis in writing by articulating this double-movement in moving image. Most importantly, the film describes this metaphor through a critical use of montage.

This film moves in two directions — which can both arguably be described as "horizontal" — that combine together to critical effect. On the one hand, the horizontal is found in the film's chronological ordering of found-footage to represent a linear progression through history. This chronology emphasises a straight line that is charted by a vision rotating consistently through time; creating an imaginary lineage of the space-wheel from the Space Age to the present. This is "horizontal" montage in the Eisenstein sense, manifest in the arranging of one space-wheel after another in a logic of visual accumulation. Here, montage articulates a "continuum" of imagined futures for the space stations to fall on (Caracciolo 2015: 77),[23] and affirms the centrality of the floating space wheel as a constant icon of "expansionist logic" projected onto the cosmos (Geppert 2018: 128). This horizontal montage thus figures a stabilising repetition of historic ideas extending beyond Earth, symbolising a "technological determinism" (Messeri and Vertesi 2015: 80) that rhymes with what Beery (2011: 25) and MacDonald (2007: 610) term a "basic infrastructural maintenance" of earthly practices and hierarchies.

On the other hand, *In Straight Circles* turns about itself to signify another "horizontal" montage and a more critical position. Looping the images' chronological order back to the start is a simple editing gesture, yet a pivotal one. This is horizontal montage in the image of Chris Marker, where a linear motion through the film materials becomes *lateral*: a change of direction that enables a critical type of audiovisual commentary. Through this gesture, I*n Straight Circles* counters the straight line of history (FitzGerald 1972: 9; Limerick 1994: 13) and the forward directionality compelled by a foundational North

22 Though each of the films is featured twice, no clip from any of the films is repeated in the entire sequence.

23 This process also resonates with scholar Marco Caracciolo's idea of "metaphorical blending," that I refer to in Chapter 1, to describe the Blue Origin promotional video, *Millions of People Living and Working in Space* (2018). Here, the company aligns their reusable launch vehicles along a history of earthbound exploration figured by sail ships and aeroplanes.

American myth of progress. Upon reaching space station *Elysium* (Blomkamp 2013), the film traverses backwards along this line to create different effects. First, the edit inverts the space-wheels visual accumulation and their combined sense of technological determinism. Returning to the metaphor for the Euro-American imaginary, this change of direction also articulates the second part of its double movement. Whereas a "metaphorical blending" can imply a stabilising continuum about imaginary infrastructures, reversing the sequence highlights the recycling of familiar designs from a "future past" (Valentine 2012: 1064). Here, the inversion exposes a symmetry of the different space-wheels in a different light; turning them from a "cutting edge" symbol of progress into a form of cliché bordering on parody. Borrowing from designer Fred Scharmen's (2019b) critique of the space colony designs by Blue Origin, the imagined space-wheels of science and science fiction history together envision "nothing new," only "note for note" repetitions of the same design. By returning to a 1950s future, the film also resonates with Kermode's (1967: 39) ideas of myth, namely the degeneration of stories into myths through unchangeable gestures. Here is a speculative space design going backwards as it progresses through filmic time, regressing from a fictional thought experiment to become *merely* an icon.

In Straight Circles concludes with the closing sequence from Disney's *Man and the Moon* (Kimball 1955), which posits the space-wheel station as a floating outpost for a first expedition around the Moon. Typical for an astro-futurist projection of this era, the story is triumphant and full of expectation, as the narrator proclaims to his audience:

Ladies and Gentlemen, you have just witnessed the first successful voyage into interplanetary space. This pioneered trip around the Moon will be followed by an expedition that will actually land on the Moon's surface. Even now, construction is going forward on the atomic powered rocket ship that will challenge the limitless depths of space and solve the mystery of the red planet Mars.

In these words, *Man and the Moon* promises a series of cumulative, progressive steps made by humans "going forward" into outer space. And yet, by completing a cycle of space-wheel imagery, this rhetoric is reframed to mean something else. By articulating the double-movement of the space wheels, as a primary metaphor Euro-American spaceflight imaginary, *In Straight Circles* counters the promise to "challenge the limitless depths of space" with fragments of circularity. Here, the repeating motif of the rotating space station projects a tangible limit to space advocacy imaginations. Through combining different types of "horizontal" montage, the film transforms the space-wheel from an icon of expansionism in the space frontier into an icon of the frontier's imaginary closure.

Clear Ideas

(2019) 2 mins 25 secs, HD

Joseph Popper

(Following pages) **Figures 110–127:** Film stills from *Clear Ideas* (Popper 2019).


This is Maui on its best day all year round.


There are two fundamental paths


along which history will bifurcate,


There is something we have to do.


The fact of the matter is if we stop stretching ourselves, extending ourselves


and looking out, that's when civilisation will begin to decline.


We should have a lunar base by now.


The Earth is no longer big. Humanity is big.


The Earth is finite,


the Earth is a crumb.


If the world's resources are fixed, then ultimately we are all enemies.


Only in a universe of infinite resources can all men be brothers.


All kinds of danger wait for us here,


This is our true environment.


This is Maui on its best day all year round.

This is Maui on its best day all year round.

There are two fundamental paths
along which history will bifurcate.

There is something we have to do.

The fact of the matter is if we stop stretching ourselves,
extending ourselves and looking out,
that's when civilisation will begin to decline.

We should have a lunar base by now.

The Earth is no longer big.
Humanity is big.

The Earth is finite, the Earth is a crumb.

If the world's resources are fixed then ultimately,
we are all enemies.

Only in a universe of infinite resources can all men be brothers.

All kinds of danger wait for us here.

We have said a great deal about the advantages of migration,
but not all can be said or even imagined.

This is our true environment.

This is Maui on its best day all year round.

— Clear Ideas (2019)

Clear Ideas

Clear Ideas (Popper 2019) is a short film that thinks through images of desolation, which form another important theme for the Euro-American spaceflight imaginary. Through experimental combinations of imagery and language, the film manipulates particular aesthetic gestures made by leading space industry figures who imagine a spacefaring future to be a desirable one. By bringing desolate landscapes and their heterotopian capacity to the foreground, *Clear Ideas* forms a critical response to the double exposures and inversions found at the heart of spaceflight advocacy master narratives, where horrors of existential threats are often imagined close to their spacefaring solutions (Ormrod 2017: 388). In "omnipotent" fantasies of control (Ibid), these juxtapositions create tensions that are productive for the spacefaring cause. Through similar audiovisual gestures, the film plays with the words of space settlement advocacy, inverting their terms of persuasion to expose a different, disruptive set of tensions.

Clear Ideas is made of found-footage from two particular science fiction films. The first is *Operation Ganymede* (Erler 1977), a dystopian film about a group of astronauts who return to Earth and land on an abandoned, inhospitable coast — conditions that lead the group to suspect that humankind has suffered a global nuclear catastrophe. The second film is *The Martian Chronicles* (Anderson 1980), a three-part BBC miniseries based on the Ray Bradbury novel (1950) that tells short stories of early human exploration and settlement on Mars. The choice of films is important for both productions were made on the island of Lanzarote, whose volcanic terrains were the reframed for imagining futures far apart. My interest in these films emerged from discovering that such contrasting future visions can share a singular desolate landscape. Forming the stage for diverse science fictions, Lanzarote arguably performs as an exemplary heterotopia by enabling multiple and contradictory scenarios to be exposed on to its otherworldly environment. Furthermore, the fictional premises of *The Martian Chronicles* and *Operation Ganymede* — of space colonies and the end of the world — also represent the dreams and nightmares envisioned by space settlement advocates, often simultaneously.

Clear Ideas comprises a single-channel video that is split into two juxtaposing film frames, which fill with separate image sequences of footage collected from the respective films. This arrangement aims to form a dialogue between the imagery, yet another simple editing gesture is just as essential to the critical function of the work. Using digital post-production software, I isolated the desert landscapes in chosen scenes by removing any human actors or man-made objects from every film frame. This process rendered an image series made of only empty and arid volcanic terrains, evacuated from any recognisable context or narrative. What remains are desolate landscapes, where clouds and rocks saturate the screen in varying scales and compositions. The separate film frames differ in colour and texture — burnt reds and ochres contrast bleached greys and blues — yet there remains a geological symmetry about them. Through their

composition, landscapes figuring the promise of alien wilderness meet those representing dystopian nightmares. This visual bifurcation plays upon an image of human history posed by Elon Musk, where humankind becomes multiplanetary or ultimately becomes extinct, depending on future actions. Whereas Musk projects this image to create a sense of urgency about space travel, *Clear Ideas* exposes the similarity of how and where these disparate futures can be envisioned. By isolating science fiction landscapes that figure Martian colonies and an apocalyptic Earth, the film tries to collapse any tension produced by these futures imagined disparity.

Borrowing from Foucault (1986: 26), the audiovisual process of negation in *Clear Ideas* can also be read as a "certain gesture" that opens up Lanzarote's volcanic environment as a *heterotopia*: as a place of many possible spaces. With this in mind, the artistic methods and themes I describe about the films of Werner Herzog and Ben Rivers are also influential for my own film. Just as Herzog and Rivers evacuate chosen geographies from history through the frame of their camera lens, digital manipulation of found-footage is another means of creating a similar effect of spatiotemporal ambiguity about this particular place and its distinct geographical characteristics. This ambiguity ultimately renews a heterotopian potential of Lanzarote as a cinematic stage. As Rivers (2015) describes the documented islands of *Slow Action*, the landscapes of *Clear Ideas* can also be imagined as existing "outside of time." This sense of ambiguity extends to the narration of the film, forming another important component, where a script is read aloud, and text captions overlay the imagery. The words collage direct and adapted quotes from leading contemporary and historical figures of space settlement advocacy, from science fiction authors and scientists to commercial NewSpace actors. By playing with their words, the film engages with spaceflight advocacy's language of persuasion, responding primarily to a use of double exposures for rendering space settlement a straightforward "easy choice" (Bezos 2019). Founded upon North American myths of progress and the frontier, these rhetorical double exposures create a sense of agency and urgency about spaceflight, in what cultural anthropologists Jasanoff and Kim (2015: 21) term a "complex dialectic" of utopian and dystopian imagery. In surveying the chosen words, one finds a multidimensional conflation of ambition with anxiety (Dark 2007: 556): a collage of aspirational sentiments with impatient concerns regarding human futures on and off Earth. Here, "magnificent desolations" are imagined in both optimistic and pessimistic light. In Clear Ideas, the narrator declares a forking path of history and a need to act decisively; there is a pragmatic recognition of Earth as a small planet of finite resources and fears about existential threats posed by "all kinds of danger," including cultural stagnation and decline; there is frustration regarding a lack of progress and a confident faith in the unimaginable "advantages of migration" and things to come.

In their gradual delivery, *Clear Ideas* reframes the words of space settlement advocacy in a bid to destabilise their sense of urgent clarity. Together with the otherworldly imagery, the words are displaced from any historical

or spatial context — with the exception of Maui, the Hawai'ian island, whose paradisiacal associations contrast conspicuously with the arid volcanic terrains. In their ambiguity, the words project a temporal layering of past, present and future.[24] Fragmented, they convey a collection of incoherent "slices in time" (Foucault 1984: 6) where a situated present appears to multiply. The voice proclaims this place is Maui, and "our true environment," suggesting arrival in a supposed "green promised land" (Kirby 2018: 307), yet also warns that "all kinds of danger wait for us here." Mirroring the imagery, the distance figured by the words separating utopian and dystopian rhetoric collapses, and with it the tension created by their oppositional or binary dialectic. In the confusion, ambition overlays anxiety in close proximity as hope and fear are imagined in the same place. This disorientation further complements other aesthetic gestures made by *Clear Ideas*, where the influence of Herzog and Rivers is also manifest.

There is a formal similarity with Rivers' Slow Action and Herzog's *Lessons of Darkness* in the use of a single character narrating the film, who remains disembodied and largely anonymous. *Clear Ideas* is also particularly inspired by Herzog's ideas about nature. Namely, the image of something immense, foreboding and indifferent to any humans who encounter or explore it. As I mention in the preceding chapter, Herzog (2002) describes a universe that "knows no smile." His films strip away the glamour and romance about travel in any wilderness imagined "exotic," and render popular settler-colonial fantasies of space travel absurd. To this effect, a constant Herzog motif is a "compositional showdown" between the very large and very small; between nature and the human (Corrigan 2011: 125). This showdown ultimately represents an antithesis of the settler myth, where any notion of human control diminishes against the spectacle of a yawning, ambivalently violent world. Far from the taming figure of Robinson Crusoe, the human is made mediocre again. *Clear Ideas* also tries to describe this compositional showdown, particularly in its use of sound. Here, the adapted words of spaceflight advocacy are projected against roaring desert winds. The narrator's voice is made to feel as if it is drowning in the din; fighting to be heard in the howl. From the accompanying imagery, there is no one to hear the words but a cold, vast geography that remains distinctly unmoved. After Herzog, this composition aims for a similar absurdity, reflecting upon the untenably simplistic projection of earthly frontier stories onto the extremities of alien worlds in outer space.

Through complementary and contrasting audiovisual compositions, *Clear Ideas* creates audiovisual double exposures to counter those found in the language of space settlement advocacy and shaping a Euro-American spaceflight imaginary. The film itself is arguably formed by a process of negation,

24 Layering in a similar way to Herzog's *Lessons of Darkness* or Rivers' *Slow Action* (Rascaroli 2017: 85).

where the editing of imagery and sounds produces a series of discrete fragments that share spatiotemporal uncertainty; ready for imagining multiple spaces and times in Lanzarote landscapes. Different montage techniques are also recognisable in the film's production. First, multiplication, simultaneity and ambiguity define an audiovisual structure about *Clear Ideas* that is recognisably "soft," after Farocki and Silverman (1998). Borrowing from Nora Alter (2015: 152), the screen arguably becomes a "force field" where found imagery, sound and words interplay in an atmosphere of general relatedness; landscapes of utopian space colonies blend with those of a dystopian apocalypse in ways that negate their imaginary "equation of opposition" (Alter 2015: 151). Here and there, visual rhymes and associations are found in the different elements. For example, as the narrator dismisses Earth as merely "a crumb," the image frames a rubble of stones that resemble discarded morsels. The split-screen further hints toward the editing room, as the imagery of volcanic terrains fold together in a nonlinear array — an array that amplifies a planetary connection of a future Mars and a future Earth. However, *Clear Ideas* also uses montage for deliberately *harder* collisions of opposites to produce moments of audiovisual disjuncture. After Herzog, exposing space advocacy rhetoric atop extreme environments renders another compositional showdown of the big and small. Perhaps closer to the lateral montage of Chris Marker, here are image and sound working *against* each other to create a sense of absurdity. By instigating audiovisual confrontations with otherworldly desolations, these different essayistic gestures try to disrupt the mythical stability of a hegemonic vision of the future.

Columbus

(2020) 2 mins 40 secs, HD

Joseph Popper

(Following pages) **Figures 128–151:** Film stills from Clear Ideas (Popper 2019).


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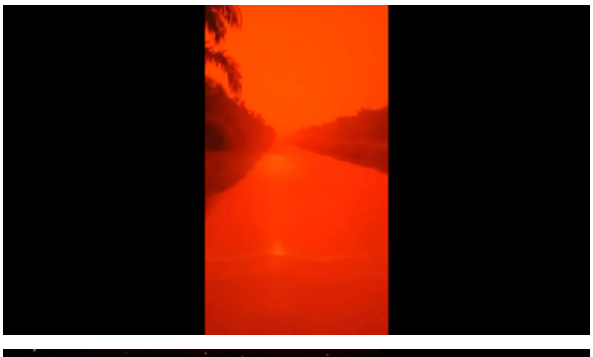

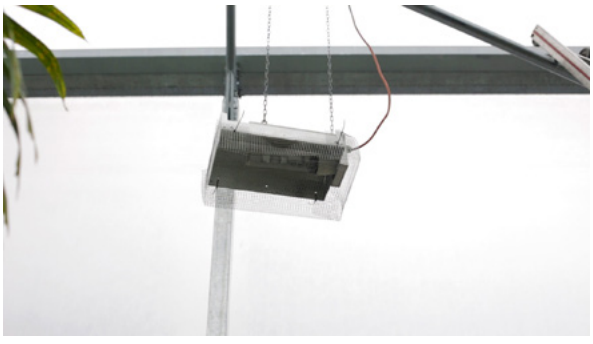

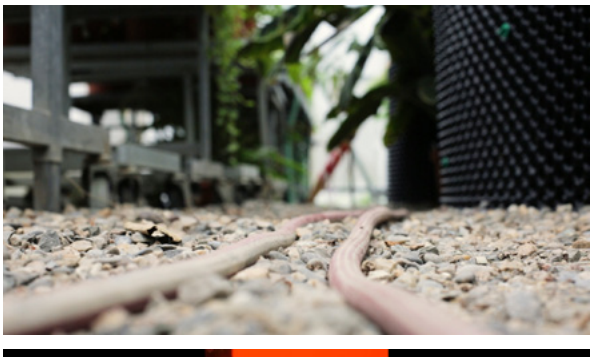

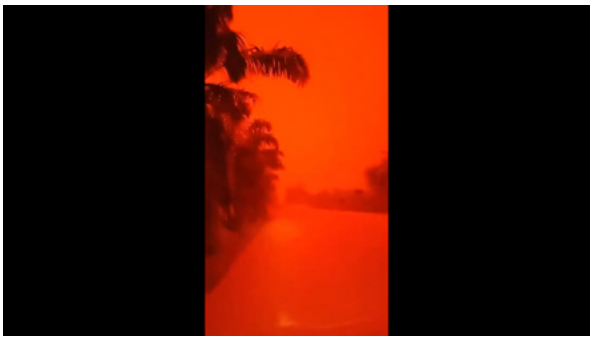

Columbus

Columbus (Popper 2020) is a short film exploring how life in extreme environments is imagined in cinematic and other forms of production. The film is based upon three primary film sources: original footage filmed at the University of Basel botanical gardens; found smartphone video shot in a region in Sumatra, Indonesia affected by forest fires in 2019; and the twentieth-century science fiction film *Robinson Crusoe on Mars* (1964), directed by Byron Haskin. For *Columbus*, montage is also a central mechanism. The film amplifies analogue linkages between the different imagery, where Earth is imagined as Mars by design and by accident. The edit joins the three sources together through association, playful collisions and poetic changes of framing. Through montage, science fiction and otherworldly landscapes reframe the artificial environment of a botanical greenhouse as a habitat on another planet. There is a sort of triangulation in the way the different fragments relate to each other, where sharp audiovisual cuts produce imaginary continuity and disjuncture. The greenhouse is animated with the voice of a Columbus character, while roadside imagery imbues Martian landscapes with a sense of mundanity.

In *Columbus*, montage moves simultaneously in horizontal and vertical directions, in a "polyphonic" manner described by Eisenstein (1957: 75). First, the edit composes a sense of linear continuity. The film begins inside the greenhouse, where a series of establishing shots start to build a sense of an enclosed interior space. Later, loose visual associations bridge different places in more poetic leaps. Palm trees populating the botanical garden and are then seen lining a dirt road from a traveling motorcycle; a distant car headlight "blends"[25] with a sunset imagined over Martian dunes. The entire sequence also plays upon a distinct red colour that is shared by the different imagery. In *Robinson Crusoe*, matte paintings imagine a copper red Martian sky to reframe the landscapes of Death Valley National Park in California; whereas on the island of Sumatra, polluting micro-particles made by enormous forest fires saturate the atmosphere in a toxic red haze (Lamb 2019). Negating the disparate origins of the footage, the uncanny colour match enables an imaginary continuity to be cut together, where the cameras zoom out from a roadside journey to wider panoramas of desert landscapes imagined to be from the same place. However, I stress a loose nature of these associations, for a sense of fragmentary collision is inescapable. There is a noticeable difference in the quality and dimensions of the films; the grain of anamorphic cinema film jars with the compressed megapixels of smartphone video, shot in "portrait" mode. This visual contrast further foregrounds the editing room and highlights a distinct vertical structuring of audiovisual materials. In Farocki's words, this is "linking images through

25 A "metaphorical blending" as coined by Marco Caracciolo (2015: 75).

ideas" (2004: 77). Moreover, the use of sound in *Columbus* is where a lateral gesture of montage is arguably found to be most compelling. In particular, where the voice and visceral breathing of Haskin's Crusoe character overlays imagery of the greenhouse.

Columbus is founded upon a synthesising of complementary and contrasting elements. The principal effect here is arguably one of displacement: of the greenhouse, the landscape and the Robinson Crusoe figure. In what can be described as a *shot/countershot* dialectic, the imagery of the greenhouse interior, the deserts and roadside exteriors exchange and imbue each other with different possible meanings in "a play of contrasts" (Warner 2016: 30). Saturated in a shared toxic red, the landscapes are imagined as the empty wastelands of a sterile, inhospitable world; through visual association, the motorcycle rider is transported to another planet. In turn, the greenhouse is imaginatively situated as an artificial habitat in an extreme environment.[26] Inside, we find an unseen, anonymous human presence voiced by Haskin's Crusoe character. Apart from the voice, the only other trace of his presence is the swaying or quivering leaves of the tropical plants, implying someone out of shot has just brushed past them. In our first encounter with him, "Crusoe" is heard crashing around as he gasps for air; his desperate heaving overlays sharp cuts of imagery from around the greenhouse that surveys different infrastructural apparatus, designed for maintaining the artificial climate and life of its organic inhabitants. Here, the hostile environment, imagined beyond the greenhouse walls, renders Crusoe and his botanical companions in a technological confrontation with an alien nature (Redfield 2000: 8).

Columbus appropriates chosen excerpts from the *Robinson Crusoe on Mars* soundtrack and overlays them with footage shot inside the botanical gardens. In their back and forth, the Martian and greenhouse imagery work to displace Crusoe inside a habitat situated on another planet. Thinking through Robinson Crusoe as a primary embodiment of the settler myth as Redfield (Ibid) describes, this displacement also produces an inversion effect. Inside the greenhouse, we hear an isolated Crusoe struggle for breath, plead desperately and deliriously for human company, and reflect on his time in a "strange new land." There is an atmosphere of futility and failure, symbolised by one particular matching of image and sound.[27] At the end of the film, as he

26 An extraterrestrial outpost similar to the isolating soap bubble architecture that designer Fred Scharmen (2019c) describes in speculative space settlement designs.

27 This process is very similar to the one used by the artist Guy Ben-Ner, which he coined as "budding": "the opposite of "dubbing — images to a pre-existing, readymade soundtrack." In his work *Soundtrack* (2013), Ben-Ner appropriated the soundtrack of the Steven Spielberg film *War of the Worlds* (2005) and shot images of his family in the kitchen to match it (Eler 2013).

says defiantly, "I'm going to stay alive, believe me...", overhead we see a light go out, in time with a heavy clunk of a switch in the film soundtrack, suggesting as if the bulb went. This final image sharply contrasts any lingering sense of hubris in the character's voice. Trapped in a fragile greenhouse, *this* Crusoe is arguably an antithesis of the intrepid frontier explorer, taming wilderness with technical mastery, that is more commonly associated with the name. This is a reversal of positions — an inversion that explicitly counters the settler myth and its complementary notion of outer space as a natural and necessary destination for human progress.

Columbus aims to collide the historical figure of Robinson Crusoe with a more hostile and ambivalent nature, to ultimately convey this colonial narrative irreconcilable with the conditions and practices of human life in outer space. As actual space stations demonstrate (Peldszus 2018: 250), constraint and confinement define any human existence sustained beyond planet Earth. Outer space means a constant state of "stasis" (Ibid: 248) to mundanely endure, as opposed to the frontier dynamism projected by space settlement advocates of the past and present. Though unseen, the human figure is diminished by montage, his breathless struggle betraying his maladaptation to his environment (Caracciolo 2015: 82) and a dependency on artificial means of survival against a cold and lethal world. In his desperate pleading to hear another human voice, Haskin's Crusoe further offers another image of a "goldfish bowl" effect, his solitary isolation in the greenhouse inverting the degenerating image posed by Clarke (1946: 72-73) for what confinement to the Earth's surface could mean for the human mind. Here, a failing and stagnating Crusoe imagines interplanetary travel as the degenerating act.

Colliding Fragments: Reflecting on a Screening

On the 21st April 2021, I organised an online screening and discussion event, where I presented my essay films to an invited audience. Reflecting upon the dialogical and discursive nature of the essayistic, it became increasingly important to share my own films in order to test their capacity for inciting "unfinished reflection" (Borgdorff 2012: 143). The screening further presented an invaluable opportunity, in Laura Rascaroli's words (2017: 16), to expose them to their shared "instability of meaning." I coordinated the event, entitled *Colliding Fragments*, on dedicated online video hosting and webinar platforms, for watching and discussing the films respectively. The audience of twelve guests included my research peers at the FHNW Academy of Art and Design along with other designers and academics who are engaging with critical outer space studies. In general, I found the screening to be a very enjoyable and rewarding experience. The audience offered many insightful comments and stimulating questions about the films, from which I gathered multiple interpretations about what they do, how and why they work, and diverse reflections about what they can mean. Furthermore, the audiences' critical responses to the films contributed important materials for my own reflection about the artistic and essayistic methods in their making.

The session began with *In Straight Circles*, followed by a short conversation about the film. I decided to present this film first, partly as a way of introducing the Euro-American spaceflight imaginary as the subject of my research concern. *In Straight Circles* directly responds to my analysis in the first chapter of this PhD thesis and focuses explicitly on the wheel-shaped space station as an imaginary offworld infrastructure; tracing its heavy rotations through a history of speculative science and science fiction film. By describing a metaphorical double-movement at the heart of the Euro-American imaginary, the film frames the space-wheel as not only an icon of cosmic expansionism (Geppert 2018: 128) but also of my research. This double-movement figures the ways in which space settlement actors project a desirable space future along a straight line of North American history, while recycling earthly, Western imagery and stories for rendering this future familiar.

Upon watching the film, some of the invited audience found it hard to find the critical response of *In Straight Circles* to the

Euro-American spaceflight imaginary. Though they did grasp a sense of continuation in the repeating space-wheel imagery, the dense collaging of outer space scenarios positive and negative, safe and dangerous, rendered any precise disposition or disruptive gesture of the film arguably ambiguous; "I'm not sure what to think," said one, "or what it wants me to think." From similar shared reflections, I learnt that the circular trajectory I shaped out of found footage — beginning and ending in a mid-twentieth century Disney animation — was subtler than I first imagined. In truth, none of the audience clearly apprehended this montage-based gesture as a basis of my critique. However, as our conversation continued, some found the film more meaningful in terms of *setting a scene* for outer space in the Euro-American imaginary. Here, the repeating and fragmentary wheel motifs, constantly rotating about their axes, were read as a sort of "rehearsal," or constructing of a stage: "building a general impression," in their words, "for narratives to start unfolding." This idea relates to an interesting characteristic about the space-wheel as speculative infrastructure. On film, the wheels function as structures *for speculating*. Reflecting upon the clips I chose for producing *In Straight Circles*, many of the space-wheels "set the scene" for imagining future explorations beyond their geostationary orbits. Surveying their different offworld scenarios, the circular space stations perform as technological and *narrative gateways*; as floating platforms for envisioning the promise of great adventures, discoveries, economic gain and material plenitude in outer space — if they only build the wheel.

Another interesting theme emerged about *In Straight Circles* as the audience reflected upon the experience of watching the film. Many described the film as a "very visceral experience," noting the dizzying effect of watching the space-wheels spin on screen, while one guest shared a similarly intense feeling of "disorientation" created by a circular element drawing a straight line; imagined not only as a double-movement but a "counter-movement." For another guest, these visceral sensations led to contemplating a more theoretical position of being caught in-between outer space in imagination and actual exploration; or trapped in-between a desire to get offworld and the realities of leaving Earth behind. This idea rhymes with, in Dickens and Ormrod's words (2016: 19), the gap between "real" and "ideal" outer space. For the audience, this gap separating the imaginary and "reality" creates another "dizzying position," that arguably connects to the film's dynamic circularity and the destabilised experiences it creates.

After *In Straight Circles*, I proceeded to screen the *Clear Ideas* (2019) and *Columbus* (2020). In general, I found the audiences responses to the latter two films were much closer aligned to my own initial interpretations and intentions. Both films join together in exploring themes of desolation, focusing on desolate landscapes of science fiction, where human futures — positive or negative — are imagined on and off Earth. Returning to the aforementioned gap between real and ideal outer space, *Clear Ideas* and *Columbus* explicitly engage with a palpable discord separating the grand visions of space settlement advocacy and the extreme, alien environments they are projected upon.

For the audience, *Columbus* described a real sense of enclosure: of humans and nature sheltered by technical designs. Moreover, one guest offered the notion of nature "nourished by and through infrastructure" as a metaphor for the Euro-American spaceflight imaginary: forming a narrative infrastructure sustaining the heteronormative practices of the space industry. In *Columbus*, the spectacle of the characters' struggle for breath conveys a sense of dependency on artificial life support in outer space. This imagined dependency prompted another guest to reflect upon other projects dealing with "what we [humans] get on Earth for free." Many in the audience were impressed by the presence of the unseen character's voice, whose range of emotions — cut together in the edit — bring different themes around human spaceflight together. One guest found the film "very scary and violent," while others found the character embodied the boredom-inducing dullness of isolating and mundanely technical experiences beyond Earth's atmosphere. This reading reaffirms an unglamorous, uncomfortable and "piecemeal" reality of the human condition in outer space, as described Regina Peldszus (2018: 250), where dependency on hermetic habitats, "measured down to the single breath of the correct oxygen mixture" (Ibid: 248), renders spaceflight cautious, calculated and systematic.

From the Crusoe character in *Columbus*, a sense of displacement transfers to *Clear Ideas*, which also generated a strong sense of estrangement for the audience. On hearing the words of space settlement advocacy removed from their original framing, they found a distinctly "weird" effect created by this *alienated* media. On reflection, the audience sensed the film's evacuation of context, separating utopian imagery of space colonisation from the grand technological spectacles they are

often harnessed to. This interpretation can be further extrapolated to consider the functions of the sociotechnical imaginary, as a desirable image of the future *grounded* in scientific and technological developments (Jasanoff and Kim 2015: 4). As *Clear Ideas* arguably demonstrates, when they are untethered from reusable rockets; lunar lander prototypes, or other "material instantiations" of the Euro-American spaceflight imaginary (Messeri and Vertesi 2015: 56), the master narratives performing this common vision of the future can be thoroughly destabilised. The film's contextual evacuation also disrupted perceptions in other ways I did not expect. One guest noted that the film script speaks of "the advantages of migration" in general, as opposed to "interplanetary expansion," and furthermore refer to "Maui," which is an old American frontier, implying other migration scenarios which are not only cosmic or of the future. This confusion further reaffirms a sense of repetition about the imagery and rhetoric of space settlement advocacy. Borrowing from Richard Tutton (2018: 527), removing their "cosmic context" exposes their stories about the future as simple "retellings of North American and European colonial and frontier narratives as analogues: the adventures of white men of the last 500 years replayed…"

As the conversation continued, the audience raised that my presence, as the filmmaker, is notably most pronounced in *Clear Ideas* out of the three films I presented. This reading corresponds to not only more recognisable manipulation of image and sound fragments in the edit, including its split-screen composition, but also to the use of *my own voice* in the film soundtrack, projecting words of spaceflight advocacy into the wind. One guest, an anthropologist of outer space, noted they were not used to hearing space settlement discourse in anything other than a North American accent. This observation led to questions about what my unmistakably British accent does in delivering these words, furthermore through a transpiring sense of "fanaticism." In discussion, no conclusions were reached regarding the impact of my accent. I could only offer my honest answer, which is that the decision to use my own voice reflected an honesty and immediacy in producing the film with the tools readily at my disposal. However, *Clear Ideas* is the only film in which I speak directly on the soundtrack, and my audible presence made a significant difference for the audience — perhaps because they, being my friends and colleagues, were already familiar with my voice and were encountering it here in another context.

Nevertheless, their reaction made me reflect upon just how pronounced my I am in the three films as the filmmaker, and what this enunciation means for their capacity for critique.

In the introduction of this PhD thesis, I mention a notional scale about essay films — suggested by Álvarez López and Martin (2014) — that charts a range of synchronic and disjunctive audiovisual compositions, which can describe either a sense of homogeneity and heterogeneity about their assemblages of image and sound. This scale helps to reflect upon my three films by distinguishing the different ways they addressed the audience and the responses they generated. Whereas *In Straight Circles* charts a trajectory of an imaginary space infrastructure through a largely homogeneous set of speculative imagery, *Clear Ideas* and *Columbus* arguably play much more upon a heterogeneous assembly of filmic materials; colliding opposing fragments or testing their relations through folding them together on screen. In the case of the latter films, their montage-based juxtapositions also foreground my presence as filmmaker: through the edit and also, in the case of *Clear Ideas*, audible on the soundtrack. Working with and against the footage, the presence of a human voice amplifies not only a sense of heterogeneity about these essay films but also of performativity. Considering that the audience appeared to find my non-affirmative dispositions and destabilising gestures in *Columbus* and *Clear Ideas* much easier to grasp than in *In Straight Circles*, this suggests a connection linking the pronouncement of a character or filmmaker's subjectivity, emphasising dynamic atmospheres of heterogeneity, and the capacity of an essay film to articulate its process of critical and "unfinished thinking" (Borgdorff 2012: 143).

Conclusion

Why Outer Space, and why the Essay Film?

Outer space has been a longstanding interest in my art and design practice. Through the course of this PhD project, as my research focus sharpened, this interest transformed along with my perceptions of both outer space and the power of imagination. To begin with, I thought of the cosmos as a liminal space of human experience and knowledge; a distant place for meeting the limits of the possible at the fringes of the knowable, where knowledge produced by a subjective imagination gains credibility in an absence of any scientific or objective certainty. From an artistic perspective, outer space represents a chance to invent in imagining extraordinary and extraterrestrial experiences from my Earthbound position; a chance for artistic choices and poetic leaps, in the making of art and design works, to mediate cosmic encounters with a sense of "impossible immediacy" (Messeri 2017b: 133). From my education in critical and speculative design, outer space later became a site for exploring possible futures, founded upon scientific and technological projects, and their critical implications for human conditions. Here, I learnt about the potential of imagining as a form of thought experiment, where imagery and fiction become vehicles for describing, examining and questioning technological futures in engaging ways. For example, this approach manifests in *The One-Way Ticket* (Popper 2012), a film-based project exploring what it means for humans to travel into deep space without returning to Earth. Shifting from a premise for poetic imagery into a place for describing and exploring futures through a critical imagination, my interest in outer space would undergo further transformations in developing my PhD research question and theoretical concerns. This change corresponds to the significant influence of cultural anthropologists, historians and other science and technology studies scholars, whose writings saturate outer space with a complex, earthly relationality.

Together, the different scholars render outer space *social* (Dickens and Ormrod 2016: 8; Battaglia, Olson and Valentine 2009: 15), a very human production (Geppert 2018: 125) and furthermore an urgent matter of common concerns. Through their diverse materials, I learnt about human spaceflight as a technological *and* social project, where offworld activities pose local as well as planetary consequences, and belief systems entangle with reusable rockets and other technical materialisations. These materialisations combine in

instantiating a promise of outer space and a path to a desirable offworld future (Jasanoff and Kim 2015: 4). From here, the scholars further sharpened my research focus by emphasising the critical impact made by images of the future in shaping what outer space *means* in collective imaginations; highlighting the role of contemporary "astroculture" (Geppert 2012: 2020) and framing a dialectical relation between space representations and practices of space exploration (Dickens and Ormrod 2016: 2). By emphasising technological futures as "inherently value-laden," Jasanoff and Kim (2015: 337) also informed my study of the ideological tenets from North American history — manifest in myth and metaphor — which are regularly adopted by space industry actors for making outer space meaningful. Borrowing from Dickens and Ormrod (2016: 7), I came to understand outer space as a place that is highly aestheticized as much as it is politicised. Imagination therefore transformed in my understanding, from a vehicle of exploration and critique, into a formidable sociopolitical force in the world. Here, the specific concept of the "sociotechnical imaginary" (Jasanoff and Kim 2015: 4) articulates the power of commonly held images, publicly-performed, in holding communities and larger societies together. These realisations ultimately catalysed my research into the functions and mechanisms of a Euro-American spaceflight imaginary — an imaginary I find to be as powerful as it is problematic.

Starting in the background, my interest in the essay film gradually grew and became evermore pronounced during the course of this PhD project, ultimately becoming an integral part. My first encounter with the term "essay film" occurred early on in my PhD candidacy, at an *Essay Film Night* at the Institute of Experimental Design and Media Cultures, at the FHNW Art and Design Academy in Basel, featuring a screening of *The Wild Blue Yonder* (Herzog 2005). I was already familiar with the film, yet this was the first time I had heard it described as an "essay film." After the screening, my motivation to continue exploring this quasi-genre (Warner 2016: 28) came from a personal search for tangible forms of research I could recognise as artistic or art-based, where critical concerns and theoretical explorations can be articulated from inside practice and through other material forms, distinct and independent from the more predominant or established language-based methods of reading and writing. In learning from filmmakers and film scholars, the essay film became increasingly interesting for me as a form of film; a form of artistic research and, most importantly, as a specific means for investigating and responding to my particular research concerns.

First, the essay film is described by many scholars as a "critical and theoretical practice" (Rascaroli 2017: 179) — a practice that produces theory by moving image (Alter 2018: 10). In practicing "essayistic principles and procedures" (Warner 2016: 28) which arguably stem from its foundations in the literary essay, it displays many characteristics rhyming with those I find in theories of artistic research. In general, these traits describe the essay film as experimental, discursive and pluralistic in approaching subjects and objects of concern. The characteristic I find most interesting about the essay film — and most res-

onant between film- and artistic research theories — is the idea of an emphatic, cinematic articulation of *thinking*. This enunciation of thought, foregrounding the filmmaker as thinker, connects the open-ended nature of an essayistic *"pursuit of knowledge"* (Huurdeman 2018: 62; emphasis in original) with a dialogical gesture to an embodied audience; inviting them to participate in this pursuit and the construction of possible meanings (Warner 2016: 49; Rascaroli 2017: 62).

Essay films are also products of a very material practice, with montage and found-footage both arguably at its heart. Moving along "the very seam of juxtaposition and the cut" (Luckhurst 2018a: 193), montage forms a vocabulary for enabling and expressing an essayistic thought process, where the multidimensional layering and interplay of multiple audiovisual materials reflect the complex subjects or issues that many essay films address. Álvarez López and Martin (2014) also find found-footage shaping "cine-poems": artistic audiovisual essays made from sampling pre-existing imagery and sound, which further convey an inherent articulacy of their materials and literacy in their manipulation (Cazeaux 2017: 100). These characteristics further inspired my exploration of the essay film, for they form threads linking to tendencies of my own artistic practice. To be specific, montage aligns found-footage essay films with a notional "found" fantastic," what Luckhurst (2008b: 181) describes as realising the fantastic or science fictional potential found in existing "bits and pieces of the world" through creative changes of framing. I strongly identify the "found" fantastic" in my practice, which imagines fictions by consistently transforming low-grade materials, readymade objects and found spaces; by framing through a camera lens, crafting installations or other artistic interventions. From here, my approach addresses a "metaphoricity" of materials (Cazeaux 2017: 100), where one quality can be imagined in terms of another (Lakoff and Johnson 1980: 74). For example, returning to *The One-Way Ticket* (Popper 2012), I constructed a 1:1 scale space capsule and other prototypes from cardboard, polystyrene, found objects and other cheap materials for simulating and describing a speculative outer space experience on film. This sensibility for an articulacy of physical materials extends into this PhD project, where the "fantastic" potential of found-footage, in its sampling and reframing, informs the making of my own essay films.

A Matter of Montage

As a product of artistic research, this PhD project forms a hybrid. It works at the intersection of artistic research, science technology studies, film practice and film theory; fusing these different discourses together to study outer space through a specific lens. Tying these aspects together, and central to my contribution to a critical outer space discourse, is a multidimensional method of montage. Here, montage stands for both a material practice — of joining two or more discrete elements together in different ways (Rohdie 2006: 1) — and a transdisciplinary *montagist* approach (Warner 2018: 101), which sharpens and deploys a critical sensibility for moving image and other forms of representation.

Montage thus means a "way of thinking" (Petric 1978: 438) and a kind of "intelligence" (Stob 2012: 37) for making and reading images. Whether on film or in words, it "*makes* meaning, forges connections, [and] creates juxtapositions" (Álvarez López and Martin 2014; emphasis in original). Borrowing from Álvarez López and Martin (Ibid), montage as method is "always in operation" throughout this PhD project, formulating my theoretical concerns about an outer space imaginary and informing artistic strategies for a critical response. For example, in Chapters 1 and 2, I tune into different "channels" (Álvarez López and Martin 2014) in the imagery and rhetoric of historic and contemporary space settlement advocacy, finding threads linking settler-colonial histories and mid-twentieth century science fiction to present-day astroculture, while analysing the "pervasive aesthetic and rhetorical framings" of leading space industry actors (Valentine 2012: 1057). Moving through the three thesis chapters, from social studies into experimental film, a montagist sensibility and material practice change in emphasis as my focus shifts from observations to interventions.

Most importantly, a montage-based approach enabled me to understand both the Euro-American spaceflight and the essay film as distinct forms of *infrastructure*. This PhD project composes a sort of confrontation of the two, where I explore the potential of the latter to apprehend and disrupt the problematics I find in the former. After philosopher Chiara Bottici and sociologist Benoît Challand (2011: 28), these two infrastructures can also be described as "imaginal": whether social context or artistic practice, both infrastructures are "made out of images" (Ibid). This definition ties a space community collectively imagining a desirable future with filmmakers who consistently experiment with fragmentary structures of image and sound. In broader terms, this confrontation also figures a collision of opposites, where affirmative plans for space settlement are countered by more discursive positions on human and technological conditions; a confident certainty of things to come is met by playful questioning of the way things are; and linear narratives of history are destabilised by non-linear methods of storytelling. However, the Euro-American spaceflight imaginary and the essay film also share tendencies as infrastructural forms. Namely, they are both *elusive yet powerful* and display a "special kind of logic" (Robertson 1980: 21). Though this thesis does not explain either entirely, I explore both the spaceflight imaginary and the essay film as "constitutive magma[s] of meaning" (Gaonkar 2002: 4) by highlighting and analysing their particular aspects, functions and capacities. In practice and in critique, montage comprises a vocabulary fragments and gaps. Through my analysis, fragments and gaps also emerge as essential themes for my understanding of these infrastructures, their aesthetic mechanisms and their pivotal differences.

Fragments and Gaps

In emotional and structural states, fragments create tensions out of the spaces in-between. In surveying methods of writing fiction, author Peter Turchi (2004: 204) states fragments of narrative produce tensions because of the readers' "expectation that there will be, or is, a shape" to a story. As I expand upon in Chapter 1, this is a claim I find can also describe the mechanisms of the Euro-American spaceflight imaginary. Forming a crucial extension of the sociotechnical imaginary, the "sociotechnical projectory" (Messeri and Vertesi 2015: 56) describes a path, instantiated by different media and artefacts, that orients a scientific or technological community toward a commonly desirable future. At the International Astronautical Congress in Washington, DC in 2019, aerospace company Blue Origin presented technological demonstrations and pastiche imagery of floating space colonies together to describe a certain shape: *the road to space*, which further extends a notional straight line of frontier history reaching beyond planet Earth. Though they seem disparate at first, reusable rocket engines and space colony imagery complement each other as fragments of the same imaginary. By projecting different pieces of a common vision, in articulating the promise of a spacefaring civilisation, Blue Origin and other space industry actors heighten an anticipatory discourse about their contemporary space projects and create tensions of expectation about the space future they and other NewSpace actors are reaching for.

The myths and metaphors of the Euro-American spaceflight imaginary are assimilations of fragments; assemblages of familiar things from the American "cultural storehouse" (Robertson 1980: 21) that render distant worlds and their complexity easily understood. For historian Howard E. McCurdy (2011: 318), the failure of these myths and metaphors to ultimately grasp the nuances of the complicated or unfamiliar in outer space also *"promotes gaps between expectation and reality"* (Ibid; emphasis in original). As Dickens and Ormrod (2016: 19) infer, this gap separating outer space in imagination from outer space in practice is "substantial and growing," and can produce profound psychological and social effects. By reflecting on its seminal impact upon spaceflight advocacy, the Apollo programme also arguably stands as a fragment — a fragment which catalysed the influential emergence of a commercial space industry sector. Space historians today read the Moon landings not as a blueprint for any space colonisation project, but as a historical anomaly forged in the intensity of Cold War competition. And yet, contemporary space industry actors appear to misread the Apollo missions as a "fragment of the future" (Timberlake 2018: 4). For them, the Moon landings represent the end of the beginning of a spacefaring civilisation; a promise made by government agencies that they subsequently failed to keep.

Gaps further pertain to the imagining of limits in space settlement advocacy, as well as the limits of advocate imaginations. On the one hand, in Chapter 2, limits figure the manifold forms of finitude facing humankind so

long as it remains bound a small, fragile Earth; ranging from the incapacity of planetary resources to fulfil increasing material needs, to an accepted vulnerability to catastrophe from manmade or extraterrestrial objects. Imagined together or separately, these ends of the world engage in a "complex dialectic" (Jasanoff and Kim 2015: 21) of dystopian Earth imagery with utopian space visions. The desolate landscapes on Earth and other planets are arguably integral to this dialectic, as sites where earthbound horrors are imagined by space settlement actors in close proximity to spacefaring solutions in a series of imaginary double exposures (Ormrod 2017: 388). Here, tensions are created in the absence of any gap. Such radical juxtapositions enable Jeff Bezos, Elon Musk and commercial space industry leaders to reason a multiplanetary existence as imperative for human evolution and survival.

On the other hand, the gap further relates to the distant time horizons in which leading space industry actors project their plans for making humans multiplanetary. Returning to Chapter 1, these extreme timescales exceed the limits of their imaginations (Valentine 2012: 1055) and pose a troubling disconnect from "reality" (Tutton 2018: 5) by *negating* any need to render these desirable futures possible. Furthermore, such limits also expose a failure of imagination about space settlement advocacy. This failure not only leads to an underlying, earthly relationality about the space projects of Blue Origin, SpaceX and other aerospace companies, but projects a continuum of the status quo extending into the solar system.

Whereas critical geographers find practices of sociopolitical "maintenance" (Beery 2012: 25; MacDonald 2007: 610) consolidating power structures of mutual benefit for the US government and private space entrepreneurs, Kilgore (2003); Billings (2007); Scharmen (2019a) and other scholars find a distinctly defensive, selective and *unimaginative* space future imaginary, shaped by distorted ideas of American history and mid-twentieth century science fictions. First, the foundational myths of the frontier and progress — constituting an "ideological bedrock" of Americanism (Billings 2007: 485) — ground space settlement advocates' unwavering, almost fundamentalist belief in the "colonisation, exploitation and development of outer space" (Ibid: 495). These myths tie envisioned space futures to common memories of the past. However, as McCurdy (2011: 318) and Robertson (1980: 37) infer, the past itself is *also imagined*. For example, by retelling settler-colonial stories of the Old West to explain a new frontier, advocates frame space settlement in an unchangeable image of "a pre-Columbian, empty New World, inhabited by small numbers of primitive (virtually invisible) natives" (Ibid); moreover, for some, there are ostensibly *no* natives in space to speak of, or to take from (Tumlinson 2016). The frontier further symbolises a promise of evolutionary and technological advance (Dark 2007: 555); it is also imagined foremost as a place of unbridled individualism. Here, the "rational anarchists" of Robert Heinlein's science fiction lunar colonies (1966: 64) embody the promise of space exploration and faith in the free market; where visionary entrepreneurs produce wider social good in gaining enormous personal wealth (Kilgore 2003: 95; Day 2007a). As arguably the last "unabashed

enthusiasts of imperialism" (Redfield 2002: 797), NewSpacers and other leading space industry actors mobilise American myths in imagining space settlement through a pervasively neo-colonial and neo-libertarian lens. In other words, what renders this future so familiar and "beckoning" (McCurdy 2011: 324) for its advocates is also precisely what causes its promise to be so problematic.

In words and moving image, as I explore in Chapter 3, fragments are also fundamental to an essayistic way of thinking. In the *Essay as Form* (1984: 164), Adorno lays the literary foundations for the essay film by claiming the essay "thinks in fragments just as reality is fragmented and gains its unity only by moving through the fissures, rather than by smoothing them over." From here, Rascaroli describes the essay film working and *thriving* in gaps (2017: 21). For Rascaroli (Ibid: 8), in their montage-based juxtapositions, fragments enable essay films to produce discursive tensions in the "in-between spaces," which hold potential for the undoing and redoing of any audiovisual assemblage (13). This tension in contingency, made of an "essential incompleteness" (Cotter 2019: 12) also rhymes the essay film with artistic research, and furthermore contributes to a mutual "radical potential" (Ibid; Rascaroli 2017: 189) for destabilising perceptions and inciting critical perspectives on "what is or should be" (Borgdorff 2012: 72). The manifold distances separating images from sounds, objects from worlds, and filmmakers from objects create openings for reimagining found-footage in the edit, for example, and for an audience to actively participate in constructing a film's meaning.

Together, my three essay films form part of my critical response to the Euro-American spaceflight imaginary. Using montage to create different aesthetic gestures, including *double exposures* and *inversions*, they complement this dissertation by extending and transforming ideas in the text. Thinking through the imaginary *through* moving image, they present a means of engaging and disrupting particular problematics I find in a heteronormative vision of an offworld future. It bears repeating, the films each contest the normalising gestures of the spaceflight imaginary by playing with them. First, *In Straight Circles* (2020) uses imagery of the iconic wheel-shaped space station to counter the "technological determinism" (Messeri and Vertesi 2015: 80) of the spaceflight imaginary by reimagining its metaphorical double-movement. From articulating a notional straight line through accumulating a history of speculative space fictions, the montage changes direction, reversing the chronology to complete a circle of space-station imagery. This shift produces a critical effect, where the wheel becomes a vehicle for projecting a sense of imaginary closure about any space frontier. As I learnt from the *Colliding Fragments* screening, the film's counter-movement can create a dizzying experience, as the symmetry of space stations, rotating into nowhere, becomes increasingly disorienting.

Whereas *In Straight Circles* explicitly connects different space-wheel imagery to confront a prevalent sense of repetition about the spaceflight imaginary, *Clear Ideas* (2019) complicates its normalising double expo-

sures and inversions through different processes of negation. Through certain heterotopian gestures (Foucault 1986: 26), the film evacuates the rhetoric of space settlement advocacy and the science-fiction landscapes of Lanzarote from their original framings. By creating a sense of ambiguity about these words and worlds, *Clear Ideas* attempts to confuse the dialectics of positive and negative imagery, as a means for collapsing the productive tensions created by space settlement actors in order to justify their sociotechnological projects. In bringing audiovisual fragments together in disjunctive juxtapositions, *Clear Ideas* further produces and highlights destabilising gaps about the Euro-American spaceflight imaginary. In particular, montage collides aspirational words against desolate and indifferent Martian landscapes; drowning them in howling desert winds. Here, the imagery relates directly to the aforementioned gap separating "ideal" and "real" outer space (Dickens and Ormrod 2016:19), or outer space in the imagination and outer space in practice. *Columbus* (2020) also attempts to produce a similar gap, by emphasising the critical irreconcilability of settler-colonial narratives for framing the actual conditions and practices of sustaining human life anywhere beyond the Earth. Here, the film stresses this disjuncture by composing a sort of confrontation, where a cold and ambivalent alien terrain traps a diminishing Robinson Crusoe character inside a botanical greenhouse; removing him far from the intrepid explorer and the settler myth he regularly embodies (Redfield 2000: 8).

By exploring its continuations and exposing its contradictions, my three essay films combine with this dissertation to confront the Euro-American spaceflight imaginary with both its visionary limits and with the extremities of outer space, as an array of environments drastically different from Earth — issues which space settlement advocates appear to actively try to ignore. Borrowing from anthropologist David Valentine (2016: 521), these issues further constitute a fundamental problem of *context*, where any potential for "radical rethinking" about humans unbound from Earth is dismissed by those with the financial and technological means to affect the future on- and off-planet (Morton 2019: 171). Valentine and other critical outer space scholars help to articulate a central concern of my research, where outer space productions and representations are inseparably entangled (Geppert 2007: 590; Dickens and Ormrod 2016: 2) however, concerning the predominant collective imagination in the space industry, they also appear to be increasingly far apart.

As I survey in this conclusion, fragments and gaps play very different infrastructural roles in the Euro-American spaceflight imaginary and the essay film. For the spaceflight imaginary, in stimulating anticipatory discourse as well as conflating images of ambition and anxiety, fragments and gaps work to *stabilise* a common vision of a desirable spacefaring future. In contrast, by arranging audiovisual materials in disjunctive and provisional configurations, essay films *go against stability* by producing gaps and performing estrangements (Alter 2018: 13). Opposing any traditional idea of truth, Adorno (1984: 159) champions instability by claiming "the desire of the essay is not to seek and filter

the eternal out of the transitory; it wants, rather, to make the transitory eternal." In aligning with artistic research as cultural forms of knowledge production, the essay and the essay film remain "irreducibly disjunctive, conflictual and disputable" (Arsenjuk 2016: 233) and resolutely "unfinished" (Borgdorff 2012: 143). And yet it is this destabilising incompleteness, this "vulnerability" of structure (Dillon 2017: 111), that arguably both defines the essayistic and renders the essay film so "productively inventive" (Corrigan 2011: 4).

If outer space productions and representations are inseparably entangled, and if any human future is arguably bound to offworld practices, it is the role of artists and designers — in the words of curator Nicola Triscott (2016: 441) — to develop "alternative poetic and progressive imaginaries that potentially can help us to question the uncritical transfer of existing ideologies from Earth to space." Though I do not, or just partially create alternative imaginaries here, I do explicitly question this "uncritical transfer," posed by a commonly held image of the future, through artistic interpretations and interventions. I respond to a need, articulated by critical geographer Oliver Dunnett (2020: 45), for "thinking critically about imaginative representations of space technology" and for space infrastructures to be contested "across both fictional and critical scholarly registers" (Ibid). From here, my contribution to a critical outer space discourse is shaped by a radical potential of essayistic methods for confronting and countering a monolithic imaginary. By framing the Euro-American imaginary as a form of spaceflight *infrastructure*, I describe, critique and contest its normalising functions, mechanisms and materialisations through a specific lens. Through a montage-based approach, I trace its structuring linkages and pull its aesthetic gestures apart. In the previous chapters, I establish this predominant spaceflight imaginary as a formidable social force yet troublingly distorted, inconsistent and fallible to meaningful scrutiny. In parallel, I also find a promise — or "potentiality" (Rascaroli 2017: 189) — of the essay film as a material practice for rethinking and reimagining outer space. By creating and highlighting gaps (Ibid: 187), essay films can reframe found fragments and perform estrangements; disrupting perceptions on what there is and could be. To end, I hope the different dimensions of this PhD project can contribute towards outer space future imaginaries that are less closed, determined or didactic, and decidedly more open, discursive and progressive.

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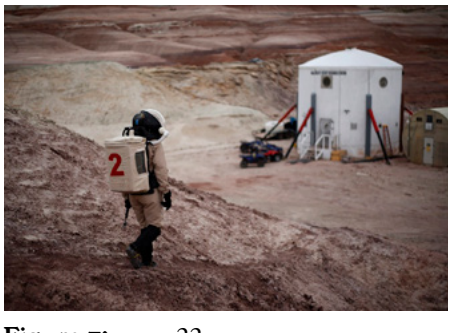

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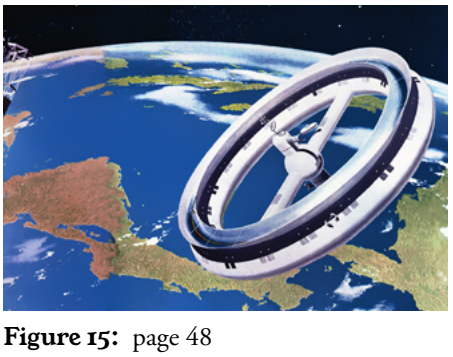

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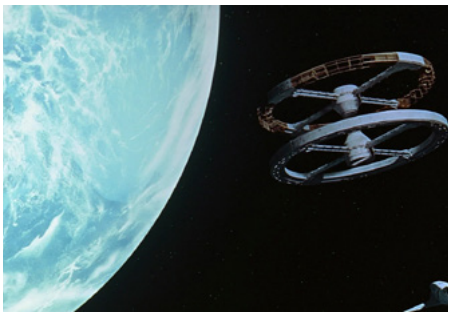

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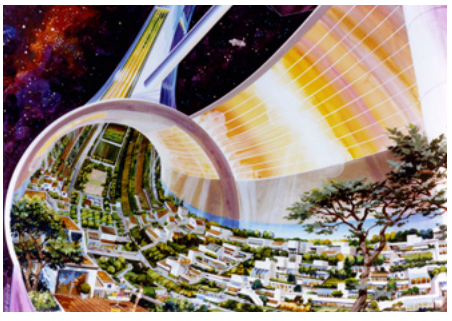

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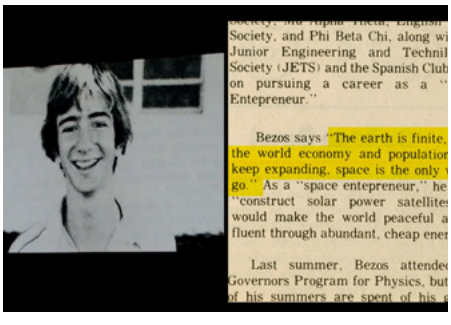

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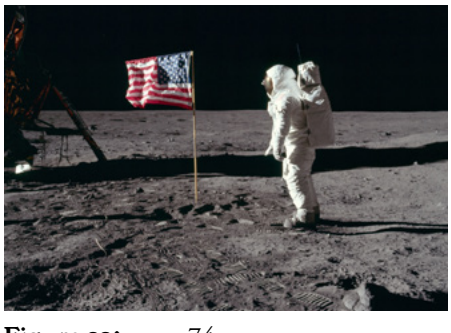

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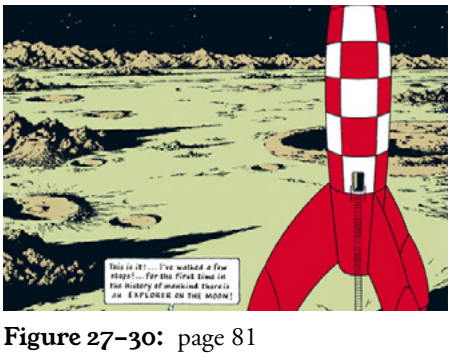

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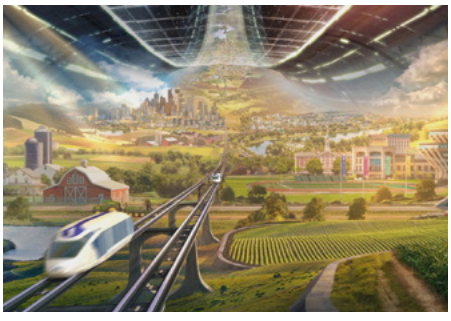

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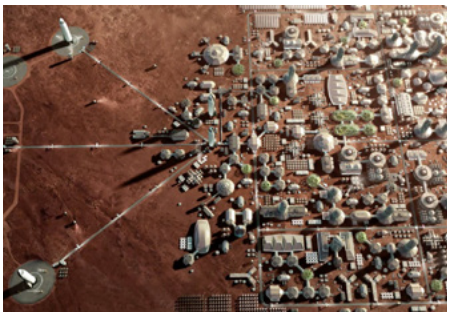

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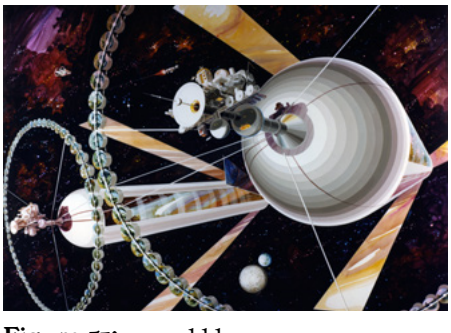

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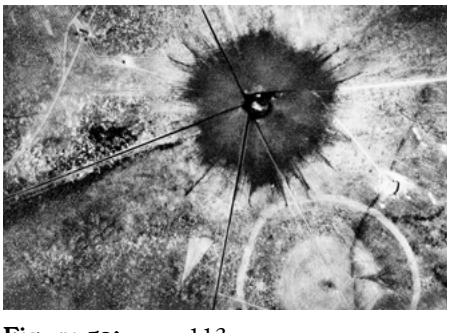

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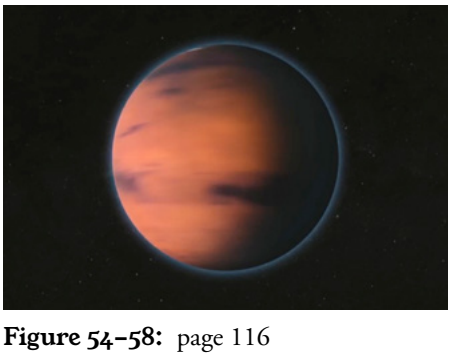

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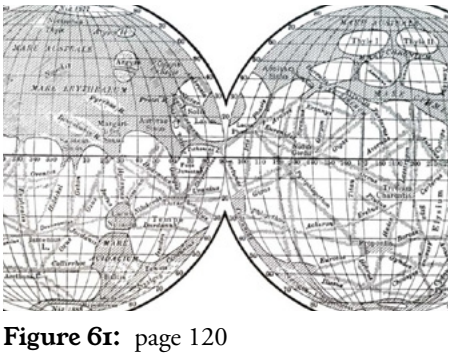

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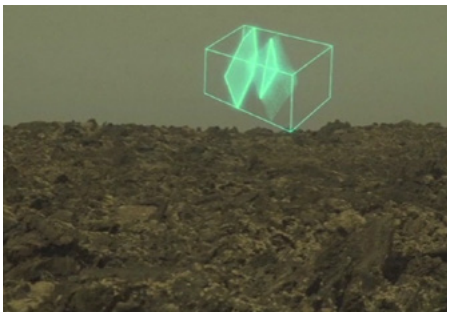

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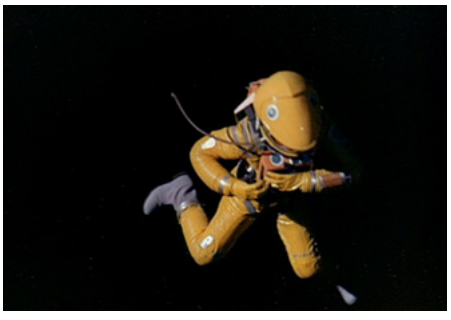

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Fragmenting a Monolith:
Exploring and Disrupting an Outer Space Imaginary

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This dissertation is submitted for the degree of Doctor of Philosophy

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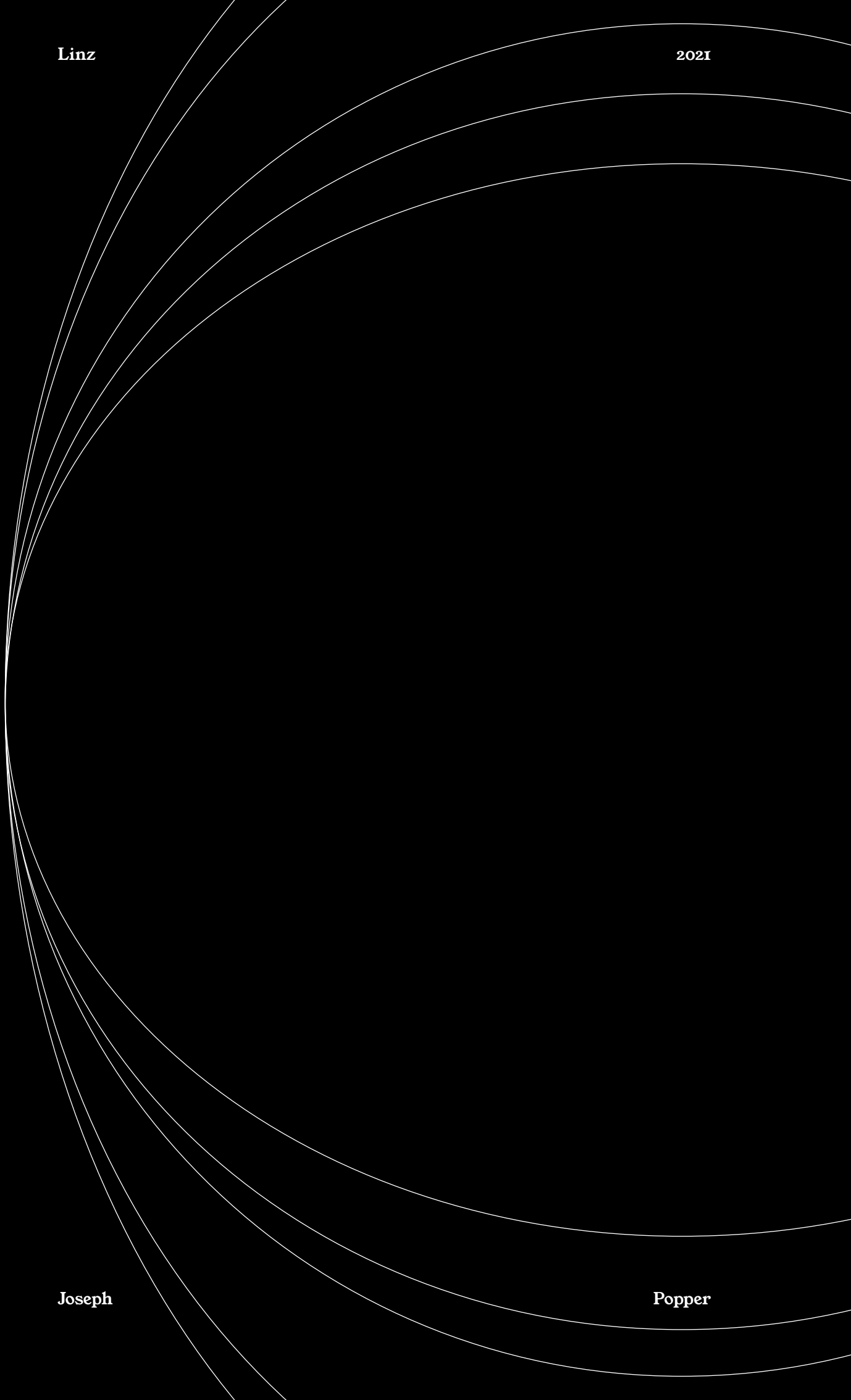

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