Heavenly Bodies

Gender and Sexuality in Extra-Terrestrial Culture

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Thesis Summary

This thesis explores how gender and sexuality are conceptualised in human spaceflight. The culture of outer space has received relatively little critical attention, and even less on the subjects of gender and sexuality. In this thesis I aim to expand upon this limited field and to investigate how the cultural dimensions of outer space can be used to productive critical ends.

The history of gender in human spaceflight is a troubled one. For decades, women were systematically excluded from most spaceflight endeavours. I argue that in addition to this, more insidious forms of exclusion have continued despite increasing representation of women in the global astronaut corps. Representations of gender in space culture are drawn from a long history of traditional conceptualisation of masculine and feminine bodies, particularly in spatial theory. Additionally, using the particular spatiality of extra-terrestrial spaces, I argue that traditional notions of gendered bodies and spaces can be uniquely destabilised by human spaceflight experience.

The gendering of outer space is often entangled with sexual culture in space discourse, as discussions of women in space are often conflated with discussions of sexuality, reproduction, and human futures in space. I analyse these ideological connections alongside feminist and queer theory to argue that while space culture is primarily heteronormative, it also holds great potential for destabilising narratives of heteronormativity. Discussions of the future, in particular, often revolve around heteronormative ideas of family and procreation, however the temporality of space culture is not as straightforward as these narratives would suggest. It is my contention that the critical potential of outer space both necessitates and facilitates a radical shift in understandings of spatiality and temporality. Ultimately, I argue that the extremity associated with extra-terrestrial exploration can inform broader theoretical discussions of gender, sexuality, cultural space, time and the future.

DECLARATION

This work has not been submitted in substance for any other degree or award at this or any other university or place of learning, nor is being submitted concurrently in candidature for any degree or other award.

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This thesis is being submitted in partial fulfillment of the requirements for the degree of **PhD**

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This thesis is the result of my own independent work/investigation, except where otherwise stated.

Other sources are acknowledged by explicit references. The views expressed are my own.

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I hereby give consent for my thesis, if accepted, to be available online in the University's Open Access repository and for inter-library loan, and for the title and summary to be made available to outside organisations.

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Introduction: Heavenly Bodies

Just as the topology of space is at odds with

everyday human experience, the 'time' of space is

utterly foreign.

Trevor Paglen, *The Last Pictures*, 2012[1]

In this thesis, I will argue that discussions of bodies in human spaceflight tend to assume a particular kind of body: a male heterosexual body. Yet the bodies referred to in my title have a decidedly feminine origin. I draw the phrase 'heavenly bodies' from an artefact which travelled aboard the Apollo 12 lunar mission in 1969. As a prank, the Apollo 12 crew back on Earth hid several photos of naked women among the checklists and supplies used during the moon mission so that they would surprise the astronauts during the mission.[2] One of these photos received particular attention in 2011 when it was sold at an auction which received substantial press coverage.[3] The photo, from a 1969 Playboy calendar, features model DeDe Lind posing topless. On the back of the image, the ground crew wrote: 'MAP OF A HEAVENLY BODY'.[4] This image was left on-board the ship for Richard Gordon to find during the lunar landing, while he remained behind in lunar orbit. His crewmates who set foot on the moon's surface were left with their own set of Playboy photos, these hidden inside the checklists affixed to their

[1] Trevor Paglen, *The Last Pictures* (Berkeley: University of California Press, 2012), p. 6.
[2] Checklists themselves have an important history within human spaceflight; see Matthew W. Hersch, 'Checklist: The secret life of Apollo's "fourth crewmember"', in *Space Travel and Culture,* ed. by David Bell and Martin Parker (Oxford: Blackwell, 2009), pp. 6-24. Hersch also discusses the Playmate images, and comments, ambiguously: 'Such jokes were magnified by the profound distance between the author and recipient: on the surface of the Moon, no one could hear the astronauts groan'. Hersch, p. 19.
[3] See for example Oliver Pickup, 'Revealed: The Playboy pin-up who went to the moon and back', *Daily Mail,* 4 January 2011 <http://www.dailymail.co.uk/news/article-1344040/Playboy-pin-went-moon-back-Apollo-12-1969-auctioned.html> [accessed 16 September 2015].
[4] See Pickup.

sleeves. The captions on these other photos included similar puns: 'SEEN ANY INTERESTING HILLS AND VALLEYS?' and 'SURVEY-HER ACTIVITY', among others.[5]

These artefacts speak to the problematic constructions of gender and sexuality that, as I will show, are pervasive in the field of human spaceflight and the culture surrounding it. The women of the Apollo 12 mission are present only in their relation to male heterosexuality. That it would be more than a decade before the American space programme accepted actual women into the astronaut corps further underscores the symbolic meaning of these photographs. These women – undressed, sexualised, and packaged within an entirely male-dominated field – are, in symbolic terms, the first women on the moon, yet they do not represent either women's agency or women's inclusion. As I will discuss, the symbolic meanings associated with these women are not dissimilar to those imposed upon actual women in human spaceflight.

This thesis is composed of two parts. In Part One, I primarily focus on the subject of gender in space; in Part Two, I shift this focus to sexuality and sexual culture. In many cases, as I will discuss, the topics of gender and sexuality are not mutually exclusive. Despite this, the related yet distinct subjects of gender and sexuality form a useful logic for dividing this document into progressive chapters. In addition to these dual concentrations, I have chosen to approach the question of gender from the perspective of feminist theory and particularly feminist spatial theory, and the question of sexuality from the perspective of queer studies, including queer temporality. I will elaborate on these theoretical choices further in this introduction.

The epigraph above speaks to another duality which helps to structure this thesis. This quotation comes from *The Last Pictures*, the publication of artist Trevor Paglen's photo project

[5] Low-resolution scans of the checklists, including the Playboy images and other crew jokes, are available from NASA's website. The checklists are also filled with doodles and cartoons, one of which depicts the astronauts placing a pornographic photograph into the view of their video camera on the lunar surface; one of the astronauts says, 'How's That, Houston?' (a reference to the way mission control, based in Houston, Texas, was addressed in astronaut communications). A theme is identifiable in these artefacts. NASA, 'Apollo 12 Lunar Surface Journal', 27 April 2013 <http://www.hq.nasa.gov/alsj/a12/a12.html> [accessed 16 September 2015].

created for the *EchoStar XVI* communications satellite. Paglen's *Last Pictures* are designed to remain stable, and available to interception, as the satellite continues to orbit Earth for up to five billion years.[6] In this way his project raises issues of both space and time in the extra-terrestrial, to which he refers in this quotation. These questions of the space and time of outer space have been central to the construction of my enquiry in this project, and this is reflected in the two-part structure of this document.

In Part One of this thesis, I focus on the influence of gender in space culture. The texts I examine in Part One raise questions of gendered spatiality and of women seeking a place in space. As a result, much of the theoretical background I use, especially in Chapters Three and Four, comes from feminist geography and spatial theory. In Part Two, I turn my attention to sexual culture in space, including a discussion of time and of the extra-terrestrial's relationship with the future. I explore these in part through queer theoretical approaches to time, particularly in Chapters Seven and Eight. Like gender and sexuality, the concepts of space and time are not always easy to disentangle, which Paglen also references in the subtitle of his introduction: 'Geographies of Time'.[7] Still, considering the spatial and temporal elements of extra-terrestrial culture separately has been useful to me in shaping this project, because it has allowed me to tease out some of the complex, contradictory meanings of time and space in the culture of spaceflight.

Diverging from Paglen's quotation, although with all respect to the beauty and depth of his words, I will argue that in many ways the spaces and the time of space culture are not so far removed from their earthbound counterparts. There are many material differences between the extra-terrestrial and the earthly; however, when humans travel into extra-terrestrial spaces, we take much of Earth's culture with us. In particular, in space as on Earth, discussions of gender and sexuality tend to privilege a male, heterosexual subject. In this way, as I will argue, extra-terrestrial culture is constructed as a masculine, heterosexual culture.

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[6] Paglen, p. 7.
[7] Paglen, p. x.

Method

This thesis comprises close textual analysis of artefacts drawn from what I broadly refer to as 'extra-terrestrial culture' or 'space culture'. I use these terms to mean the cultural reality that exists within and around the field of spaceflight. I contend that spaceflight has a cultural presence beyond the aerospace sciences, beyond government space programmes, and beyond actual astronauts themselves. Space culture is a significant aspect of contemporary culture more broadly, and it is ultimately for this reason that I have pursued this project.

My focus is informed by Constance Penley's argument in *NASA/TREK: Popular Science and Sex in America,* in which she identifies a 'blended cultural text' that she calls NASA/TREK, consisting of both the American government's space programme, and the field of popular media and fiction that surrounds it.[8] As Penley argues, the space programme is part of popular culture, and thus is subject to the same critical readings that would be applied to any cultural texts.[9] My belief in the broader cultural relevance of spaceflight is further informed by the work of David Bell and Martin Parker in the introduction to their collection *Space Travel and Culture*, in which they claim that space travel is 'central to any iconography of the twentieth century'.[10] In this way and in others, the work of Penley and of Bell and Parker is truly central to my project. I will return to them repeatedly throughout this thesis, and I explain in further detail below how these and other theoretical texts have guided my analysis.

Analysis

My approach in this thesis, what I refer to above as close textual analysis, is drawn from a tradition of critique developed in literary and critical theory. Both the texts I examine and the theoretical approaches I apply to those texts are drawn from a wider field, as I discuss below. However, throughout, my analysis involves reading of my texts for discussions of gender, sex, and/or sexuality – or the lack thereof – and reflecting on this in the context of theoretical works which address these topics. My approach is aligned with the critical practice outlined by

[8] Constance Penley, *NASA/TREK: Popular Science and Sex in America* (London: Verso, 1997), p. 4.
[9] I will elaborate on Penley's argument in Chapter One. See particularly Penley, pp. 1-21.
[10] David Bell and Martin Parker, 'Introduction: making space' in *Space Travel and Culture,* ed. by David Bell and Martin Parker (Oxford: Blackwell, 2009), pp. 1-5 (p. 1).

Catherine Belsey in her book of the same name. Here, Belsey describes reading as 'a transaction, a relation between the cultural vocabulary of the text and the cultural vocabulary of the reader'.[11] In conjunction with theoretical reflection, this is the cornerstone of the kind of criticism Belsey discusses, and that which I practice in this thesis.

I began this project with a particular theoretical approach in mind, and I discuss this in further detail below. At the same time however, my choices of theory have been informed throughout by the content of the texts I analyse. Throughout, I have endeavoured to use theoretical approaches which most closely relate to the relevant content of the texts I examine. I elaborate on some of these decisions later in this section.

My overarching aim in this mode of analysis is to illuminate the themes that run throughout these texts regarding gender and sexuality. In referring to the sources of these themes, I use the terms 'discourse' and 'narrative' in a relatively loose manner which at times may seem interchangeable, however I do use them in specific ways and for specific, distinct purposes. When I refer to narrative in this thesis, I mean simply the stories that I am identifying within and across the texts that I analyse. 'Narrative', as I use it, refers to the broader resonance of particular stories, especially about gender and sexuality, which I identify in individual texts, but which I argue are not limited to those individual texts. While in some ways this is similar to my use of 'discourse', when I refer to 'discourse' I am speaking specifically of the language used in discussions of the topics I examine, and how these discussions are themselves structured by the underlying stories that make up cultural understandings of these topics. These are overlapping concepts, however they are both necessary to my approach. In this way, I use both 'narrative' and 'discourse' as a way of accessing, through my textual analysis, the cultural reality of which they are a part. For one example, in Chapters One and Four I discuss at some length the way that female bodies are understood as a 'problem', distinguished from the male norm by the special challenges they

[11] Catherine Belsey, *Critical Practice* (London: Routledge, 2002).

are perceived to pose.[12] I refer to this as part of the discourse around women astronauts, in that it is part of the language used within the field; I also examine how this discourse is part of the narratives, or stories that are told, about the roles women play in spaceflight more broadly.[13]

I have chosen this methodological approach because it has allowed me to make use of a broad range of texts, which in turn I have used to bolster my argument that the narratives about gender and sexuality which I identify in these texts are part of larger themes, rather than being limited to individual texts. I devote the next section to discussion my choices of theoretical material, but later in this Introduction I will turn my attention back to these texts and more fully explain my rationale behind my choices for subjects of my analysis.

Theoretical Foundation

Donna Haraway's work on the cultural meanings of outer space has laid the foundation for my own investigation of space culture in this project. Her renowned 'A Cyborg Manifesto: Science, Technology, and Socialist-Feminism in the Late Twentieth Century' draws upon the science of spaceflight for its subject, the figure of the cyborg.[14] However, this project draws upon other Haraway texts much more than her work on the cyborg – especially 'Situated Knowledges' and 'The Promises of Monsters'.[15] Specifically, Haraway's 'Situated Knowledges' is the source of a perspective on the construction of masculine reason which is integral to this project, and particularly evident in Chapters Three and Four.

On a broader level, Haraway's analysis of outer space in 'The Promises of Monsters' is foundational to this thesis's own perspective on space culture. Her argument about the relationship between space and the African wilderness of Jane Goodall's primate research in

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[12] See especially my discussion of Casper and Moore's research, pp. 42-43.
[13] In addition to pp. 39-40, see also pp. 35-38.
[14] Donna Haraway, 'A Cyborg Manifesto: Science, Technology, and Socialist-Feminism in the Late Twentieth Century', in *Simians, Cyborgs and Women* (London: Free Association Books, 1991), pp. 149-182.
[15] Donna Haraway, 'Situated Knowledges: The Science Question in Feminism and the Privilege of Partial Perspective', in *Simians, Cyborgs and Women* (London: Free Association Books, 1991), pp. 183-202; Donna Haraway, 'The Promises of Monsters: A Regenerative Politics for Inappropriate/d Others', in *The Haraway Reader* (London: Routledge, 2004), pp. 63-124.

Tanzania establishes the basis for my own interrogation of the wider cultural meanings of space and spacelight:

> The wilderness was close in its dream quality to 'space', but the wilderness of Africa was coded as dense, damp, bodily, full of sensuous creatures who touch intimately and intensely. In contrast, the extraterrestrial *[sic]* is coded to be fully general; it is about escape from the bounded globe into an anti-ecosystem called, simply, space. Space is not about 'man's' origins on earth but about 'his' future, the two key allochronic times of salvation history. Space and the tropics are both utopian figures in Western imaginations, and their opposed properties dialectically signify origins and ends for the creature whose mundane life is supposedly outside both: modern or postmodern man.[16]

Haraway identifies space as a construction both of the natural world's outside, and also of the future of the human, and her self-aware use of the male generic emphasises the gendering of this construction. This construction of outer space as a 'fully general', non-bodily space lies at the heart of my argument in this thesis. As I will discuss, the cultural meanings Haraway identifies have made the position of women and the prospect of queer sexuality particularly problematized in space culture.

Constance Penley's *NASA/TREK* is another vitally important progenitor of my own project. I expand on Penley's work and its relationship to my own argument in Chapter One. Penley's argument lays the groundwork for my own in applying a critical lens to the culture of spaceflight, and particularly in examining the gendered and sexualised aspects of this field. Additionally, as I mentioned above, in considering the space industry itself alongside the culture around it – spanning policy, practice, and popular culture – Penley establishes a field of critique to which my own project is deeply indebted.

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[16] Haraway, 'Promises', p. 92.

Monica Casper and Lisa Jean Moore's sociological examination of the cultural meanings inscribed on women in the astronaut corps is also a significant basis for my own research.[17] Their 'Inscribing Bodies, Inscribing the Future: Gender, Sex and Reproduction in Outer Space' examines many of the same issues to which this thesis is devoted. Throughout this thesis, in many instances I analyse my texts within the structures Casper and Moore identify in the discourse of gender and sexuality in spaceflight.

Historian Margaret A. Weitekamp's work on the history of women in the American space programme is also a vital contribution both to this field of enquiry and to my thesis in particular. Her *Right Stuff, Wrong Sex* provides vital insight into the cultural context of women in the era prior to their official acceptance into the astronaut corps.[18] Weitekamp's work is also exceptionally useful to a critical study of space, such as this one, because of her article, 'Critical Theory as a Toolbox: Suggestions for Space History's Relationship to the History Subdisciplines'. [19] Weitekamp's argument about the usefulness and importance of critical theory to understanding the culture of spaceflight has, I argue, resonance beyond the disciplinary boundaries of historical scholarship, and her call for incorporating the lessons of critical theory into the project of space history provides useful background for my own work.

Aside from the above scholars, the majority of the theorists I turn to in constructing my argument do not directly address outer space. This is in part due to the relative scarcity of researchers in the humanities or social sciences who examine space culture, an issue to which I speak in more detail later in this introduction. In the face of this deficiency, I have chosen to analyse these texts in part through perspectives on cultural space and time. This choice is informed by my own observations about the spatial and temporal aspects of space culture, such as those seen in the epigraph to this introduction; also, this choice is importantly

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[17] Monica J. Casper and Lisa Jean Moore, 'Inscribing Bodies, Inscribing the Future: Gender, Sex, and Reproduction in Outer Space', *Sociological Perspectives* 38:2 (1995), 311-333.
[18] Margaret A. Weitekamp, *Right Stuff, Wrong Sex* (London: Johns Hopkins UP, 2004).
[19] Margaret A. Weitekamp , 'Critical Theory as a Toolbox: Suggestions for Space History's Relationship to the History Subdisciplines' in *Critical Issues in the History of Spaceflight*, ed. by Steven J. Dick and Roger D. Launius (Washington, D.C.: Government Printing Office, 2006), pp. 549-572 (especially pp. 551, 562-563).

influenced by existing research on space. Human geographer Fraser MacDonald's 'Anti-Astropolitik – outer space and the orbit of geography' argues for inclusion of outer space within studies of human geography.[20] In discussing work on the whole-earth view afforded by an extra-terrestrial perspective, a construct to which I apply critical attention in Chapter Three, MacDonald argues that 'the space from which the globe can be apprehended is not given much regard'.[21] MacDonald argues that the spatial presence of extra-terrestrial observation, such as imaging satellite technology, is an important consideration for human geographers as 'the outer-Earth and other extra-terrestrial spaces are already part of our everyday lives'.[22]

For my own spatial approach to space, my interest in the gendered aspects of this discourse has led me to feminist spatial theory. The work of Gillian Rose in *Feminism and Geography* particularly shapes my argument in Chapters Three, Four, and to a lesser extent Five and Six.[23] As I expand upon in these chapters, Rose's work on the gender *of* geography, rather than representation of gender *in* geography, provides a focus on the spatial which I extrapolate to my analysis of the space industries. As I will show, space culture evidences presumptions about both spatiality and gender which are productively analysed by feminist theoretical approaches to cultural space.

In Part Two, when I begin to analyse the sexuality of space culture, I continue to incorporate Gillian Rose's work to some extent, while also bringing in theoretical approaches to cultural space and sexuality. To this end I draw upon more of Donna Haraway's work, this time focussing on her discussion of heteronormativity in scientific discourse around 'the family'.[24] It is also from this point that I begin to incorporate work from queer studies into my analysis, including the work of Gayle S. Rubin, Lauren Berlant and Michael Warner, Patrick

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[20] Fraser MacDonald, 'Anti-Astropolitik – outer space and the orbit of geography', *Progress in Human Geography* 31 (2007), 592-615.
[21] MacDonald, p. 599.
[22] MacDonald, p. 599.
[23] Gillian Rose, *Feminism and Geography* (Cambridge: Polity Press, 1993).
[24] Donna Haraway, *Modest_Witness@Second_Millennium.FemaleMan©_Meets_OncoMouse™* (London: Routledge, 1997); see especially pp. 241-243.

Califia, and Lee Edelman.[25] All of these texts importantly illuminate how sexuality is readable within the construction of cultural spaces, and from this foundation I build my argument that outer space is constructed as a heterosexual space.

I also return to Lee Edelman's work in the second half of Part Two when I turn my attention directly to how time is conceptualised in space culture. In examining the temporality of space culture, I am informed by Bell and Parker, who write in their introduction to *Space Travel and Culture*:

> Apollo stands now as a future that never happened, or a history that seems not to connect with our present. But in remembering it, we might also begin to remember a sort of orientation to the future that is hard to sustain, as the ice caps melt and the credit crunch bites. The spaces opened in this volume ask some very specific questions about the past and present, but imply some very big questions about the future. We think that is why it is worth making space for space.[26]

In this passage, Bell and Parker highlight the non-linearity of space culture's temporality. This concept becomes very important to the later stages of my argument, as I illustrate in Chapters Seven and Eight. They also hint at an idea that this temporal disruption can be used to productive theoretical ends. In remembering a failed future through a disconnected past, Bell and Parker suggest that we can look to space culture to think through a broader cultural relationship to the future. I expand on some implications of this suggestion in Chapter Eight.

In Chapters Seven and Eight I use queer theories of time alongside Bell and Parker to consider the relationship between sexual culture and the temporality of space. Toward this end, the primary theorists on queer temporality to whom I turn are Lee Edelman, and José

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[25] Gayle S. Rubin, 'Thinking Sex: Notes for a Radical Theory of the Politics of Sexuality', in *Deviations: A Gayle Rubin Reader* (Durham: Duke University Press, 2011), pp. 137-181; Lauren Berlant and Michael Warner, 'Sex in Public', in *Intimacy,* ed. by Lauren Berlant (Chicago: University of Chicago Press, 2000), pp. 311-330; Patrick Califia, *Public Sex: The Culture of Radical Sex* (San Francisco: Cleis Press, 2000); Lee Edelman, 'Men's Room', in *Stud: Architectures of Masculinity*, ed. Joel Sanders (New York: Princeton Architectural Press, 1996), pp. 152-161; Lee Edelman, 'Tearooms and Sympathy, or, The Epistemology of the Water Closet', in *Homographesis* (London: Routledge, 1994) pp. 148-170.

[26] Bell and Parker, p. 4.

Esteban Muñoz.[27] These two theorists have ostensibly divergent views of futurity; however, I believe that using them in tandem has been necessary to my analysis because of the different perspectives they offer. In this way, I align my approach with Muñoz's own discussion of Edelman's work in *Cruising Utopia*.[28] Also in these chapters, I discuss Elizabeth Freeman's concept of 'temporal drag', which I relate to the work of art theorist Elizabeth Guffey, whose analysis of 'retro' aesthetics I will argue relates productively to queer critiques of normative time. I will return shortly to the rationale for my use of Guffey in the section on selection of texts.

In considering extra-terrestrial culture from both spatial and temporal perspectives, I am making two implicit claims about the nature of the extra-terrestrial. One is that, as the extra-terrestrial is a site of human culture, it is within the purview of the same studies of culture as would apply on Earth. The second, and in many ways the crux of this thesis, is that those aspects of the extra-terrestrial which are unique can be used to productively contribute to broader studies of space and time, on and off the Earth. I will explore this second point throughout this thesis, particularly in Chapters Four and Eight, in which I suggest that the particular ways that spatiality and temporality are conceptualised in spaceflight can be used to destabilise the patriarchal and heteronormative structures which underpin traditional discourses of space and time, even as those structures are reproduced in space culture. Throughout, I contend that space culture lacks a clear disciplinary home, a point on which I will elaborate later in this Introduction. In this thesis I bring together perspectives from a variety of disciplines – especially feminist theory, spatial theory, art theory, and queer theory – because I wish to apply a multifaceted, interdisciplinary perspective to the complex culture of spaceflight.

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[27] Lee Edelman, *No Future*, (Durham: Duke University Press, 2004); José Esteban Muñoz, *Cruising Utopia: The Then and There of Queer Futurity* (New York: New York University Press, 2009).

[28] Muñoz writes, '*No Future* is a brilliant and nothing short of inspiring polemic' and that his own work in response to Edelman's theorising of futurity 'should be read as an idiosyncratic allegiance to the polemical force of his argument and nothing like an easy dismissal' – Muñoz, p. 11. He also writes, 'I believe there is a lot to like about Edelman's polemic—mostly its disdain for the culture of the child' – Muñoz, p. 22. This 'disdain' makes up the portion of Edelman's work that I employ in Chapter Seven, thus I argue that my use of both of these theorists is harmonious.

Selection of Texts

Toward the goal of illuminating these discourses in space culture, I have selected specific texts for analysis which span a number of different disciplines. These texts can be roughly categorised into four main areas within space culture: non-fiction writing, including autobiography and biographical/historical writing, about astronauts and spaceflight experience; science journalism and popular science writing; biomedical science research which pertains to human spaceflight; and art which explicitly engages with spaceflight. Of these four categories, I expect that the fourth requires more explanation of rationale than do the previous three. In addition, my choice to not discuss science fiction, although it is very closely aligned with much of what I do examine, requires explanation.

The decision to exclude science fiction was one I made very early in my project. This choice was made primarily on the basis of scale. There is already a great deal of critical analysis of science fiction, and I believe that to do justice to that alongside the texts I have selected would require a project of greater scope. An additional reason for this omission is that it simply seemed clear and simple to me to draw a line between fictional and non-fictional accounts of space exploration. As this project has developed, this line has continued to seem clear to me, but my choice to include examples from the visual arts has invited questions about the position of this line. However, I contend that the artistic texts I analyse are comfortably situated within the rest of the non-fictional examples I use because of the specific nature of these works. The primary artists I discuss – Aleksandra Mir, Joe Davis, Frank Pietronigro, and Trevor Paglen – all engage with the materiality of spaceflight in particularly stark ways. Indeed, of those on this list, Aleksandra Mir is the only one who has neither been to, nor sent art into, space or a microgravity environment.[29] The other visual examples I analyse, the Pioneer Plaque illustration and the visual branding of the Virgin Galactic space tourism company, are at least

[29] For my discussion of Mir's work, including how she uses artefacts of real spaceflight in her work on Earth, see pp. 63-68; for Davis, see pp. 56-63; for Pietronigro, see pp. 184-189; for Paglen, in addition to the material in this Introduction, see pp. 177-181.

as clearly situated in the space industry itself as in visual culture.[30] I discuss further in Chapters Two and Three how these artistic texts specifically fit into my analysis alongside the other texts.

For these reasons I feel that including art that is related to the space industry in these ways is just as appropriate, and just as necessary, as including the other texts I discuss. Together with examples from space science, popular media, and biographical and autobiographical accounts of astronaut experiences, these texts have allowed me to demonstrate how the themes I identify are present across multiple aspects of space culture. All of these areas are, I believe, demonstrative of the greater presence space culture has in culture more broadly. I have chosen to analyse texts from all of these disciplines because it has allowed me to access this broader presence of space culture within the limited scope of this project.

Additionally, in Chapter Seven I incorporate some theoretical approaches from art criticism into my analysis, including Elizabeth Guffey's claims about the cultural relationship between spaceflight and aesthetic practices of the 20th century.[31] This choice was informed by my decision to use artistic texts, and it has been a very important choice in the overall construction of my argument. Additionally, as I discuss in Chapter 7, Guffey's argument, alongside theoretical work on temporality, additionally supports the necessity of artistic texts for this project. Also, my discovery of the art of Frank Pietronigro had an enormous influence on my decision to use so many artistic texts in this thesis.[32] As I mentioned, Pietronigro's artistic practice engages directly with spaceflight; as I discuss in Chapter Eight, he has created some of these projects in simulated microgravity. Even more importantly for my analysis, some of Pietronigro's art is explicitly theoretical in its consideration of queer culture and spaceflight. His body of work provides the only texts I have found in any discipline to so directly address a

[30] See pp. 84-87 for my analysis of the Virgin Galactic imagery, and pp. 51-56 for the Pioneer Plaque.
[31] See Elizabeth E. Guffey, *Retro: The Culture of Revival* (London: Reaktion, 2006).
[32] See Frank Pietronigro, 'Flags in Space', Pietronigro.com (2006) <http://pietronigro.com/wp-content/uploads/2013/06/Flags-In-Space-by-Frank-Pietronigro-2006.pdf> [accessed 28 November 2013]. This project, which I explore in detail in Chapter Eight, involves explicitly queer cultural iconography in microgravity, and it was my introduction to Pietronigro's work.

possible relationship between queer culture and space culture, a possible relationship which is integral to my argument in Chapter Eight, and indeed the thesis as a whole.[33]

As I state above, my decision to draw texts from such a range of fields is toward the goal of illustrating the broad applicability of my argument. Like art, as I have discussed, all of the other arenas I have drawn from offer particular advantages that have shaped my decisions of what to include. The autobiographical, biographical, historical, journalistic, and popular science writing I include in my analysis provides examples of how gender and sexuality have influenced narratives of astronaut experience and space science research in both the space industry itself and the sphere of public interest surrounding it. Autobiographical and biographical material has allowed me access to first- or second-hand accounts of space travel, and this offers productive opportunities to examine how cultural meanings of spaceflight experience are negotiated by space travellers and by those who are officially tasked with recording their life stories. I follow Constance Penley's lead in drawing heavily upon these sources, and like Penley in *NASA/TREK,* I find them to be an extremely productive arena for critical analysis.

Similarly, the popular science writers and journalists whose work I use have access to experts that I would likely not be able to reach, due to constraints of geography, time, and the scope of my project. Mary Roach, for example, includes in her *Packing for Mars*[34] many accounts of her own direct access to astronauts, space scientists, and space industry officials, access which I would not have been able to obtain for such a range of individuals. Additionally, I apply critical attention to Frank White's *The Overview Effect*, which I treat here as an example of popular science writing due to the author's background as a space scientist.[35] While White

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[33] For his writing on queer culture and space exploration, see Frank Pietronigro, 'The Potential Contributions of Queer Culture on the Future of Space Exploration' Paper presented at LESS REMOTE: The Future of Space Exploration – An Arts and Humanities Symposium, September 30 – October 1, 2008, organized by Flis Holland and The Arts Catalyst in association with Leonardo and OLATS. Co-sponsored by IAA Commission VI; to run parallel to the 59th International Astronautical Congress (IAC), SECC, Glasgow, Scotland.

[34] Mary Roach, *Packing for Mars: The Curious Science of Life in Space* (Oxford: Oneworld, 2010).

[35] Frank White, *The Overview Effect: Space Exploration and Human Evolution* (Boston: Houghton Mifflin, 1987).

also has a great deal of access to former astronauts and reprints many of their accounts, my analysis of this text is toward the goal of establishing how gendered narratives of observation are invoked in popular science writing itself. As Penley argues, popular science, gender, sex, and spaceflight are entangled concepts in contemporary culture.[36] It is this entanglement that leads me to analyse this range of texts, and to these ends.

Early on in this project, I recognized the necessity of researching for myself some of the biomedical data invoked in discussions of gender in spaceflight, because this data seemed surprisingly contentious even in contemporaneous accounts.[37] In the process of satisfying my own curiosity and desire for precision, I was frankly astonished to find explicit examples of heteronormative and sexist assumptions in even very recent research on sex and gender in space medicine. This discovery made the inclusion of more scientific research feel a natural one alongside the other texts which reproduce these same assumptions. In this endeavour I follow in the footsteps of Monica Casper and Lisa Jean Moore, who incorporate some medical texts in their analysis of the culture of anxiety about women in space.

As I have discussed, one of the reasons I chose not to include science fiction in my analysis is due to the large field of critique which already exists around this topic, to which I cannot do justice in this project. By contrast, as I will discuss later, there is a markedly scant field of study on these issues in the non-fiction aspects of space culture. This is also part of why I have chosen to draw texts from a relatively diverse range of fields – there is simply little material available for analysis, and as a result, opening up my area of critique has allowed me to access much more material for critique. This thesis intentionally focusses on a topic which has been largely neglected within studies of gender and sexuality, and as I will argue, especially in Chapters Four and Eight, it is a topic which holds particular critical value for these fields.

Structure

The two parts into which this thesis is divided are each composed of four chapters. Although the stated topics of these two parts are gender and sexuality respectively, it will become clear

[36] Penley, pp. 4-5.

[37] See my discussion of retrograde menstruation in Chapter Four, pp. 104-105.

throughout my analysis that these topics are often intertwined. Nonetheless, I feel that this structure is productive because of the way that it allows me to separate the main underlying threads of my theoretical analysis. In Part One, I primarily use feminist theory to analyse texts that primarily deal with women and gender roles in the extra-terrestrial; in Part Two, I primarily use queer theory to analyse texts which primarily deal with sex, sexuality, and the construction of 'the family' in the extra-terrestrial. Because of this structure, each part begins with an introductory section which more specifically introduces the content of the four chapters that follow. In addition to this, I explain below the overarching logic behind my organisation of these chapters.

Part One: Gender in Space

The chapters in Part One are organised thematically, beginning with a chapter which elucidates more of the existing field of research on gender in space culture. From this foundation, in Chapter Two I analyse similar themes but in different texts, texts which invoke women in space communication and space art rather than material concerning actual women astronauts. From this point, I transition to a more overtly spatial theoretical approach, toward the goal of answering some of the questions about cultural space posed by the texts in Chapters One and Two. In Chapter Three I investigate the relationship between astronautic vision and Western spatial discourse, using a concept outlined by Gillian Rose in *Feminism and Geography*. Rose's work is particularly significant because she sought to interrogate not the presence of gender *in* geography, but the gender *of* geography – the influence of gendered ideology, embedded within the structures of Western geographic enquiry.[38] I endeavour throughout this thesis to emulate this aspect of Rose's scholarship; to focus not on gender *in* space, but the gender *of* space. I detail later in this introduction how I also apply this approach to Part Two and my investigation of sexuality. Rose's work continues to be a major guide to my argument in Chapter Four, in which I argue that accounts of spaceflight experience can be used to productively interrogate broader understandings of spatiality in contemporary culture.

[38] Rose, p. 5.

In Chapter One, I focus on women in space, and I approach this topic through the theoretical lens of existing work on women and gender in space culture. I particularly focus on Penley's *NASA/TREK*, and I expand upon her argument about the necessity of radical feminist analysis of women's representation in the American space programme by incorporating additional examples from more recent stories of women in space. I also explore Casper and Moore's argument in greater depth, alongside my own research on space biomedicine and women's spaceflight experience.

In Chapter Two, I turn my attention away from astronauts and space medicine, toward the outer limits of the space industry, including attempts to communicate with extra-terrestrials and art projects which involve women in space. As I illustrate, these two categories are not always mutually exclusive. The examples I investigate in this chapter are further linked by their representations of women. I use these examples from the fringes of spaceflight to flesh out my analysis of space culture, further influenced by Penley's claim that space culture is a 'blended' text, productively approached from multiple perspectives.

In Chapter Three, I analyse several texts from within and around the space industry which explicitly invoke the perspective of looking at earth from outer space. Using feminist critiques of geographic and cartographic subjectivity, I argue that spaceflight masks its own cultural relationship to broader constructions of gendered perspectives. I use feminist spatial theory to illuminate how traditional gendered ideologies of spatial perspective appear in spaceflight discourse. This same theoretical approach carries on into Chapter Four, where I turn to feminist theoretical approaches to the body and spatiality. I argue that aspects of space culture's spatiality are used to construct women's bodies as particularly problematic. At the same time, I contend that aspects of the materiality of the extra-terrestrial can be used to additionally interrogate gendered ideologies of spatial use. In this final chapter of Part One, I make the case that spaceflight can be used to productively inform broader critiques of traditional spatial discourse.

Part Two: Sex in Space

In Chapters Five and Six I continue the thread I begin in Chapters Three and Four through further discussions of cultural space, this time in terms of sexuality; however I also begin in Part Two a move away from the spatial. Chapters Seven and Eight primarily deal with the temporality of space culture. Many of the perspectives on sexuality which have most informed my interpretations of space culture come not from studies of space, but studies of time. Thus work on queer temporality, and particularly on conceptions of the future, more deeply informs my argument in Part Two than does work on spatiality. I use the word 'conceptions' here with all multiplicity of meaning intended, for as I will explore further, the temporal positioning of outer space itself relates very clearly to a procreative ideal of the future. Toward this point I will discuss in more detail Edelman's concept of 'reproductive futurism', and how assumptions about heteronormative reproduction in discussions of the future impact upon discussions of a future in outer space.

In Chapter Five, Haraway's work on the construction of the 'family of man' and Lauren Berlant and Michael Warner's work on sexual culture form the basis for my exploration of heteronormativity in scientific research from the space industry.[39] Also in Chapter Five, Michael Warner's work on the Pioneer Plaque helps to further support my argument that space is an important site for exploration of sexual culture.[40] As I will show in Chapter Five and throughout Part Two, examples from the space industry show a marked devotion to heteronormativity, to a degree that makes critique both easy and, as I will argue, particularly pertinent to study of sexual culture more broadly.

In Chapter Six, I return to the subject of spatiality, this time from the perspective of queer theory, and explore the construction of the toilet in spaceflight as a fraught place of bodily and sexual meanings. In this chapter I will also discuss some of the more explicit writing, both scientific and popular, from within and around the space industry – that which directly

[39] Haraway, *Modest_Witness;* Lauren Berlant and Michael Warner, 'Sex in Public', in *Intimacy,* ed. by Lauren Berlant (Chicago: University of Chicago Press, 2000), pp. 311-330.
[40] Michael Warner, 'Introduction', in *Fear of a Queer Planet,* ed. by Michael Warner (Minneapolis: University of Minnesota Press, 1993), pp. vii-xxxi.

addresses sex acts in outer space. I will use these examples to illustrate how heteronormativity is present in ways that specifically relate to the material constraints of an extra-terrestrial environment, providing unique opportunities both to highlight and to destabilize dominant assumptions about sexual culture.

In Chapter Seven, I use Guffey's work on aesthetics to form a bridge between David Bell and Martin Parker's discussion of space and time in *Space Travel and Culture* and Elizabeth Freeman's work on queer temporality, alongside Edelman's work on futurity and the child. Specifically, I employ Freeman's concept of 'temporal drag' to explore how the temporal positioning of spaceflight relates to queer theoretical approaches to time. There are, as I will discuss, clear and important similarities among Freeman's queer project, Bell and Parker's work on outer space, and Guffey's discussion of the aesthetic of retrofuturism. I will argue that the accord of these differing accounts runs deeper than just their shared lexicon, and speaks to the broader cultural context of spaceflight, sexuality, and the future.

I continue exploring the relationship between art, space, and theory in Chapter Eight, where I expand upon this analytical framework using the work of Muñoz on queer utopia and discuss two very distinct examples from space art. In this final chapter, of particular importance is my investigation of the impact queer space artist Frank Pietronigro's queer engagement with space has upon my argument that space is a place of particular interest and usefulness for queer studies. In his self-reflective, overtly queer artistic practice, Pietronigro poses questions about the nature of human spaceflight experience. Even more vitally, as I will argue, Pietronigro's work and artistic philosophy address the potential for spaceflight experience and queerness to inform one another. Alongside Pietronigro's art and writing, I will expand on the work done throughout this chapter on queer theory and the future, particularly through Muñoz, to further explore not only how queer theory can contribute to spaceflight, but how spaceflight can contribute to queer theory. Just as in Chapter Four I argue that the material and cultural realities of space itself make it both a particularly necessary and a

particularly productive source for feminist critique, in Chapter Eight I argue that sexuality in space is a markedly rich field for analysis.

Limitations

As a doctoral thesis this text is necessarily limited in scope, and I address some of these limitations in the conclusion, as well as aspects of this project which bear further attention in future research. However, I feel that it is important to clarify this thesis's perspective on nationality, sex and gender, because there are ways in which I recognise my work may, as a result of the constraints of length and form, reproduce or even contribute to problematic discourses.

First, my work addresses masculinity and its influence on the field of astronautics only indirectly. This is in spite of the fact that the construction of masculinity is an enormously important part of the construction of this field and of the figure of the astronaut, as other scholars have addressed in more detail.[41] In this text, I simply accept the position that masculinity is the norm of astronautics, as I detail in Chapter One, without paying the construction of masculinity itself significant critical attention. This may be considered a limitation to my study of gender, however, due to the marked nature of femaleness I contend that focussing on the discursive field surrounding women in space provides a productive avenue toward exploring the construction of gender more broadly. I elaborate upon the theoretical rationale for my focus on women and gender in Chapters One and Three.

My discussion of sex and gender is also constrained by a more important set of omissions. In the interest of working within the terms set by the source material, I have not directly challenged cissexist assumptions in the texts I examine relating to what is only sometimes accurately termed 'female physiology', nor have I interrogated the assumption of binary sex categories itself. This is particularly relevant to texts from the science and policy of

[41] See Llinares, 'The Astronaut'; Llinares, 'Idealized heroes of "retrotopia": history, identity and the postmodern in *Apollo 13'* in *Space Travel and Culture*, ed. by David Bell and Martin Parker (Oxford: Blackwell, 2009), pp. 164-177; Daniel Sage, 'Giant Leaps and forgotten steps: NASA and the performance of gender' in *Space Travel and Culture*, ed. by David Bell and Martin Parker (Oxford: Blackwell, 2009), pp. 146-163.

the space industry, especially where urogenital or reproductive health issues are discussed. These texts speak of 'male' and 'female' physiology as clear, fixed, objective biological categories. In these texts there is no mention of even the possibility of a space traveller who may be intersex or transgender. Discussions of toilet facilities have assumed normative male and female external genitalia, and discussions of menstruation exclusively consider women as capable of menstruating. The subjects of toilets, body wastes, and menstruation make up a significant portion of my analysis of gendered and sexualised aspects of spaceflight; in this analysis, I work within the normative terms set by the texts themselves.

Examining these assumptions directly is a necessary project for future cultural studies of the space industries. This is both because assuming that spacefarers will be dyadic and cisgender has a limiting effect on the symbolic accessibility of space, and also because consideration for transgender and intersex people has great theoretical importance for a broader critique of gendered oppression. In this thesis I primarily consider how cultural ideas about gender impact upon discussions of women astronauts, and extrapolate from these case studies to explore the relationship between spaceflight and gender more broadly. In this vein I identify fruitful avenues of research that could follow on from my necessarily limited analysis. Remaining within these limitations also enables me to consider the texts within the framework they generally utilise themselves.

Though I do not address this in the body of this thesis, it appears that NASA is making efforts toward creating a safe environment for transgender employees. In 2014 they issued a policy document titled 'NASA Guidelines on Gender Transition'.[42] As I have stated, one of my goals in this thesis is to contribute to a culture of spaceflight that may be more accessible to individuals marginalised on the basis of gender and sexuality; NASA's efforts in this arena notwithstanding, this is a topic in which there is still a great deal of work to be done.

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[42] NASA, 'NASA Guidelines on Gender Transition', April 2014 <http://www.nasa.gov/sites/default/files/files/Trans_Guide_4_25_14_TAGGED-FINAL.pdf> [accessed 11 November 2015]. This document also includes brief mention of intersex individuals, although only insofar as to define the term 'intersex' and to state that some issues relating to employment protections for transgender people may overlap with those for intersex people.

There are additional potential pitfalls associated with investigating sexuality which I wish to avoid by making clear that my focus is on structural aspects of sexual culture, rather than any individual astronauts' sexual identities or behaviours. Though I focus mainly on these broader structural elements, there are of course important examples of the industry addressing specific sexual behaviours and identities, and I do discuss some of these in Part Two. One such issue came to the fore in 2013 when Sally Ride, the first American woman in space, revealed in her partially self-authored obituary that she had been in a long-term relationship with another woman.[43] However, despite this public coming out, the Sally Ride story is not entirely straightforward. In the aftermath of Ride's passing, she was quickly labelled in the media and by her official biographer, Lynn Sherr, as the first gay astronaut.[44] Yet Ride's sister, who self-identifies as gay, specifically stated in an interview that Ride 'didn't use labels' to describe her own sexual identity.[45] This specific case, combined with a broader lack of clarity regarding sexual identities of astronauts, leads me to a focus away from individual identities.[46] For the purposes of this thesis, I feel it would not be appropriate to apply any specific identity labels to individual astronauts, even to one whose same-sex relationship has received so much popular attention. While at the same time I contend that a structural

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[43] For the official obituary press release from Sally Ride Science see Terry McEntee, 'Sally Kristen Ride, Ph.D., Trailblazing First American Woman In Space, 1951 – 2012', *Business Wire* (2012) <http://www.businesswire.com/news/home/20120723006436/en/Sally-Kristen-Ride-Ph.D.-Trailblazing-American-Woman> [Accessed 16 March 2015].

[44] Lynn Sherr, *Sally Ride: America's First Woman in Space* (New York: Simon and Schuster, 2014). Sherr acknowledges the complexities of Ride's life, including that her sexuality was arguably not entirely a secret in her post-NASA years (see pp. 295-6). Despite the fact that the book makes Ride's sexuality and relationship to Tam O'Shaughnessy central to the story, the cover photo for Ride's biography is one in which Ride's wedding ring from her five-year marriage to astronaut Steve Hawley is exceptionally prominent. I will discuss this discursive choice in further detail in Chapter Seven.

[45] Chris Geidner, 'First Female U.S. Astronaut, Sally Ride, Comes Out in Obituary', *Buzzfeed,* 24 July 2012 <http://www.buzzfeed.com/chrisgeidner/first-female-us-astronaut-sally-ride-comes-out> [Accessed 16 March 2015]. Buzzfeed's comments from Bear Ride were widely picked up in other outlets, the majority of which omitted the mention of 'labels' and referred to Ride as a lesbian. One notable exception is Natalie Wolchover writing for Space.com, however when this story was picked up by the Christian Science Monitor, it was run with a subhead identifying Ride as a lesbian. See Natalie Wolchover, 'Why Aren't There Any Openly Gay Astronauts?', *Space.com*, 24 July 2012 <http://www.space.com/16735-gay-astronauts-sally-ride.html> [Accessed 16 March 2015]; Natalie Wolchover, 'Sally Ride: Why Aren't There Any Openly Gay Astronauts?' *Christian Science Monitor,* 25 July 2012 <http://www.csmonitor.com/Science/2012/0725/Sally-Ride-Why-aren-t-there-any-openly-gay-astronauts-video> [Accessed 16 March 2015].

[46] See Penley for discussion of rumours around sexuality, particularly what Penley calls the 'queer lore' around Canadian astronaut Roberta Bondar, p. 51.

analysis of sexual culture is a more productive focus for my research, a point on which I elaborate in Part Two, this concern is part of what guides me away from much discussion of the sexual identities of any individuals.

Additionally, there is a risk in my focus on primarily American, British, and Canadian texts as this elides the discourses of many other space cultures – most notably, that of the former Soviet Union. This thesis does not substantially discuss issues of race and national identity, though these issues are both vital to space culture in their own right and also not mutually exclusive with gender and sexuality as topics of research within this field. In particular, I have regrettably not applied critical attention to the associations that exist between gender roles and the ethnicities and national origins of space travellers. Outer space has been primarily occupied by white people, mainly men, and mainly from the United States and Russia; that this has had an enormous influence on the development of space culture perhaps goes without saying, but it is certainly in need of further investigation. This would be an extremely productive area for future research, and indeed it has been the subject of some existing research.[47]

In particular, the relationship between American and Russian (and Soviet) national identity has greatly impacted space history. By putting the first woman into outer space, the USSR positioned themselves as a leader in gender equality, however by not putting another woman into space for nearly twenty years, they raised questions about the meaning of this milestone. When Svetlana Savitskaya became the second woman in space in 1982, the American press made much of the story of her male crewmembers telling her that they had prepared an apron for her so she could get to work in the space station kitchen.[48] I have not investigated sources from the former Soviet Union in this thesis, which is largely for reasons of accessibility and scale. Although I am sure that the Western media representations to which I

[47] See for example Dario Llinares, *The Astronaut: Cultural Mythology and Idealised Masculinity* (Newcastle upon Tyne: Cambridge Scholars Publishing, 2011).

[48] See David J. Shayler and Ian Moule, *Women in Space: Following Valentina* (Chichester: Praxis, 2005), pp. 206-207; see also for one example John F. Burns, 'AN APRON FOR SOVIET WOMAN IN SPACE', *New York Times*, 29 August 1982.

refer in this thesis are bound to a particular narrative about Russia's relationship to America and to the rest of Europe, without further analysis I can only speculate. I believe this very question would productively expand upon the analysis I put forth in this thesis.

Outer Space and Critical Analysis

Before approaching the question of gender and sexuality in spaceflight in more detail, it is important to address the specific problems with bringing space exploration under a critical lens. As the dearth of literature on this topic suggests, space science seems to resist critique in a manner particular to its own construction as a discipline. In the introduction to *Space Travel and Culture*, David Bell and Martin Parker identify cultural studies of spaceflight as one of few true 'gaps in the literature', an apparent omission they find surprising given the broad influence space travel exerts on mass culture; 'the paucity of academic writing,' they write, 'seems dwarfed by the immensity of the object itself'.[49] Indeed, there seem to be very few critical works on space exploration and its related fields. According to Bell and Parker, one potential explanation for this is debate over the merit of such research:

> Of course it could be answered that there is simply not enough of interest here, or that it is too specific, too narrow. After all, it would make little sense to chide researchers for a lack of interest in the sociology of the ocean floor, or the psychology of cheese. But Apollo, along with all that preceded and post-dated it, is so central to any iconography of the twentieth century; what's more the popular literature and culture around this topic is simply immense.[50]

Bell and Parker's argument is reminiscent of that of Penley, to whom I will return in much more detail in Chapter One. As I have mentioned, Penley argues that in addition to being represented in popular culture, the space programme is itself popular culture, which makes it 'without doubt an object available to cultural criticism'.[51] In this, Penley goes further than Bell

[49] Bell and Parker, pp. 1, 4.
[50] Bell and Parker, p. 1.
[51] Penley, p. 3. It is important to note that Penley's approach is primarily centred on the popular culture of the United States, however in tandem with Bell and Parker's United Kingdon-based approach, I

and Parker toward providing a justification for critical analysis of space travel: not only is space 'central to' popular culture, it is inherently a part of the field available to cultural critique.

In addition to space exploration's inextricability from popular culture, space travel impacts upon the terrestrial lives of many in ever-expanding ways. David Valentine, Valerie A. Olson, and Deborah Battaglia address the deceptively far-reaching impact of space exploration in their anthropology article, 'Encountering the Future', in which they argue for the appropriateness and necessity of including outer space within anthropological research:

> […] at first glance outer space appears un-, even anti-social: after all, only 500 people have ever physically occupied it. Yet, for the increasing number of nations and groups with a stake in this future/space—through space exploration, remote sensing technologies, or even satellite television – being earthbound is not a limitation, and it should not be for anthropologists.[52]

For Valentine, Olson, and Battaglia, space is within the realm of the social in part because of its impact on the lives of more than just those who have been in outer space.

In spite of debate about its specificity, its 'anti-social' nature, or its inaccessibility, these theorists argue that outer space is increasingly a part of broader human experience, including both those humans who do, and those who do not personally experience extra-terrestrial travel. Thus it follows from these accounts that critical study of the social and cultural dimensions of space exploration is an integral part of understanding the science, practice, and culture of spaceflight.

Why Space?

So, given all of these constraints, why space? Unlike many other critics, including notably Penley and Bell and Parker, I was not a child with a burning passion for space. Though an avid consumer of science fiction, I never had any desire to leave the Earth. Perhaps it was the *Star Trek* marathons that piqued my original curiosity about the heavens. But as I approached this

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contend that Penley's critique can apply more broadly to the Anglophone, Western aerospace field on which this thesis is centred.

[52] David Valentine, Valerie A. Olson, and Deborah Battaglia, 'Encountering the Future: Anthropology and Outer Space', *Anthropology News,* December 2009, pp. 11-15 (p. 11).

project in 2011 – just after finishing a Masters project on sexuality in spatial theory – I was inspired more generally by something I noticed in the popular science media. When women astronauts were discussed, the conversation seemed to shift from the history and science of spaceflight into speculative discussions of a future in space, which in turn seemed inextricable from the contemporary view of humanity's future in general. It is this observation which has driven all of the work that follows, though I focus particular attention on the connection between space and the future in Part Two.

This project has been a way for me to examine cultural ideologies of gender, sexuality, and the future, issues which are very important to me: academically, politically, and personally. Throughout this project, I have become increasingly aware that the discursive links among women, reproduction, space, and the future saturate both the space industry and the culture that exists around it. These connections are pervasive, and as I will argue, they are problematic not only for astronauts themselves. Space is a part of our contemporary cultural reality, and studying the culture of space provides important insight into the surrounding culture. In particular, I aim in this text to explore how marginalisation on the basis of gender and sexuality is both reproduced and destabilised by what humans experience in outer space. As we shoot for the moon, reach for the stars, or undertake any other extra-terrestrial metaphor for aspiring to greatness – whether literally in space or not – I hope we can benefit from casting a sceptical eye over the assumptions we encounter. I hope we can consider what cultural baggage may be weighing us down – and how looking out to the universe may help bring into focus the limitations of our cultural perspective.

Introduction to Part One: Gender in Space

Our first girl in space will probably be a flat-chested lightweight under 35 years of age, and married. […] Her personality will both soothe and stimulate others on her space team. Her first chance in space may be as the scientist-wife of a pilot-engineer. Her specialities will range from astronomy to zoology. She will not be bosomy because of the problems of designing pressure suits. [...] Her menstruation will be eliminated by inhibiting medication. She will be willing to risk sterility from possible radiation exposure.

LOOK Magazine, 1960 [1]

Q.: Do you think in the Shuttle Program that having women on board is stressful to the men?

A.: I think it is entirely an attitude problem. You can turn that around and ask a woman if having men on board was stressful. (Laughs.)

Bonnie Dunbar in interview with Peter Pesavento, 2000[2]

The above quotations are illustrative of over forty years of discussion about women in outer space. The first, from a 1960 *LOOK* magazine article asking the question, 'Should a Girl be First in Space?', came in the early years of the American space programme, before the dream of human spaceflight had been realised by anyone. The *LOOK* article did not even attempt to answer its own question – it was ultimately not a question anyone was taking seriously at the

[1] Ben Kocivar, 'The Lady Wants to Orbit', *LOOK,* 2 February 1960, quoted in David J. Shayler and Ian Moule, *Women in Space: Following Valentina* (Chichester: Praxis, 2005), p. 79.
[2] Author's epigraph to section entitled 'Mixed Crews – Mixed Results' in Peter Pesavento, 'From Aelita to the International Space Station: The Psychological and Social Effects of Isolation on Earth and in Space', *Quest* 8:2 (2000) 4-23 (p. 12). I will discuss aspects of Pesavento's writing on gender further in this introductory section and again in Chapter Six.

time.[3] The second passage, in contrast, comes almost forty years after the first woman was launched into space, nearly twenty years after America's first female astronaut, and well into an era in which women are commonplace on American space missions.[4] Still, as Dunbar points out to her interviewer, it is the women who are seen as the aberration, and who are asked to justify their presence. These quotations, separated by four decades of technological and social progress, illustrate the construction of women both as other and as problem in the discourse of spaceflight, even into the twenty-first century.

In the chapters that make up Part One, I will examine the construction of women in astronautics in examples taken from a range of discursive practices, including biography, autobiography, art, the media, and industry research and policy. I position my research both within the relatively meagre field of critical analysis of space exploration, and the broader field of gender and the body in spatial theory. Those theorists who write on gender in space culture illuminate how gendered understandings of the body are apparent, and problematic, in popular stories of women in space, and in Part One I contribute further research to this existing field. There is a significant body of work on the historical cultural meanings of women in spaceflight, notably including Margaret A. Weitekamp's *Right Stuff, Wrong Sex*, an account of early, unsuccessful attempts at including women in the American space programme, and Bettyann H. Kevles's *Almost Heaven: The Story of Women in Space.*[5] As I reviewed in the overall Introduction, and as I will detail to a greater extent in Chapter One, Monica Casper and Lisa Jean Moore have conducted an important sociological examination of gender in the space

[3] Shayler and Moule, p. 79. For further discussion of early possibilities for American women in space, see Margaret A. Weitekamp, *Right Stuff, Wrong Sex* (London: Johns Hopkins UP, 2004). I will discuss Weitekamp's work in more detail in Chapter One.

[4] Women made up 22% of the active astronaut corps by the year following this publication. Deborah L. Harm, et al., 'Invited Review: Gender issues related to spaceflight: a NASA perspective', *Journal of Applied Physiology* 91 (2001), 2374-2383, p. 2375.

[5] Margaret A. Weitekamp, *Right Stuff, Wrong Sex* (London: Johns Hopkins UP, 2004).; Bettyann H. Kevles, *Almost Heaven: The Story of Women in Space* (Cambridge, MA: MIT Press, 2006).

industry, and Constance Penley's *NASA/TREK* is an invaluable cultural critique of gender and sex in space culture.[6]

In Part One I will expand upon this existing field of research by specifically focussing on how narratives of women in space invoke narratives of spatiality in space. These narratives, as I will show, evidence an ideal of astronautic vision which points to the gendered basis of spatial perspective, already productively criticised by an existing body of feminist theory of geography and cartography. Part One builds to my argument in Chapters Three and Four that aspects of traditional discourses of spatial theory are represented in the discourse of human spaceflight, and that these are importantly foregrounded in discussions of gender, embodiment, and perspective. In these chapters I aim to expand upon the existing literature on gender in cultural space by exploring how bodies and vision are constructed in astronautic discourse – that is, by taking feminist theories of space into *outer* space.

The second epigraph to this section is drawn from an article by science journalist Peter Pesavento which focusses on the psychological and sociological impacts of long-term isolation, particularly among space travellers. Pesavento devotes a significant portion of this exploration to questions of gender and sexuality among mixed-gender space crews – as I will discuss in further detail in Part Two, discussions of isolation effects are often greatly concerned with these aspects of crew relations.[7] I am interested in the passage quoted above because Pesavento's question reveals his acceptance of the construction of spaceflight as a masculine space. As Dunbar points out in her reply, he only considers the impact women astronauts have on the men in the crew, and not the other way around; this obliquely reinforces the construction of extra-terrestrial spaces as male spaces. That Pesavento then uses this excerpt as an epigraph without applying any critical attention to it is evidence that even after the fact, he seems unable to recognise the influence of ideology on his own enquiry. He seems to find

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[6] Monica J. Casper and Lisa Jean Moore, 'Inscribing Bodies, Inscribing the Future: Gender, Sex, and Reproduction in Outer Space', *Sociological Perspectives* 38:2 (1995), 311-333; Constance Penley, *NASA/TREK: Popular Science and Sex in America* (London: Verso, 1997).

[7] I will return to Pesavento's work alongside other texts on isolation in Chapters Five and Six.

Dunbar's response amusing, and he seems to agree with her implication that women belong in space to the same extent that men do. Still, that he does not reflect on the context of his own approach to the topic is evidence of the continued masculinism of this field.

In the four chapters that follow I examine texts that span a relatively broad historical period, extending beyond the four decades between the two quotations that open this introduction. As I will show, the discourse around women and gender roles in space culture shows remarkably little development in the time between the earliest and most recent of these examples. These chapters are devoted to expanding upon the existing research on how space is constructed as a space which is primarily for men. Space culture is situated at a point of intersection for narratives of science, technology, spatiality, and the body. As I will explore in further detail in Part One, this fosters a particular set of assumptions about gender in space, and this has wide-ranging impacts on the culture both within and surrounding the space industry.

Chapter One: Women in Space

In discussing the influence of gender on space culture, the subject of women in space is a useful starting point. The history of women in space is well documented, as I mentioned in the introduction to Part One, and the evidence of the influence of ideologies of gender is clear in the stories of women astronauts. While my focus in this thesis is a more general analysis of gender in the field, the topic of women in space is an important one, both historically and critically, for this study. Several authors have studied women in the history of space exploration, both in practice and in popular discourse. Theorists who notably foreground gender in their analyses include sociologists Monica Casper and Lisa Jean Moore, and cultural critic Constance Penley. This chapter is primarily structured around these authors' key texts in the study of gender issues in space: Penley's *NASA/TREK: Popular Science and Sex in America*, the Casper and Moore article, 'Inscribing Bodies, Inscribing the Future: Gender, Sex, and Reproduction in Outer Space'.[1] I use these texts both to elucidate the existing field of studying gender issues in space, and to provide a theoretical underpinning for discussing additional material. This additional material comprises astronaut narratives which have particular gendered implications and space physiology research which reinforces the claims Penley, Casper and Moore, and I make about the way women are treated and conceptualised in the space industry.

Constance Penley's *NASA/TREK*

As well as being one of the most comprehensive accounts of the cultural meanings of spaceflight, this book has a unique structure which provides a productive model on which I have structured the whole of this chapter. *NASA/TREK* is composed of two parts, which are indicated in the book's title. The first part, 'NASA/', contains an extensive discussion of the social, cultural, technoscientific, and political climate surrounding discussions of women in space. Penley argues for an understanding of space programmes as informing, informed by,

[1] Constance Penley, *NASA/TREK: Popular Science and Sex in America* (London: Verso, 1997); Monica J. Casper and Lisa Jean Moore, 'Inscribing Bodies, Inscribing the Future: Gender, Sex, and Reproduction in Outer Space', *Sociological Perspectives* 38:2 (1995), pp. 311-333.

and indeed a part of popular culture, and uses critical 'rewriting' of NASA in this broader cultural context to examine 'its inability to manage the meanings of women in space'.[2] In the '/TREK' portion of *NASA/TREK*, Penley turns her focus away from NASA itself and toward a very different community: that of the authors of sexually explicit *Star Trek* fan fiction. These authors – most of them women – have developed female-dominated communities which Penley argues provide their members with symbolic access to space via a perhaps unlikely path.

In *Star Trek* fan fiction, amateur authors use the existing characters and settings of the Star Trek universe to craft their own narratives – and, in the specific community of 'slash' fan fiction that Penley discusses, these stories are explicitly sexual, centring on homosexual pairings between male characters, chiefly Kirk and Spock.[3] The way these stories are identified by pairing – e.g. 'Kirk/Spock' or 'K/S' – gives rise to the term 'slash', and to the construction of Penley's title. By 'slashing' NASA and (Star) Trek, Penley makes the claim that NASA is a cultural text which she can rewrite in the same way that the fan fiction community rewrites the relationship between Kirk and Spock.[4] Before I discuss this aspect of Penley's argument – which will also contribute to a bridge between this chapter and the next – I will examine the research Monica Casper and Lisa Jean Moore have conducted on the women of NASA.

Casper and Moore's 'Inscribing Bodies, Inscribing the Future'

The male norm of astronautics which Penley examines is given additional in-depth analysis in Casper and Moore's research. In 'Inscribing Bodies, Inscribing the Future', Casper and Moore outline a key characteristic that unites women in the discourse of astronautics: their perceived difference from male astronauts. In their work with NASA documents and informants they find that 'gender differences are constructed at multiple "spaces" within this domain', and that in this framework, 'female bodies […] are configured as problematic.'[5] Their discussion of these

[2] Penley, pp. 3-4.
[3] In the *Star Trek* canon, Kirk and Spock are heterosexual characters with an entirely platonic relationship. See Penley, pp. 100-102.
[4] Penley, pp. 3-4.
[5] Casper and Moore, p. 312.

issues involves popular media discussion of women in space, NASA policy, and scientific research; throughout these texts, they find that 'bodies are key sites at which gender differences are constructed in this domain.'[6]

Liberal Feminism and Women in Space

Following the section on Casper and Moore, I return to Penley's analysis, though not for the last time. Throughout this thesis, Penley's discussion of different approaches to feminism in the aerospace field influences how I situate my own theoretical basis. In discussing the specific case studies of Christa McAuliffe, Lisa Nowak, and Helen Sharman, as I do in this chapter, I am focussing on particular women who have proven themselves extraordinary just by being involved in spaceflight. It is therefore important to acknowledge, as Penley's work argues, that using individual extraordinary women as evidence in a critique such as this one carries theoretical risk. Penley's elaboration on this theoretical difficulty is integral to my own argument in this thesis.

Penley calls attention to the potential problems with focussing on individual women's achievements in feminist analysis in her critique of NASA's public relations handling of Christa McAuliffe. Penley argues that the history of women in the aerospace fields is a history of valorising individual women for their achievements, from Amelia Earhart to McAuliffe; Penley also argues that this comes at the expense of analysing the context of women's underrepresentation in the agency.[7] Penley notes that McAuliffe designed a class on the history of women in America which was structured around this style of liberal feminism with, Penley argues, 'no political analysis of women's subordination and no distinct ideology'.[8] Penley characterises this 'brand of liberal feminism' as one which:

> takes for granted a society in which the sexes are equal and promotes the achievements of extraordinary individual women who can serve as role models for other women, to prove to them that women can do anything

[6] Casper and Moore, p. 317.
[7] Penley, p. 40.
[8] Penley, p. 40.

> that men can. …With no political analysis of women's subordination and no distinct ideology, liberal feminism is the least threatening and most palatable…and the one most suited to promoting the idea that sexual inequality is a thing of the past.[9]

Focussing on the stories of individual women can be an important tool for analysing the narratives both of these women themselves and of their institutional and cultural context – this is a technique that Penley employs in *NASA/TREK*, and which I use in this chapter. However, focussing on individuals *instead of* analysing broader questions of gender, as Penley argues NASA does, simply promotes the ideas that such analysis is unnecessary and that gender inequality is a problem of the past.[10] Following from Penley's lead in her analysis of the Christa McAuliffe story, in discussing the stories of the individual women I focus on in this chapter I aim to employ these accounts as case studies toward illuminating the broader gendered context of the discourse of spaceflight.

NASA/…: Extraordinary, Extra-Terrestrial Women

In *NASA/TREK,* Penley argues that NASA's 'inability to manage the meanings of women in space' acts as a barrier between women and space, which functions both in terms of actual astronaut selection and in women's engagement with space exploration narratives.[11] Penley identifies a common thread running through many narratives of women in space: that of women and their bodies as a problem, and even as dangerously out of control. As I have mentioned, much of Penley's analysis in the first half of *NASA/TREK* is focussed on Christa McAuliffe, finalist of the Teacher in Space programme. Penley argues that McAuliffe's story

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[9] Penley, p. 40. Penley draws this definition of liberal feminism from Susan Ware, who positions it specifically in the post-suffrage America in which Earhart lived as a public figure. See Susan Ware, *Still Missing: Amelia Earhart and the Search for Modern Feminism* (London: Norton, 1994).

[10] This is something that Weitekamp also argues, as I discussed in my introduction. See Margaret A. Weitekamp , 'Critical Theory as a Toolbox: Suggestions for Space History's Relationship to the History Subdisciplines' in *Critical Issues in the History of Spaceflight*, ed. by Steven J. Dick and Roger D. Launius (Washington, D.C.: Government Printing Office, 2006), pp. 549-572 (pp. 551, 562-563).

[11] Penley, p. 3; this second aspect leads to the */TREK* portion of Penley's analysis, as I will discuss later in this chapter.

reveals much about the cultural meanings of women in space, and about the shortcomings of NASA's ability to cope with those meanings.

'Hey, guys, what's this button?': Penley on Christa McAuliffe

A plan to make an astronaut out of an 'ordinary' American, the Teacher in Space programme was intended to reinvigorate NASA and to generate greater interest in space, science, and patriotism among the American public.[12] Christa McAuliffe was the teacher chosen to make the journey, but her dream of spaceflight was tragically unrealized. The entire crew of her mission were killed when the Space Shuttle *Challenger* exploded upon launch in 1986. The loss of the *Challenger* to faulty mechanical components was a national tragedy, and Penley argues that the loss of Christa McAuliffe was particularly deeply felt as a result of both media and school outreach programmes undertaken during the selection process.[13] Penley further argues that McAuliffe was a particularly poor choice for Teacher in Space because she was easily caricatured as incompetent and unintelligent.[14] However, I do not feel certain of Penley's implication that a different woman with more scientific credentials could have escaped such popular criticisms. I will elaborate on this point shortly, as well as later in this section when I analyse the figure of Lisa Nowak using some of the same tools of analysis that Penley applies to Christa McAuliffe.

Penley analyses public perception of Christa McAuliffe partly through 'sick jokes' which were told about her and the Challenger disaster, which she details in the book:

> What were Christa McAuliffe's last words?
>
> 'Hey, guys, what's this button?' […]
>
> What was the last thing that went through Christa McAuliffe's head?
>
> A piece of the fuselage. […]

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[12] Penley, pp. 22, 29-31.
[13] Penley, p. 42. Penley further discusses the critical framework surrounding this reading of *Challenger* disaster, and the continued interest in the event in American studies of collective trauma (pp. 42-46, 155). See in particular Lenore Terr, *Too Scared to Cry: Psychic Trauma in Childhood* (New York: Basic Books, 1990), pp. 325-326.
[14] Penley, pp. 27-28.

How do you get rid of a teacher?

Challenge her. […]

I can't believe it. Seven months of training and she still went to pieces after takeoff.[15]

Penley argues that these jokes are underpinned by widespread assumptions about women and technoscientific pursuits, including 'the frequent conflation of woman-out-of-control with technology-out-of-control' when 'catastrophe is seen to ensue because the woman is stupid, ill-qualified, or out of place.'[16] There is underlying evidence here as well, as Penley goes on to claim, of 'another popular discourse, a story of women's inherent deficiencies, which become glaringly visible – and risible – whenever she forgets her place'.[17] The concepts of female bodies 'out-of-control' and 'out of place' permeate popular discussions of women in space, as Penley identifies. This is particularly so when these women become associated, as McAuliffe has been, with danger or failure.

Though I agree with the terms of Penley's argument, I diverge from her analysis in that I am not convinced that Christa McAuliffe's specific credentials (or lack thereof) significantly influenced the stories told about her tragic death. Indeed, I argue that Penley could be fairer to McAuliffe in some ways – especially in her derision toward McAuliffe's chosen project for her time aboard the *Challenger*. Penley writes that 'with no scientific background', McAuliffe diverged from other applicants who planned scientific experiments and instead 'simply proposed to keep a journal of her experiences'.[18] In fairness to McAuliffe, in her application interview she offers a rationale for this in which she contends that the historical accounts provided by ordinary people are an integral part of a well-rounded historical education.[19] Whether this is a legitimate concern for space history or not, I remain unconvinced that a

[15] Penley, pp. 22, 27.
[16] Penley, p. 23.
[17] Penley, p. 23.
[18] Penley, p. 26.
[19] She was, after all, a history and social studies teacher. See NASA, 'TIS Finalist Interviews: Christa M' [downloaded 13 October 2011 from NASA's online archives; no longer available].

woman with more scientific credentials would have escaped the mockery levelled at McAuliffe in the ‘sick jokes’. These jokes focus on her status as a woman and a teacher, not as a history teacher or a writer of a journal.

Penley also acknowledges that even ‘highly trained, professional female astronauts’ have ‘symbolic meanings insistently imposed’ upon them, which depend on their femaleness at the expense of their individual accomplishments.[20] Certainly there is ample evidence that other women, including women with more technoscientific knowledge and experience, have been plagued by the same sexist questions about their place in space. Small assumptions about women's fitness for scientific pursuits appear in many stories of other women in space, notably including women who come from established scientific backgrounds. America's first female astronaut, Sally Ride, who Penley describes as 'the very model of the cool, professional, and scientifically accomplished astronaut' was dogged by questions about such topics as her interest in childbearing, her emotional stability under pressure, and her underwear, in ways that her male colleagues were not.[21] A gendered focus is also apparent throughout the story of British astronaut Helen Sharman, to whom I return in more detail later in this chapter. Sharman was a chemist, and at the time of her selection she was studying flavour compounds at Mars Confectionery while completing doctoral research on crystal formation; nonetheless, she was primarily known in the press as simply 'the girl from Mars', a nickname with which she expressed displeasure in her autobiography.[22]

More recently, the media coverage of former astronaut Lisa Nowak’s high-profile attempt to kidnap a romantic rival evidences the same tropes of deficiency, incapacity, and inherent peril. I argue that among the many elements of Nowak’s story, not only are her professional and scientific achievements forgotten, but even her violent criminal intentions become a mere backdrop to a lurid, irreverent story of a female body ‘out-of-control’.

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[20] Penley, p. 29.
[21] Penley p. 57. See also Denise Grady, 'American Woman who Shattered Space Ceiling', *New York Times,* 24 July 2012, p. A1. Questions about Sally Ride's personal and family life have once again surfaced in the aftermath of her recent death, as I discussed in the Introduction.
[22] Sharman, p. 78.

'Astro-Naughty': Lisa Nowak Out of Control

With a background as an aerospace engineer and robotics expert, Nowak logged nearly thirteen days in spaceflight before her dismissal from NASA. For her service in the United States Navy in support positions within Electronic Warfare and as a pilot she earned multiple medals and commendations. Her Navy experience, combined with her postgraduate degrees in aeronautical and astronautical engineering, made her an exceptionally qualified NASA candidate. Her time with the agency culminated in over a week spent aboard the International Space Station in 2006.[23] It is, however, the events of early 2007 for which she is most well-known.

That February, Nowak drove from her home in Houston, Texas to Orlando, Florida, with what the Orlando Police affidavit describes as 'detailed planning […] weapons, disguises, and other evidence'.[24] Her alleged goal was the abduction of a woman who she considered a rival for the romantic attentions of a NASA colleague. Nowak succeeded only in locating the woman, Colleen Shipman, and spraying her with mace before Shipman escaped and alerted authorities. Nowak's resulting arrest and trial was the subject of enormous media interest in the United States, and the questions raised about the mental stability of astronaut candidates led NASA to overhaul its astronaut selection and screening process.[25]

Among the 'other evidence' found in Nowak's car were two items which became of particular interest to the media: a computer disc containing bondage-themed pornographic images, and adult diapers. Other ‘other evidence’ included a steel mallet, a BB gun, a folding knife, several feet of rubber tubing, large plastic bags, a wig, and a large amount of cash – evidence which is cited in the charging affidavit toward establishing a ‘well-founded fear for the safety of the victim.’[26] Yet instead of the weapons, disguises, or even the confession, it was

[23] NASA, 'Biographical Data: Lisa M. Nowak', March 2007 <http://www.jsc.nasa.gov/Bios/htmlbios/nowak.html> [accessed 26 March 2013].
[24] Orlando Police, 'Orlando Police Department Charging Affidavit 2007-47314', pp. 2-3.
[25] See Mary Roach, *Packing for Mars: The Curious Science of Life in Space* (Oxford: Oneworld, 2010), pp.16-17.
[26] Orlando Police, p. 3.

the diapers which became, and ultimately remain, the most visibly public aspect of the sordid affair.

This is despite the fact that Nowak consistently denied, except for in the statement reported in her initial charging affidavit, that they were related to her plans for Shipman. They were initially reported as a time-saving measure to circumvent toilet breaks during her interstate drive, and this inspired much media discussion of the use of diapers in actual space travel – an aspect of astronautics with which the public seem particularly fascinated.[27] Nowak and her attorney, however, attempted to convince the press that the diapers were actually left over from preparations for her family's evacuation from Hurricane Katrina. Curiously, and perversely despite Nowak's insistence, the press largely continued to focus on the diapers rather than the more incriminating items found in her car. Headlines addressing the evidence admitted to trial often mentioned only the diapers, and the tabloid press employed a parade of puns, from the relatively subdued 'Astro-Diaper Tale is Pooh-Poohed' to such gems as 'Astro-Nut Sez Diaper Rap Stinks', and the particularly gendered 'Diaper-Ditz Astronut Pleads Not Guilty'.[28]

The insistent focus on the prurient at the expense of the damning illustrates that Lisa Nowak's achievements – including the criminal ones – are not the focus of the story told about her. Rather, she is portrayed as another 'out-of-control' female body, 'out of place' in and incapable of coping with the demanding technoscientific environment of astronautics. The flippant tone and skewed focus of the Nowak coverage exposes the foregrounding of gendered

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[27] Roy Rivenburg, 'NASA Diapers Become Topic No. 1' *Los Angeles Times,* 9 February 2007 – I will discuss further examples of puns in reportage on Lisa Nowak later in this paragraph. See also Roach, particularly p. 50, p. 181, and Chapter 14 (pp. 225-243).

[28] Respectively, Athima Chansanchai, *Seattle Post-Intelligencer,* 30 June 2007; *New York Daily News*, 30 June 2007; Lorena Mongelli, *New York Post,* 23 March 2007. Diapers are not the only source of punny headlines in the Nowak case – the computer disc with its 'scenes of bondage' gave rise to the likes of the rhyming 'Astronut's Pervy Pics - S&M Spacewoman's Bizarro Bag of Tricks' (Lukas I. Alpert, *New York Post*, 11 April 2007), and the more succinct, 'Astro-Naughty' (Leo Standora, *New York Daily News*, 11 April 2007). I will be addressing the uncomfortable relationship between space research and sexual bondage in Chapter Six.

assumptions in the discourse of female astronauts, as Penley puts it, the ‘symbolic meanings insistently imposed’ on them throughout discussions of their place in space.[29]

Without regard to the gendered aspect of the story, NASA research psychologist Norbert Kraft characterises Nowak’s public unravelling as a turning point in broader popular perception of astronauts. In interview with Mary Roach, Kraft objects to the portrayal of astronauts as 'superhuman', until 'one of the astronauts goes with diapers across the U.S. Now they are people suddenly!'[30] However, I argue that the Lisa Nowak case does not straightforwardly relate to this general concept of astronaut humanity. The manner in which the press latched on to the scatological aspects of the story, and the mocking tone in which Nowak's crime was covered, speak specifically to the difficult position women astronauts occupy.[31] Like the sick jokes about Christa McAuliffe, the Nowak story lies at the unstable intersection of science, propriety and femaleness.

Of course, any parallels between Nowak and McAuliffe can only be uneasy ones. It should not be obscured, either by parody or sympathy, that Lisa Nowak committed a crime and appears to have been prepared to commit a graver one. Christa McAuliffe, in contrast, was mocked and vilified for a tragedy in which she was purely a victim. Still, Nowak's post-arrest media treatment echoes aspects of the McAuliffe narrative, as outlined by Penley: of spacewoman ‘out-of-control’. The symbolic meanings present in these accounts are neatly, if flippantly, encapsulated in the punning tabloid headlines which dubbed Lisa Nowak the ‘Diaper-Ditz’. Nowak's impressive scientific accomplishments have been rendered invisible. Her criminal behaviour, meanwhile, is similarly dismissed, replaced by lurid dwellings on the scatological and tropes of gendered difference.

Setting aside the subsequent questions about NASA's psychological screening process, and about the potential consequences of high-pressure careers, Lisa Nowak was exactly the kind of NASA candidate that Christa McAuliffe was not. As both an experienced military pilot

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[29] Penley, p. 29.
[30] Roach, p. 26.
[31] I will continue discussing the relationship between gender and bodily functions in spaceflight in Chapters Three, Four, and Six.

and a highly educated scientist, Nowak should have been the kind of hyper-qualified superwoman who could deflect the gendered criticisms that McAuliffe garnered for NASA. Yet Nowak's treatment in popular culture has simply repeated the trope of the 'out-of-control', 'out of place', dangerous female body, separately from mention of the actual menace she posed.

Underpinning these themes of the female body 'out-of-control' is the concept of women's bodies as out of the ordinary. This is a common trope in discussions of women in general and is particularly apparent in narratives of space travel, as Monica Casper and Lisa Jean Moore argue.

Casper and Moore: Women's Bodies, Men's Space

Casper and Moore's sociological research on women in NASA finds that, overwhelmingly, the space industry's norm is presumed to be male. In this environment, women astronauts experience unique difficulties in conforming to the expectations of the institution. Casper and Moore's analysis centres on texts from both NASA policy and from related biomedical research. This research, they argue, is responsible for some of the difficulties women astronauts experience with cultural inclusion within this historically male-dominated field.

Casper and Moore trace some of the problems with women's inclusion in spaceflight to biomedical research on microgravity, radiation, and other impacts of spaceflight upon the human body. They argue that as the possible research subjects were overwhelmingly male until at least the 1980s, the scientific literature is complicit in the view of female astronauts as abnormal:

> Male physiology has come to be seen as the standard by which female bodies have been evaluated and, unsurprisingly, found to be different. Thus, the prospect of long-term multigendered missions had made salient a host of issues related to bodies in

> space--including sex, reproduction, and pregnancy—all of which are constructed *'scientifically'* against the male norm as 'female' problems.[32]

Further, in their examination of the role of women in NASA specifically, Casper and Moore also found continued problematising of women's anatomy and bodily functioning. The assumption of a male norm in the space industry leads to what Casper and Moore describe as 'a range of practices within NASA aimed at reconfiguring women to fit into the space program'.[33]

As invoked in the 1960 *LOOK* article which provided one of the epigraphs to Part One, menstruation remains a particular 'problem' in the discourse of spaceflight, although one about which little information has been made public. Casper and Moore recount an informant's story that the director of NASA's medical programme took four months to issue a 'stuffy' reply to the question of whether astronauts use tampons or sanitary towels.[34] Though the discussion alludes to underlying medical questions of the possibility of retrograde menstruation occurring in microgravity[35], the response was interpreted by the informant as speaking to the difficulties women astronauts face when their bodies are marked as deviations from the male norm:

> [...]they have worked so hard to get there, and they're so sensitive to not measuring up … about the issue of being female. And that yes, women are different and they do have cycles, … and it's been my impression that the women on the astronaut corps have tried to minimize the differences.[36]

The idea of women's constructed difference in relation to a male norm is invoked by this informant's 'impression' that women have tried to conceal aspects of their bodies which are seen as particularly problematic. The male-dominated environment Casper and Moore identify

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[32] Casper and Moore, p. 318. This concept has far-reaching implications for my project, as I will discuss throughout this chapter and in later chapters. I return to biomedical discourse in Chapters Three, Four, and Six.
[33] Casper and Moore, p. 317.
[34] Casper and Moore, p. 317.
[35] Casper and Moore raise this question, however Harm et al. find that while there is insufficient evidence overall about the impact of microgravity on the development of endometriosis, 'medical debriefing data from shuttle flights have not supported concern that retrograde menstruation increases during spaceflight'. Deborah L. Harm, et al., 'Invited Review: Gender issues related to spaceflight: a NASA perspective', *Journal of Applied Physiology* 91 (2001), 2374-2383 (p. 2381).
[36] Casper and Moore, p. 317.

prompts these women to downplay their femaleness in pursuit of 'measuring up' to the standard of a male subject.

In addition to reproductive organs, the issue of excretion is often central to gender questions in astronautics, sometimes starkly so. Former NASA flight surgeon Patricia Santy argues in *Choosing the Right Stuff: The Psychological Selection of Astronauts and Cosmonauts* that the move from rudimentary bag systems to toilets with some degree of privacy was 'probably more than any other reason' at the root of NASA's move to accept women.[37] I argue that this speaks not only to underlying gendered ideas of propriety, but also to the overwhelming tendency to consider women as secondary and as a source of difficulty.[38]

The secondary consideration of the female body in waste management design came to the fore during the first flight of the American Space Shuttle *Discovery* in 1984, when an ice blockage caused the standard toilet system to break down. The only alternative was the 'plastic bag' style system used in all-male Apollo-era flights.[39] Shayler and Moule report that 'During the flight, the crew were full of praise for the Apollo astronauts who had to use these devices, and nothing else, for twelve days. But they also commented, "You do not want to hear what Judy *[Resnik]* has to say!'[40] Resnik's experience highlights that even after NASA was no longer exclusively male, the extent to which women are considered in the development of living spaces in outer space is limited. Similarly, even many years after Casper and Moore identified the male norm established in scientific research, space biomedicine continues to reproduce some of these assumptions. To examine this in further detail, I turn now to a publication which post-dates Casper and Moore's study by more than a decade: the book *Space Physiology* by Jay C. Buckey.

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[37] Patricia Santy, *Choosing the Right Stuff: The Psychological Selection of Astronauts and Cosmonauts* (Westport: Praeger, 1994), p. 51. I will return to Santy's claims about toilets for further analysis in Chapters Four and Six.

[38] I will further discuss these 'underlying gendered ideas of propriety' in the design of spacefaring toilet facilities in Chapter Six.

[39] In this system, the urinary provision consist of a condom-like sheath which would provide the user's connection to the storage bag – this, it perhaps goes without saying, assumes that the user possesses a penis. See Roach, p. 108.

[40] Presumably, the 'crew' referred to here indicates the five of six crew members who were male. Additionally, what Resnik had to say post-flight was reportedly, 'The Apollo bags, if you're female, don't work. Period!' See Shayler and Moule, *Women in Space*, p. 218.

Space Physiology

Authored by medical doctor and former NASA astronaut Jay C. Buckey , *Space Physiology* is a biomedical text aimed at the spaceflight community; in his preface, Buckey defines the audience of the book as 'the wide community of scientists, physicians, and engineers who support space crews' and the book's 'objective' as 'to provide a practical handbook and reference to enable flight surgeons, astronauts, and their support teams to make informed decisions about medical care and physiological maintenance'. [41] There are several material aspects of *Space Physiology* which I wish to highlight before examining the specifics of its treatment of gender. One is its relative contemporariness; published in 2006, it both follows and makes reference to some scientific research on urogenital medicine and reproductive health including some I have already mentioned.[42] However, this does not prevent *Space Physiology* from arriving at spurious conclusions regarding women's fitness for space. Additionally, as a former NASA astronaut and also a medical doctor, Buckey is positioned in a particular place of authority as author of this text. The title of the book itself, so direct and succinct, lends it an additional sense of authority and exhaustiveness that goes beyond even the appeal to status implied by Buckey's multiple sites of authority. This is *Space Physiology*: such a general title positions this text as an eminent source for students of the field, and lends it a sense of gravity and prestige.

The main source of my critique of Buckey's text is the way that discussions of women in space are conflated with discussions of sexuality in space. As I will discuss in more detail in Chapter Five, Buckey only discusses the question of sexuality within the context of his discussion of gender, and his discussion of gender is primarily a discussion of women.[43] His discussion of women, in turn, focusses problematically on their reproductive capacity, and reproduces the discourse of women's physiology as itself inherently problematic. In a key moment, Buckey even cites research which indicates that menstruation is unlikely to pose

[41] Buckey, p. x.
[42] Harm et al. conclude that female reproductive health is not a statistically significant concern for spaceflight. See Harm et al., p. 2381.
[43] Buckey, pp. 217-218.

health risks for female astronauts; he then still concludes that more research on retrograde menstruation would be necessary before concluding that microgravity is not a risk factor which could impede women's participation in spaceflight.[44] Elsewhere in Buckey's text, I do not find evidence that he requires such a high standard of proof for considering health issues that impact upon men.

Another prominent example of cultural influences on Buckey's analysis is in the different phrasing of two statements which appear in his section on contraceptive methods. 'For males who no longer want children (or have sperm banked), vasectomy is an option,' Buckey writes. 'Similarly, surgical sterilization is an option for women who have completed childbearing.'[45] Though this distinction is subtle, I argue it is analytically very significant. While men in Buckey's analysis are granted agency in their reproductive capacity – they can consider sterilisation if they '*no longer want children*' – women are only afforded such an option if they have '*completed childbearing*'. This aligns with the culture Casper and Moore identify of considering women primarily in terms of their reproductive capacity.

The Buckey text demonstrates through these examples that the male-centric culture Casper and Moore identify continues to characterise space biomedicine in the years following Casper and Moore's study.[46] Though Buckey is throughout clear that he does not think women should be restricted from spaceflight, his scientific practice is still influenced by these tropes of female difference. As I discussed in the cases of Christa McAuliffe and Lisa Nowak, such tropes are particularly stark when considering the individual experiences of women in the space industry. Another example of this, which raises clear issues around gender and biomedicine, is the autobiography of Helen Sharman, *Seize the Moment*.

The Girl from Mars: Helen Sharman and Gender in Project Juno

Seize the Moment is, as Penley points out, the only English-language personal account of a female astronaut's experience of space travel and training which has been published for

[44] Buckey, p. 215.
[45] Buckey, p. 216.
[46] Buckey's text contains much more material for my analysis, as I will explore further, particularly in Chapter Five.

adults.[47] Sharman's detailed record of the Project Juno selection process provides a wealth of information about the early days of commercial space travel as well as international cooperation in the latter days of the Soviet Union. I focus here on Sharman's detailed account of the Project Juno selection process, as she directly discusses gender issues in the programme.

Sharman recalls being annoyed by her treatment in the media, as in the case of the 'Girl from Mars' nickname which I mentioned earlier in this chapter. She also objects in stronger terms to her media characterization as the 'Token Woman' in the later stages of the selection process.[48] She recalls that the women in the candidate pool were consistently highlighted by the press, in ways that the men were not. She recalls that some reports at the time considered the percentage of women in the group – one-third – to be an overrepresentation.[49] This speaks to the perception of women as 'out of place' in technoscientific fields, as Penley identifies in the McAuliffe narrative. One-third, after all, is a markedly smaller percentage than that of women in the population at large.

Sharman's description of the stages of the competition contains further evidence of the male dominance of spaceflight, and particularly of space biomedicine, which additionally supports Casper and Moore's argument. In her account of the psychological tests to which the Juno candidates were subjected, Sharman shares an intriguing fact for which she offers no explanation: the psychological exam had more of an impact on the female candidates than the male, and eliminated all but three of the women in a pool of twenty-two.[50] Additionally, the women were given psychological testing first while the men underwent the first stage of physiological tests, 'the reasoning being that the doctors didn't want to subject the women to

[47] The distinction here of adult literature is important as many astronauts – particularly female astronauts – have written children's books about their experiences. Constance Penley raises this in terms of the acceptable roles of women within the space programme, and I will discuss this again in Chapter Seven. See Penley, pp. 87-88.
[48] Sharman, pp. 92-93.
[49] Sharman, p. 77.
[50] Sharman's phrasing prevents establishing the gender breakdown of the nine candidates rejected after the psychological testing; Sharman, p. 80.

unnecessary X-rays'.[51] Sharman does not elaborate on this point, but it seems likely that the underlying reason for this was concern for the female candidates' reproductive health – and also, perhaps, an assumption that women would be more likely to fail the psychological tests, and so should be spared the physical examination until the project doctors were satisfied that they were psychologically fit.[52]

The concern about women's sterility expressed in Project Juno is very like that expressed in *LOOK* in 1960, and still looms large in research on female astronauts, to a greater degree than it does for males.[53] This is despite the fact that such risks exist for men as well; in fact, according to Harm's 2001 overview of research on gender and health in spaceflight, men are 'at considerably increased short-term risk from damage to gametes' due to the location of male gonads, though otherwise evidence suggests that the health impact of space radiation is comparable for men and women.[54] This, once again, points to the marked nature of women in astronautics, as always gendered and always reproductive, against an unmarked male norm.[55] Sharman's story illustrates that even decades after the *LOOK* article, discussions of women in space continue to invoke questions of the body in ways that discussions of men do not.[56] Buckey's work further demonstrates that the scientific practice behind popular discussions also reproduces these narratives even into the twenty-first century. All of these examples raise the question: in the face of institutional exclusion and alienating biomedical discourse, what place is there for women in space? Constance Penley, in the second part of her *NASA/TREK*, posits that women have created their own grassroots avenues to space in perhaps unexpected

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[51] Sharman, p. 79.

[52] Buckey also references the statistical likelihood that women will experience more minor psychological distress than men, which he situates in the context of the difficulty of leaving one's family behind for a long-duration spaceflight. This may, he speculates, take more of a psychological toll on women than on men. Buckey, p. 215. For more about the heteronormative underpinnings of Buckey's argument, see Chapter Five.

[53] See Harm et al., particularly 2380-1.

[54] Harm, et al., p. 2381.

[55] Casper and Moore, as I have mentioned, examine this 'always reproductive' ideal further, and I will return to their analysis in Part Two. I will also be returning to Sharman's experiences, along with those of other unmarried female astronauts, in examination of the concept of the family in space culture, especially in Chapter Five.

[56] I also will argue in Chapter Three that this relates to the broader history of constructing women as 'more bodily' than men.

ways. This claim makes up the bulk of Penley's book's second part, to which I now turn my attention.

…/TREK

The examples of Christa McAuliffe, Lisa Nowak, and Helen Sharman all support, in their own ways, Penley's claim that space travel has been systematically constructed as a space which excludes women. In the /TREK section of *NASA/TREK*, Penley reads the primarily female community of homoerotic *Star Trek* fanfiction writers in part as a large-scale attempt at reaching the stars from a group (women) who have been effectively marginalised by non-fictional space programmes. This community of *Star Trek* 'slashers' developed out of the broader *Star Trek* fan community in the early 1970s. The themes these amateur women writers use – of romantic and sexual relationships between male *Star Trek* characters, especially Kirk and Spock – make it what Penley terms 'the most radical rewriting of NASA/TREK yet.'[57] In this way, Penley posits that *Star Trek* slash writers are engaging directly with the phenomenon Penley herself has named according to the conventions of slash fan fiction. As she has argued, NASA is popular culture, and NASA and *Star Trek* together make up a blended text which encompasses the space industry and space culture. The *Star Trek* slash community is radical both in that it is a sexually explicit, homoerotic medium, and that it is one dominated by women.[58] In this way it is a stark contrast to NASA itself, which has been historically unaccommodating to women and historically uncomfortable with the idea of sex.[59]

In the early 1970s, there was no official way for American women to imagine going to space – NASA would not begin recruiting women into the astronaut corps until 1978.[60] In the decades since, although more and more women have travelled to space, the slashers' self-made engagements with outer space have continued. Even as NASA has made important progress toward gender equality, Penley argues that the slashers' own version of space

[57] Penley, p. 100.
[58] Penley, p. 101.
[59] I will discuss this latter point throughout Part Two, especially Chapters Five and Six.
[60] See Weitekamp, *Right Stuff*, p. 187.

provides 'a much more satisfying utopian solution than NASA has yet been able to conceive'.[61] That Penley specifically claims that this creative, symbolic access to space offers a more successful utopian vision than an official space programme can muster highlights the complex relationship between the space industry and its cultural surroundings. This is evidence of the broader importance of space travel within culture. It is also demonstrative of the importance that cultural engagements with space can have on space culture itself. In the next chapter, I will explore how other creative artefacts from outside the human spaceflight industry provide examples of gender issues in space culture. I will analyse these artefacts in a similar spirit to Penley's approach to NASA and the slash community, as I explore how they are positioned at the intersection of space, science, popular culture, and gender.

[61] Penley, p. 148. In this way Penley's argument mirrors Haraway's work on space in 'The Promises of Monsters' as I discussed in the introduction. See Donna Haraway, 'The Promises of Monsters: A Regenerative Politics for Inappropriate/d Others', in *The Haraway Reader* (London: Routledge, 2004), pp. 63-124. I will return to ideas of space utopia, particularly in relation to sexuality, in Chapter Eight.

Chapter Two: Women in Space Art and Interstellar Communication

In this chapter, I move away from the previous chapter's focus on women who have travelled to space to explore how women are (and are not) included in other ways of engaging with space, through space art and interstellar communication. Although this differs from Penley's focus on amateur artistic expression in the second part of *NASA/TREK,* my view of these peripheral aspects of space culture is aligned with Penley's analysis of NASA as 'fiction, folklore, myth, and popular culture', as well as her assertion that 'issues of sex, science, and popular culture' are 'increasingly entwined'.[1] In this chapter I will focus on three examples of just how these three topics are entwined in the related fields of space art and space communication.

As I discussed in the Introduction, I have chosen to analyse examples of artistic texts in part because of the existing relationship between art and space science. Two of the examples I explore in this chapter fall between these two categories, as examples of both artistic expression and interstellar communication. This chapter's final example, though not itself a scientific endeavour, uses the iconography of spaceflight to engage with the same questions around gender in space that are raised by the first two examples, as I will show. The common threads woven through all of these artefacts are evidence of both the relevance and the productivity of examining them alongside one another. Space art is not always distinct from space science, and further, space art can provide unique opportunities for comment on the culture of spaceflight.

Space art itself is a relatively broad field which encompasses many forms of artistic expression that either use elements of, or in some cases directly engage with, outer space. This includes art which uses traditional media to depict astronomical subjects, art which explicitly engages with spaceflight, as well as in some cases art which is created in aerospace

[1] Constance Penley, *NASA/TREK: Popular Science and Sex in America* (London: Verso, 1997), pp. 88, 3.

environments.[2] Interstellar communication comprises attempts humans have made to send messages into space through various means. Such messages have taken a variety of forms, including physical inclusion on spacecraft and radio messages broadcast toward space, as I will discuss in two of this chapter's case studies. Such interstellar communication attempts are a bid for potential discourse with an extra-terrestrial intelligence, though so far the only partners to these conversations have been other humans. These communiqués are designed to teach extra-terrestrial beings something about Earth's culture, but as many critics have pointed out and as I will discuss, they primarily reveal a great deal about their own culture.

In addition to the disciplinary overlap between the following examples of space art and space communication, both of these disciplines are examples of that to which I have been referring as space culture. They exist within, around, and alongside human spaceflight endeavours and they provide additional insight into the cultural meanings ascribed to the extra-terrestrial. The artefacts I discuss in this chapter complement the case studies of women astronauts from Chapter One, both as further examples of space culture and more specifically as examples of the treatment of women in this cultural context. Women are at least partially the subject of all three of the following examples, but as I will show, each example represents and uses women in very different ways.

The Texts: Carl Sagan, Joe Davis, and Alexandra Mir

The first section centres on the Pioneer Plaque, a prospective communiqué to extra-terrestrials which was affixed to the *Pioneer 10* space probe launched by NASA in 1972. The plaque was inscribed with scientific and figurative illustrations, including, perhaps most notably, depictions of two human figures: a man and a woman. In this chapter I will analyse not the Pioneer Plaque itself, but creator Carl Sagan's own writing about the response to the plaque's design. The Pioneer Plaque's depiction of male and female human figures has been

[2] I will discuss in Chapter Eight the artwork Frank Pietronigro has created in NASA microgravity simulation flights, for one example of the latter. For some general resources on space art, see Ron Miller, *The Art of Space: The History of Space Art, from the Earliest Visions to the Graphics of the Modern Era* (New York: Zenith Press, 2014) and James D. Dean and Bertram Ulrich, *NASA/Art: 50 Years of Exploration* (New York: HNA Books, 2008), the latter of which specifically addresses NASA's internal artists programme.

the subject of much criticism from a number of perspectives, notably on the basis of its representation of gender, sexuality, race, and humanity itself.[3] Carl Sagan's 1973 *The Cosmic Connection: An Extra-Terrestrial Perspective*, published one year after the launch of *Pioneer 10*, contains a lengthy discussion of the criticisms the drawing received at the time. I will argue that the way that Sagan addresses this criticism only magnifies the problems with the Plaque's representation of gender. Instead of meaningfully examining the logic which may have led Sagan and his wife Ann Druyan (who drew the figures) to depict them in a way which invited feminist criticism, Sagan denies responsibility for the way the illustrations were received by his human critics.

The sexuality represented (or not represented) in the Plaque was also a source of a great deal of critique, as I will discuss. Another prominent critique of the Plaque's representation of sexual relations (or, rather, lack thereof) comes from the artist Joe Davis, whose dislike for the design of the Pioneer Plaque inspired his own work of both space art and interstellar communication, 1986's *Poetica Vaginal,* a work which may be perceived as performance art, which involved the transmission into outer space of sounds generated from the muscular contractions of volunteers' vaginal canals. As I will explore, Davis positions *Poetica Vaginal* as an attempt to compensate for the Pioneer Plaque's anatomically incomplete representation of a female body. I argue that this work, despite its use of actual women's bodies, effects a continued lack of representation of women. Through complex scientific and artistic practice, Davis's work reduces women to their reproductive organs and quite literally denies them a voice or other active involvement in the project.

Both the Pioneer Plaque and *Poetica Vagnal* further contribute to the exclusionary, male-dominated culture I have identified in Chapter One. However, other work within space

[3] Carl Sagan's own writing on the subject of gender makes up the majority of this chapter's first section. Sagan himself also laments the problematic depiction of race in the final artwork. See Sagan, *The Cosmic Connection: An Extra-Terrestrial Perspective* (Cambridge, Cambridge University Press, 1973), p. 20. I will discuss the representation of sexual culture in the Pioneer Plaque in Chapter Five (see especially pp. 131-133), through Michael Warner's own critique of the Plaque's imagery. See Michael Warner, 'Introduction', in *Fear of a Queer Planet,* ed. by Michael Warner (Minneapolis: University of Minnesota Press, 1993), pp. vii-xxxi.

art posits alternatives to this culture. In this chapter's final section I will divert from interstellar communications to examine a project by the artist Aleksandra Mir, whose work overtly provides women with symbolic access to space. Mir regularly works with space and space culture in her art, as well as with questions of women's representation.[4] I will explore how Mir's performance art piece *The First Woman on the Moon* addresses the lack of representation of women in space that I discussed in Chapter One and in the first two sections of this chapter. Mir's project provides a voice that women have not been granted in the other two works, and her self-aware use of the imagery and symbolism of mid-century American astronautics constitutes a direct critique of the exclusionary culture of the field. The discussion of these artefacts is arranged chronologically in this chapter, beginning with the Pioneer Plaque.

Carl Sagan and the Pioneer Plaque

In *The Cosmic Connection,* Carl Sagan addresses the criticisms and the lore surrounding the human figures on the Pioneer Plaque. He shares with pride the breadth of responses received from the general public, from such apparently disparate groups as 'scientists and housewives, historians and artists, feminists and homosexuals'.[5] Much to my disappointment, he does not elaborate on the commentary he received from homosexuals,[6] though he has a great deal to say about the feminists who took issue with his depiction of the human race.

The illustration of human figures on the Pioneer Plaque portrays a man and a woman side by side, their bodies set against a line drawing of the *Pioneer 10* craft itself, to scale. This was intended to give extra-terrestrials a sense of the size of average human bodies in comparison to the craft. Both of the figures are drawn unclothed, although the man has clearly

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[4] Mir's website gallery includes works such as 1996's *New Rock Feminism,* 2002's *Pink Tank*, and *Smash Patriarchy* (1996-2005), all of which explicitly engage with issues of representations of women and/or feminism. See Aleksandra Mir, 'Projects', <http://www.aleksandramir.info/projects/> [accessed 11 January 2016].

[5] Sagan, p. 21. It is notable that Sagan responds to these criticisms waith minimal reference to the actual artist, Ann Druyan, herself. The Pioneer Plaque figures are here mainly referred to as a product of the entire team's planning and discussion. I have not been able to find Druyan's own response to the issues I discuss in this section.

[6] I discuss the queer criticism Sagan receives decades later from Michael Warner in Chapter Five, pp. 131-133.

illustrated external genitalia, while the woman's lower abdomen is only differentiated by the triangular lines marking the tops of her legs. The figures are depicted in different poses: the man raises a hand in greeting, while the woman stands angled toward the man rather than the viewer, with her arms relaxed at her sides.

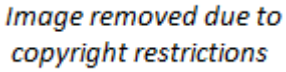

Figure 2.1: The Pioneer Plaque[7]

The design of the woman drew significant criticism, of which by 1973 Sagan was already well aware. These criticisms focussed on two points: the lack of female genitalia, and the choice to represent the two figures in different poses.

Greeting the Universe

'Several women correspondents,' Sagan writes, 'complain that the woman appears too passive. One writes that she also wishes to greet the universe, with both arms outstretched in womanly salutation.'[8] That Sagan does not elaborate on this criticism is illustrative of his dismissiveness toward it. He earlier writes: 'The man and woman are not shown in precisely the same position or carriage so that the suppleness of the limbs could be communicated', and

[7] Courtesy NASA/JPL-Caltech.
[8] Sagan, p. 22.

'Only one of the two people is shown with hand raised in greeting, lest the recipients deduce erroneously that one of our arms is bent permanently at the elbow'. [9] These claims only beg the question of the chosen gender of the person with the bent arm; if it had to be one, why a man? And why could the other not, as the unnamed woman correspondent suggests, be depicted in a different active gesture? To these questions, Sagan gives no answer. In dismissing the criticisms in this way, Sagan shows unwillingness to address them in their own terms. The choice to depict the man with arm raised in greeting and the woman without is not sufficiently analysed as a result. The question posed by Sagan's feminist critics is not why the figures are positioned differently, but why, given those constraints, the choice was made to select the man for the active role, and the woman for the passive. Sagan answers the first question, but not the second, and in this way he refuses to engage with the substance of the criticism.

Feminist objections to the Pioneer Plaque were made on the basis of its representation of traditional ideologies of gender. Sagan does not acknowledge or explore this in his response, instead limiting his analysis to the individual figures at hand; they needed to be posed differently, and one of them should be greeting the universe, and at this point the analysis ceases. Though no real woman is travelling to space on *Pioneer 10*, Sagan's lack of analysis recalls Penley's claims about liberal feminism in aerospace history.[10] Sagan's feminist critics ask him to evaluate his own underlying perspective on gender, and he does not do so. Sagan's analysis remains fairly uncritical as he explores further concerns raised by critics of the Pioneer Plaque. As he explains, criticisms of the woman's depiction did not just centre on the woman's passivity.

'a very short line'

Indeed, criticism of the passive role depicted in the drawing of the woman is not even the primary concern raised by Sagan's critics. He writes:

> The principal feminine criticism is that the woman is drawn incomplete—that is, without any hint of external genitalia. The decision to omit a very

[9] Sagan, p. 22.
[10] See Penley, p. 40. I discussed this in Chapter One, see especially pp. 31-32.

> short line in this diagram was made partly because conventional representation in Greek statuary omits it. But there as another reason: Our desire to see the message successfully launched on *Pioneer 10*. In retrospect, we may have judged NASA's scientific-political hierarchy as more puritanical than it is. In the many discussions that I held with such officials, up to the Administrator of the National Aeronautics and Space Administration and the President's Science Adviser, not one Victorian demurrer was ever voiced, and a great deal of helpful encouragement was given.[11]

Sagan expresses here his awareness of feminist criticisms of the depiction of the woman's groin, but the phrase 'a very short line' again makes clear his dismissive view of these critiques. Of course, in reality the external genitalia of female humans do not solely consist of 'a very short line', which I surmise is something of which Sagan's feminist critics are well aware.

More interestingly, however, Sagan shows no interest in reflecting on the fact that his own concerns about NASA's possible prudery centred on the woman's genitals and not the man's. That a more faithful depiction of female nudity would be more of a concern than male speaks to the marked, sexualised nature of the female body; that Sagan does not seem to realise this speaks to his own gendered presumptions as much as those he imagines of NASA. He goes on to express surprise that some offense was directed at the depiction of male genitalia, continuing:

> Yet it is clear that at least some individuals were offended even by the existing representation. The Chicago *Sun Times*, for example, published three versions of the plaque in different editions all on the same day: In the first the man was represented whole; in the second, suffering from an awkward and botched airbrush castration; and in the final version—intended no doubt to reassure the family man dashing home—with no

[11] Sagan, pp. 23-24.

> sexual apparatus at all. This may have pleased one feminist correspondent who wrote to *The New York Times* that she was so enraged at the incomplete representation of the woman that she had an irresistible urge 'to cut off the man's…right arm!'[12]

In this passage, Sagan reveals the degree to which he was unprepared for criticisms of a depiction of male genitalia, writing that some 'were offended *even* by the existing representation'. To Sagan, concern about representation of a penis and testicle could arise only from unexpectedly extreme prudery. Further, in raising this issue alongside that of the women's incomplete depiction, Sagan implies parity between the feminist criticisms of the drawing and the puritanical ones. He portrays both as irrational, groundless concerns, distracting from or even obstructing his scientific practice. The criticisms he received, he is quick to point out, 'were not directed at the pulsar map, which was the scientific heart of the message, but rather at the representation of the man and the woman.'[13]

Ultimately, Sagan wants to dispel concerns about the claims of censorship of the Pioneer Plaque more than he cares to address the concerns about women's representation. He writes:

> An entire mythology has evolved about the absence of discernible female genitalia. […] The idea of government censorship of the *Pioneer 10* plaque is now so well documented and firmly entrenched that no statement from the designers of the plaque to the contrary can play any role in influencing the prevailing opinion. But we can at least try.[14]

Try though he might, the idea of censorship of the Pioneer Plaque has persisted in popular and media accounts of the project, including in the mind of artist-scientist Joe Davis. The next artefact I will discuss was developed in direct response to just this idea – that the Pioneer

[12] Sagan, p. 24.
[13] Sagan, p. 22.
[14] Sagan, pp. 24-25.

Plaque was edited for reasons of excess propriety, and that this required correction through a new interstellar broadcast, focussed specifically on the vagina.

Joe Davis and *Poetica Vaginal*

Among those who objected to the Pioneer Plaque's depiction of humans was the artist Joe Davis, whose work with scientific messages and techniques has earned him honorary posts at Harvard University and the Massachusetts Institute of Technology as an unofficial artist in residence.[15] Davis was working at MIT in 1985 when he decided to undertake a project to try to compensate for what he saw as the shortcomings of Sagan's representation of humanity.

In a 2006 radio interview, Davis's comments on the Pioneer Plaque drawing are very similar to some of the criticisms Sagan himself quoted in *The Cosmic Connection*:

> In the first messages we sent a line drawing of a male human being complete with external genitalia, but a line drawing of a female human being without any external genitalia. We sent a picture of man and Barbie Doll into deep space to communicate with aliens as if they weren't entitled to know what we look like. It was really a picture of our own intolerance.' [16]

Unlike the criticisms Sagan quoted about the woman's depiction, however, this critique is not concerned with the woman herself. For Davis, as I will explore further in this section, the problem with drawing a woman without genitalia is not a problem of women's representation, but of sexual representation. While Davis expresses much displeasure with Sagan's design, he is in this way in accord with Sagan; both conflate the issue of the woman's representation with the issue of sexual repression or censorship. This reflects the culture I described in Chapter One, which Casper and Moore's research identifies. Women in space culture are perceived

[15] Much of the material about Davis in this section is gleaned from the 2010 documentary *Heaven and Earth and Joe Davis*, dir. Peter Sasowsky (Serious Motion Pictures, 2010) [available from Vimeo.com].
[16] Joe Davis interviewed by Benjamin Walker, 'Poetica Vaginal', *Theory of Everything* (National Public Radio, 17 May 2006).

primarily as potential sexual partners and mothers, their existence in this male-dominated field defined by their relationship to heterosexual reproduction.[17]

Davis's concern about the incomplete representation of female physiology in the Pioneer Plaque is only about women's bodies in so far as it is about his rejection of sexual repression. As a result, the project he developed in response is not really about any real women – living or illustrated. Davis's approach to the problem he identifies in the Pioneer Plaque illustration is an exceptional example of actual women being silenced while their bodies are used to essentialist, objectifying ends. This is done in a complex way, which requires an explanation of the material conditions of Davis's *Poetica Vaginal* project. On the surface, *Poetica Vaginal* is a problematic work of art, and delving into the details of its technological creation only highlights these problems, as well as uncovering new ones.

Poetica Vaginal

Poetica Vaginal is Davis's endeavour to rectify the lack of visible genitalia on the Pioneer Plaque woman. To accomplish this, Davis conceived of a project in which the vagina would be centred in an interstellar radio broadcast. To accomplish this, Davis planned to send recordings of the vaginal muscular contractions of women into deep space.

The material conditions of the *Poetica Vaginal* project are complex, in that the resultant messages which were transmitted into space are several times removed from the direct input of the volunteer women themselves. Davis's own explanation of this project provides a rich text for analysis on multiple levels, as I will show. He writes:

> A "vaginal detector" was built in a laboratory of mechanical engineering and consisted of a water-filled polyallomer centrifuge tube mounted on a hard nylon base that contained a very sensitive pressure transducer. Dancers and other female volunteers (unsolicited) hygienically invaginated the detector in order to characterize vaginal contractions (the fastest was

[17] See Monica J. Casper and Lisa Jean Moore, 'Inscribing Bodies, Inscribing the Future: Gender, Sex, and Reproduction in Outer Space', *Sociological Perspectives* 38:2 (1995), pp. 311-333. I expanded upon this in greater detail in Chapter One, especially pp. 39-45.

> clocked at 0.8 Hz). The embedded pressure transducer was sensitive enough to detect voice, heartbeat, and respiration as well as voluntary and involuntary vaginal contractions.
>
> Electronic music software was used to generate real time harmonics of vaginal contractions until that frequency matched one of the frequencies in the set of unique frequencies of English speech. A collaborating linguist bit-mapped those speech sounds (called, "phonemes") so that they could be generated in real time corresponding to vaginal "inputs." A digital map of the analog detector output was also made in real time. Thus, three forms of the message were simultaneously generated: 1) an analog signal directly generated by vaginal contractions; 2) a digital map of same and 3) voice (English phoenetic maps of vaginal contractions).[18]

As Davis explains, the vaginal contractions themselves were not recorded as audio; instead the pressure information collected by the transducer was electronically mapped onto audible sound data, which was then reproduced using pre-recorded human vocal sounds matching these frequencies. The vaginal contractions themselves are, in Davis's three-point explanation, twice removed from transmissions into space. This is one of the ways in which women are given a secondary status in this project – the same secondary status, I argue, as they have historically been given throughout the space industry, as I reviewed in Chapter One.

In addition, the *Poetica Vaginal* volunteers are reduced to their physical bodies at the expense of their minds or voices – their respiration and heartbeats are given some notice here, but attention is mainly granted to their vaginal muscles; even the cardiovascular data is

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[18] Joe Davis, 'Monsters, Maps, Signals and Codes' in *Biomediale: Contemporary Society and Genomic Culture,* ed. by Dmitry Bulatov (Kaliningrad: Yantarny Skaz, 2004). Pages unknown; available from <http://biomediale.ncca-kaliningrad.ru/?blang=eng&author=davis> [accessed 16 September 2015]. I am particularly struck by the phrase 'hygeinically invaginated', part of the technical language I will shortly discuss. To invaginate, the Oxford English Dictionary explains, is an action which bears no direct relationship to the vagina, as the word simply derives from the same Latin root, meaning sheath or to sheathe. Thus anyone could conceivably invaginate the device into any orifice, which could provide alternative avenues for Davis's project were he to revisit it himself in the future. For more about heteronormativity in space, see Part Two, and specifically Chapter Eight in which I discuss queer space art.

recorded only through this invasive vaginal device. In this way, these women are silenced, their own voices and names entirely absent from the project.[19] Further, not only is their silencing the result of being represented solely by data collected invasively from their bodies; even that is being effectively silenced, replaced by recordings of someone else's voice. These women are not transmitting interstellar messages: Davis is. He is simply using their bodies – and invasively so – in his communication practice.

Davis positions his work as an answer to the euphemistic treatment of sexuality in other interstellar communication attempts. However, his own explanation of the vaginal detector is technical to the point of obscurity; in practice this functions as another form of euphemism. This is the vaginal detector:

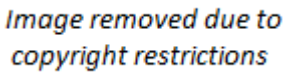

Figure 2.2: The Poetica Vaginal *Vaginal Detector*[20]

This device is undeniably phallic, and this raises questions about the full intent behind the design – questions which Davis does not directly answer. Describing the detector as 'a water-filled polyallomer centrifuge tube mounted on a hard nylon base' is disingenuous. In the

[19] The naming of women is a recurrent absence in the documentary *Heaven and Earth and Joe Davis*. Many women appear, help Davis with various projects, and then disappear without being identified (although some are interviewed). During one particularly notable scene, which was also reported alongside details of *Poetica Vaginal* by Phil McKenna writing for *New Scientist* (Phil McKenna, 'Joe Davis: The mad scientist of MIT?' *New Scientist,* 23 March 2012) Davis paints an unnamed naked woman with honey and then covers her body in gold dust for an exhibition demonstrating his optical microscope, which he uses to amplify her heartbeat. McKenna refers to her in his review as simply 'a striking young woman'. However, she is actually named earlier in the documentary as Kjersti Andvig, a Norwegian artist who contacted Davis for assistance on a project of hers which required genetic modification of apples. Her later appearance as the model for Davis's other project is not explained in the documentary. On her website, neither of these works is included in her portfolio. Kjersti Andvig, *Kjersti G. Andvig,* <http://kjersti.andvig.free.fr/> [accessed 12 November 2015]

[20] Source: *Heaven and Earth and Joe Davis.*

documentary, Davis talks about how the project functions as a remedy to Sagan's exclusion of the reality of human reproduction from interstellar communication. Davis's project is designed to tell potential extra-terrestrial receivers how human babies are made.[21] The 'polyallomer centrifuge tube' is an artificial phallus, and this is clearly its intent.

With the technical language that conceals the systematic exclusion of his volunteers from the communication, Davis also sidesteps questions about the sexuality present in his work – even as he claims to be addressing human reproduction head-on. At the same time however, in his less formal reflections on the project, his words reveal his awareness of the prurient undercurrent; that these revelations are absent from the technical work undermines his intent and reinforces the exclusion of female agency in his work. The documentary on Davis includes scenes of a presentation on the *Poetica Vaginal* project. During this presentation, the audience laughs uproariously. Davis does not join in the merriment, nor does he directly acknowledge it, but his reaction is not one of surprise, either.[22] This is laughter of recognition, and it is a recognition of which Davis is fully aware. The vaginal detector is a phallus, and the further image Davis shows of a volunteer using the device is much more prurient than it is technical. In the radio interview with Benjamin Walker from 2006, Davis also acknowledges that his work in *Poetica Vaginal* is not 'serious', positioning it in opposition to the 'serious' communication attempts like the Pioneer Plaque, which he claims are 'funny in retrospect'. I recognise that he is aware of the humour in his work, but I contend that the way that he avoids acknowledging this in the work itself undermines his stated aims about fighting censorship, and reinforces the sexism of the project.

The mix of technoscience and intimacy in the design of the project is underscored by the design of the space in which the vaginal detector is housed. Davis writes:

> Artists, architects and mechanical engineers collaborated in the construction of a "Vaginal Excursion Module" to contain electronics and human operators at the transmission site. A folding structure made of

[21] Davis explicates this throughout the *Poetical Vaginal* discussions in *Heaven and Earth and Joe Davis.*
[22] See Walker.

> steel, cable, wood, and thatch materials, the Vaginal Excursion Module looked rather like a Native American "sweat lodge" mounted on a Mars lander.[23]

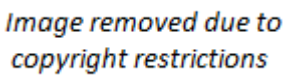

Figure 2.3: A photo of a volunteer participating in Poetica Vaginal *data collection*[24]

In combining imagery of space exploration with imagery of an ancient culture, materials from engineering with materials more closely derived from the natural world, Davis situates his work in a space which is both characterised by contrast and by similarity. Although Davis here uses the imagery of Native American culture rather than the African jungle, I argue this functions in the way that Haraway identifies in 'The Promises of Monsters'; 'primitive' wilderness space is constructed as a space before culture, while outer space is constructed as a space beyond culture.[25] Davis explicitly merges the primal (in this case, the sweat lodge) with the technoscientific (transmission of messages into space); that these two spaces are constructed as spaces without culture reinforces the problems with Davis's work. He is using themes which resist cultural analysis in particular ways, but which also are the sites of great interference from the unexamined cultural biases underlying much scientific analysis.[26] This

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[23] Davis.
[24] From *Heaven and Earth and Joe Davis*.
[25] Donna Haraway, 'The Promises of Monsters: A Regenerative Politics for Inappropriate/d Others', in *The Haraway Reader* (London: Routledge, 2004), pp. 63-124 (p. 92).
[26] See Haraway, 'Promises', pp. 78-98. I also explore the relationship between space, science, and culture in greater details in Chapters Three, Four, and Five.

also assists Davis in eluding questions about the appropriateness of depicting an unnamed woman 'hygienically invaginating' an artificial phallus of his own design as a scientific exercise.[27] Yet, that Davis himself conceals this in euphemistic language undermines his message of opposition to the prudery of the Pioneer Plaque. Even more important to my analysis is the way Davis's work obfuscates the female subject for whom he claims to be providing representation, and the sexuality both implicit and explicit in his work provides additional avenues for this. This is further clarified in the ways Davis speaks of the project when he is speaking informally.

'the skirts were flying'

In his writing and in interviews, Davis is eager to clarify that he never solicited volunteers, claiming that the excitement of the project was enough to keep 'a line' of potential women waiting for an opportunity to 'hygenically invaginate' the device.[28] In the 2006 radio interview with Walker he uses a casual metaphor which explicitly sexualises this recruitment process, saying, 'I never really had to call for volunteers […]It was just really exciting and the skirts were flying.'[29] In the process of creating this project as a sexual spectacle – provoking, as he claims it did, the kind of excitement that would prompt women's skirts to fly off – the women who volunteered are effectively erased from the work. Davis provides a particularly stark example of this in the radio interview. 'Some contractors,' he says, 'formed very specific words […] Things like "God", "Joe", things like that.'[30] In addition to the grandiosity in such a statement, it is notable that Davis refers to the volunteers using the reductive, dehumanising term 'contractors'. With this word, the women of *Poetica Vaginal* are literally reduced to the action of their vaginal muscles.

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[27] Ultimately, it was this aspect of the project which proved its undoing. The radio transmitter which Davis used was owned by MIT but contracted to the United States Air Force. When they were alerted to the precise nature of the project, they shut Davis and his team down. See *Heaven and Earth and Joe Davis.*

[28] The reference to 'a line' is from the Walker interview. He expresses similar sentiments in *Heaven and Earth and Joe Davis* as well as in his own writing on the project: see Davis.

[29] Walker.

[30] Walker.

In the context of space culture, given that this culture exists around a field which has historically systemically excluded women as discussed in Chapter One, this reduction is no surprise. While there is little space for women in the field of human spaceflight, the minimising of women in this example from space art is aligned with space culture as a whole, just as Casper and Moore and Penley have identified. However, space art itself is a broad field, and Davis's is not the only standpoint. Aleksandra Mir is a space artist whose work approaches the subject of women's representation in space from a very different perspective and is illustrative of how artistic practice can be used to find new ways for women and other underrepresented groups to access space culture.

Aleksandra Mir[31], *The First Woman on the Moon*

Aleksandra Mir's *First Woman on the Moon* recalls the source of the title of this thesis – the Playboy Playmates of *Apollo 12*, who I argued in my introduction could be considered the actual first women on the moon, if only symbolically.[32] Indeed, symbolic or not, they may be the only women ever to reach the moon – the increase in women's participation in NASA notwithstanding, only men have ever set foot on the lunar surface. In 1999, Mir was commissioned by the non-profit Casco Projects to develop a public art installation using the space of a Dutch beach, a project through which Mir decided explore themes of contested public space by using the iconography of outer space.[33] The result explicitly explores the role of women in space culture: this project, and Mir herself, are both *The First Woman on the Moon*.

Mir describes the *First Woman on the Moon* project in terms of transformation, symbolism, and legacy. Her website states:

> 28 August 1999. The day when heavy machinery and manpower transformed a Dutch beach into a lunar landscape of hills and craters. At

[31] Mir's surname and its ostensible relation to the former Russian space station of the same name is, to the best of my knowledge, purely coincidental. Lars Bang Larsen, writing for the art magazine *Frieze*, explicitly claims that 'no pun about the space station' is intended in Mir's *First Woman on the Moon*. Lars Bang Larsen, 'Aleksandra Mir', *Frieze*, January-February 2000 <http://www.frieze.com/issue/review/aleksandra_mir1/> [accessed 10 January 2015].

[32] See pp. 1-2.

[33] Aleksandra Mir, 'The First Woman on the Moon', <http://aleksandramir.info/projects/first-woman-on-the-moon/> [accessed 21 March 2014].

> sunset the labor stopped, and a live drumbeat announced the ceremony of a woman, gracing this imaginary moon with an American flag. The same evening, while the party still went on, the landscape was flattened out again, leaving no physical trace of the event behind - save the memories and a story to tell future generations.[34]

As she also writes, the project was conceived both 'to celebrate the 30th anniversary of the original' moon landing – which she visually references through the use of the American flag – and to 'effectively…beat JFK to his words and put a woman on the moon "…before the end of the millennium"'.[35] 'The implication,' of Mir's project, she writes, 'is that if a woman is to land on the moon, she simply has to build it for herself'.[36]

This idea, that a moon that could be reached by a woman would need to be created by her, directly critiques the male dominance of space exploration. Further, by staging the project as a public event, Mir addresses the exclusivity of space exploration. Creating an extra-terrestrial space on a public beach allows access for many to a space historically reserved for the few. Characterising the public portion of the project as a 'party' shows the explicit good humour underlying this project – in contrast to the implicit humour of *Poetica Vaginal*, which Davis conceals behind technical language. The populist aspect of Mir's project is reinforced by a simultaneous project which was improvised on the day of *The First Woman on the Moon*, and this offers additional insight into Mir's use of space culture as a source of artistic inspiration.

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[34] Mir, 'First'.
[35] Mir here references U.S. President John F. Kennedy's pledge, in 1962, that NASA would be 'putting a man on the moon' before the end of the decade. See John F. Kennedy, 'Moon Speech at Rice Stadium', 12 September 1962 <http://er.jsc.nasa.gov/seh/ricetalk.htm> [accessed 11 January 2015].
[36] Mir, 'First'.

Museum of Lunar Surface Findings

In tandem with *First Woman on the Moon*, Mir created an additional project called *Museum of Lunar Surface Findings*, which consisted of all of the debris collected from the beach in the process of reforming the sand into a lunar landscape.[37] Mir writes:

> During the process of digging up the beach for *First Woman on the Moon* tons of garbage and broken glass were revealed in the sand, causing a great hazard for all the kids frolicking on the moon with us. The objects were spontaneously collected and instantly displayed, making for the impromptu Museum of Lunar Surface Findings to which the public contributed all day and which I loosely organized according to their shapes , color and material. Rope, shoes, plastics, food cans from near and afar reveal the way debris travels long-distance over the oceans, and that wherever people go, nature does not remain un-spoilt for long.[38]

Here, Mir addresses two key points in this passage which I wish to analyse. The emphasis on the children is one: the other, the impact of humanity on natural environments.

That the space of the project is accessible to frolicking children is important to *First Woman on the Moon*, and it is this that gives rise to the related *Museum* project. Making the Moon into a space on which children can play is an extreme contrast to the difficulty and exclusivity involved in reaching the actual moon. In this way, Mir is making the Moon not only into a women's space, but a human space in a broader sense; a contrast to the 'giant leap for mankind' so widely associated with lunar exploration.[39] In addition, in referencing the originating project *First Woman on the Moon* in the description of *Museum of Lunar Surface Findings,* Mir further reinforces the populist, widely accessible ideal behind the projects. 'The

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[37] Aleksandra Mir, 'Museum of Lunar Surface Findings' <http://www.aleksandramir.info/projects/museum-of-lunar-surface-findings/> [accessed 21 March 2014].

[38] Mir, 'Museum'.

[39] For clips of and commentary on this famous Neil Armstrong quote, see NASA, 'One Small Step', <https://www.hq.nasa.gov/alsj/a11/a11.step.html> [accessed 11 November 2015].

work,' she writes, 'can spontaneously be re-created by anyone, on any beach, anywhere, at anytime *[sic]*'.[40] Mir's Moon is everyone's Moon.

Museum of Lunar Surface Findings also raises issues of human impact on natural landscapes, whether a beach or a celestial body. The *Museum* is a display of the materiality of this – the beach was made dangerous, Mir explains, because of all the detritus of past humans who had visited it, left behind in the sand. In addition however, both projects illustrate the cultural aspects of human impacts on spaces, including extra-terrestrial was. In *First Woman on the Moon*, Mir demonstrates how an extra-terrestrial body is made into a space of human habitation, but with specific cultural meanings; her body, occupying her Moon, contrasts with all the (male) bodies who have walked on the real Moon. By blurring the boundary between terrestrial space and the extra-terrestrial, Mir asks the viewer to consider explicitly the concept of space culture. If she can create a Moon on a beach and imbue it with all the same meanings we associate with the Moon in the sky, this suggests that those meanings are produced through similar cultural processes.

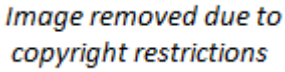

Figure 2.4: One of the vehicles used in the creation of the lunar landscape.[41]

[40] Mir, 'Museum'.

From Earth to Moon

In the video created from the *First Woman on the Moon* project, Mir uses structural and artistic technique to reinforce the conflation of terrestrial and extra-terrestrial space.[42] The video sets slow-motion footage of a loader dumping beach sand to an audio recording of a rocket launch, underscoring the relationship between these two ways of reaching the moon. Without access to the rockets that could take a woman to the actual moon, Mir makes a moon for herself.[43] A rocket moves bodies from Earth to the Moon; a bulldozer moves earth to make a 'Moon' for bodies to inhabit.

Aleksandra Mir's *First Woman on the Moon* explicitly raises issues of spatial ownership. This project is also explicitly conflating Earth-space with extra-terrestrial space, and asking questions about how spaces are made human spaces.[44] Mir also asks what cultural meanings go along with that process. By proclaiming herself the first woman on the moon, Mir is confronting the construction of the moon as a male space. She writes additionally of how other participants in the day used their own subjectivities to similar ends. 'One person,' she writes, 'declares himself "The First Black Man on the Moon", another, "The First German"'.[45] Implicit in the claim of being 'the first' is that there will be more to follow. However, the write-up of the project on Mir's website concludes with a pointed note about the continued absence of women from lunar exploration. 'Her title' it says, 'as First Woman on the Moon, in fact and fiction, remains uncontested.' In the time since *First Woman on the Moon* was constructed in 1999, of course, no one of any gender has reached the lunar surface. Nonetheless, it remains symbolically important that this has allowed the male dominance (and the white dominance, and the American dominance, and so forth) of the moon to continue, and Mir alludes to this in this conclusion. It remains true that if a woman wants to reach the Moon, she will need to

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[41] Mir, 'First'.
[42] Mir, 'First'.
[43] Casper and Moore also argue that the male dominance of the space industry is symbolically represented in the phallic nature of rocketry itself – see Casper and Moore, p. 316.
[44] As well as national spaces, something which Mir explicitly references by planting the American flag on the Dutch beach. See Mir, 'First'.
[45] Mir, 'First'.

construct her own Moon. In Chapter 8 I will return to space art in my discussion of visual artist Frank Pietronigro. Like Mir's work, Pietronigro's creations also sometimes reference intersections of space, gender, and class, as Mir does with her discussion of replicability and access. In Pietronigro's work however, sexual identity often takes centre stage.

The spatial issues raised by Mir's project are integral to my analysis of space culture. Mir's project displays both the relationship between the terrestrial and the extra-terrestrial, and the influence of human culture on extra-terrestrial spaces. In Chapter Three, I will follow a similar logic to explore how the discipline of feminist geography can usefully inform analysis of extra-terrestrial spatiality. Like Mir's *Museum of Lunar Surface Findings*, I will explore how artefacts of human meaning appear throughout space culture. In Chapter Three, I will argue that the traditional male-dominated ideologies that have had a great impact on spaceflight, its history, and its contemporary cultural context are deeply rooted in questions of spatiality.

Chapter Three: Taking Feminist Geography into Orbit

In Chapters One and Two I discussed examples of, and responses to, the male norm of astronautics identified in the work of Constance Penley and Monica Casper and Lisa Jean Moore. In this chapter, I shift my focus to a broader discipline which, I will argue, greatly influences the discourse of space culture: spatial theory. I am guided in part by the issues raised by Aleksandra Mir's *First Woman on the Moon,* discussed in the last chapter. Mir's work raises questions about the spatiality of outer space, and especially how that spatiality is associated with gender. I will argue in this chapter that the male norms of the space industry, identified by Penley and Casper and Moore, are deeply related to the broader male norms of spatial subjectivity.

As I argue, the positioning of the astronaut as a scientific and exploratory figure is integrally linked to the positioning of this figure's perspective, both literal and metaphorical. Much of the discourse of space culture is centred on the experiences of astronauts looking from space at Earth, an experience which evokes issues of the geographic and cartographic subject. For this reason, I contend that analysis of spatial subjectivity is a productive contribution to analysis of the influence of gender on space culture. To analyse this, I will employ work from spatial theory on observation, perspective, and the geographic and cartographic subject. Gillian Rose's *Feminism and Geography: The Limits of Geographical Knowledge* forms an important part of my analysis, as does the work of Kathleen M. Kirby.[1]

Theoretical Grounding

Rose's *Feminism and Geography* is a detailed account of the influence of gendered ideology in the discipline of geography. As such, Rose's work seeks not the geographic distribution of women, nor even women's use of space, but the underlying structural limitations which have

[1] Gillian Rose, *Feminism and Geography* (Cambridge: Polity Press, 1993); Kathleen M. Kirby, 'Re:Mapping Subjectivity: Cartographic Vision and the Limits of Politics', in *Bodyspace*, ed. by Nancy Duncan (London: Routledge, 1996) pp. 45-55; and Kirby, *Indifferent Boundaries: Spatial Concepts of Human Subjectivity* (New York: The Guildford Press, 1996).

historically led to the privileging of a male subject in spatial theory.[2] Rose explains that her focus is not on 'the geography of gender, but […] the gender of geography', a concept to which I will pay more critical attention later in this chapter.[3] I argue that Rose's work has important implications for the analysis of gendered structures in work on outer space.

Kirby's work on the cartographic subject similarly illuminates the underlying gendered structure of the field itself. Her 'Re:Mapping Subjectivity: Cartographic Vision and the Limits of Politics' expands upon broader scholarship on the hegemonic construction of the Cartesian subject to examine the spatial aspect of the development of this subject. This development, Kirby argues, 'was – and continues to be – inextricably tied to a specific concept of space and the technologies invented for dealing with that space'.[4] Kirby explores this concept through analysis of Enlightenment perspectives on the bounded self – the border between inner, bodily space, and the spaces outside.[5] Kirby explores the construction of this border through analysis of the discourse of cartography and the concept of 'getting lost'. Kirby argues that 'getting lost' is a violation of the strict boundary between bodily interior and exterior for the cartographic subject, and further, this has important gendered implications which construct this subjectivity as a masculine one.[6]

Both Rose and Kirby pay attention to questions of perspective in their studies of spatial theory, and it is these questions to which I dedicate this chapter. As I will show, the perspective of an astronaut looking back at Earth is an important construction within human spaceflight.[7] This construction is part of what leads me to analyse these texts from the

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[2] This also aligns with Penley's analysis of the necessity of radical feminist analysis, as I covered in Chapter One. See Constance Penley, *NASA/TREK: Popular Science and Sex in America* (London: Verso, 1997), p. 40, as well as my discussion in Chapter One, especially pp. 31-32.

[3] Rose, p. 5. This concept also informs my approach in Part Two, as I will explain in the Part Two Introduction.

[4] Kirby, 'Re: Mapping', p. 45.

[5] Rose, as I will additionally discuss, also examines this inner/outer dichotomy further in terms of gendered spatialities. See Rose, pp. 31-33.

[6] I will return to this violation in Chapter Four, for further investigation of how this functions and how it may be a useful framework to further develop feminist work in spatial theory.

[7] Importantly, the emphasis here is on *human* spaceflight. As Donna Haraway discusses in her 2006 lecture at The Open University, this perspective is something which is specifically *not* granted to non-human space travellers. See Haraway, Donna, 'When Species Meet', *The Pavis Lecture* (Milton Keynes: Open University, 11 October 2006).

perspective of earthbound spatial theory. I will further argue, using work by David Harvey on the origins of modern mapping, that the perspective that an astronaut possesses – that of an observer fully separated from the Earth itself – is not a new concept in spatial theory.[8] Harvey argues that Western spatial discourse has privileged extra-terrestrial perspective since long before humans travelled into space. He describes the importance of this exact perspective in the development of Renaissance mapping, and its roots in Ptolemaic thought:

> […] in designing the grid in which to locate places, Ptolemy had imagined how the globe as a whole would look to a human eye looking at it from outside. A number of implications then follow. The first is an ability to see the globe as a knowable totality. […] A second implication is that […] it seemed as if space, though infinite, was conquerable and containable for purposes of human occupancy and action.[9]

Harvey argues that the very foundations of modern mapping can be traced to the concept that the ideal observer is one entirely separate from Earth, so that he can see and know every part of the planet. I refer to this figure as *he* knowingly, for as I will further explore using the work of Rose and Kirby, this construction of a detached observer is associated with masculine subjectivity.

In this chapter I analyse cultural artefacts which span a fairly broad cross-section of space culture, including narratives of astronaut experience, philosophical work on astronautic vision, and some visual corporate branding from the commercial space company Virgin Galactic. I use my chosen theoretical texts to illustrate how gender, spatiality, and perspective inform the discourse around spaceflight at multiple sites within space culture. I argue that ultimately, the perspective occupied by astronauts is one that is so key to development of Western spatial theory that this perspective is not extricable from the historical male dominance of all of Western spatial thought. This perspective, however, is also unstable, and aspects of astronaut perspective can be used to productively expose this instability. This

[8] David Harvey, The Condition of Postmodernity (Oxford: Blackwell, 1990).
[9] Harvey, p. 246.

exposure is one of my goals in this thesis, and I will further explore how spatial theory can be informed by issues of astronaut subjectivity in Chapter Four.

Material for Analysis

As I will show, much of space discourse assumes that viewing the earth from outside it is a new phenomenon, unique to the field of spaceflight. Frank White's book *The Overview Effect: Space Exploration and Human Evolution* is a prominent investigation of the importance ascribed to astronautic vision in contemporary culture, although, as I will argue, White's perspective is uncritical of this importance.[10] White suggests that the experience of seeing Earth from a truly outside perspective is a new stage in human cultural evolution, and that this has a far-reaching, positive impact upon the development of human consciousness. Further, he claims that a perspective of Earth from space will lead people to 'take for granted philosophical insights that have taken those on Earth thousands of years to formulate', because their extra-terrestrial perspective will so deeply impact upon their 'mental processes and views of life'.[11] However, as I will show, the idealisation of an outside perspective on the Earth is not unique to the discourse of spaceflight. Further, I argue that its deep historical roots in the development of spatial subjectivity suggest that it is not, as White argues, inherently progressive. Toward this point, I will argue that the historical construction of extra-terrestrial perspective in geography and cartography relates to the gendered construction of the spatial subject, as identified by Rose and Kirby.

As a further example of the effects of the discourse of astronaut perspective, I also analyse a creative image from the space industry: the image of a fictional woman astronaut, 'Galactic Girl', part of the visual branding of Virgin Galactic's space tourism programme. In analysing this image, I will engage further with Rose's work on gendered aspects of subjectivity, specifically within the context of astronautics. As I discussed in the Introduction, the incorporation of visual artefacts is an important aspect of my method of analysis, and

[10] Frank White, *The Overview Effect: Space Exploration and Human Evolution* (Boston: Houghton Mifflin, 1987).
[11] White, pp. 4, 3.

Galactic Girl is a particularly interesting example in that it is situated firmly within the space industry. I discussed in Chapter Two how the lines between art and spaceflight can be unclear, and with Galactic Girl I maintain that as part of the design of spacecraft, this is an example of both how these lines can be blurred and how such artefacts can be an important part of a critical analysis of the broader culture of spaceflight.

While I argue that aspects of astronaut experience problematize ideas of subjectivity and gaze for all astronauts (a topic to which I will return in Chapter Four), I further argue that the figure of the female astronaut represents a particular challenge to idealised subjectivity. In analysing the image of Galactic Girl, I aim to demonstrate how symbolism of women in space illustrates the impact of the 'male gaze' in the discourse of astronaut subjectivity.[12] I argue that Rose's discussion of a spatialised construction of masculine observer and feminine observee is represented in the discourse and visual culture of the space industry, particularly where gender is foregrounded. In exploring this figure I will additionally draw upon Debra Benita Shaw's analysis of 'The Space Suit as Cultural Icon'.[13] Using Shaw's work on space suits and the surrounding culture of spaceflight, I argue that the contrasts between real images of astronauts and the idealised image of Galactic Girl highlight the problematic nature of women in the popular discourse of spaceflight. I further argue that functional aspects of astronaut dress, particularly the space helmet, are symbolic of an unmarked, non-corporeal subject, and thus an idealised possessor of masculine gaze as identified by Rose.

In this way I suggest that the design of Galactic Girl speaks to social understandings of women in space in much the same way as do experiences and portrayals of actual women astronauts. By expanding upon my earlier chapters' focus on actual women astronauts with this fictional one, I aim to further align my project with Penley's *NASA/TREK*, through her call for an integrated perspective on relationships between actual space programmes and science

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[12] On this subject, as I will discuss, Rose draws upon the work of feminist film critic Laura Mulvey, whose 'Visual Pleasure and Narrative Cinema' Rose brings into a discussion of geographic masculinity. See Laura Mulvey, 'Visual Pleasure in Narrative Cinema', in *Visual and Other Pleasures* (London: Macmillan, 1989) pp. 14-26.

[13] See Debra Benita Shaw, 'Bodies Out of This World: The Space Suit as Cultural Icon', *Science as Culture* 13:1 (2004), 123-144.

fiction as a 'blended cultural text'.[14] It is within this framework that I hope to position my own argument toward uncovering gendered aspects of popular understandings of space exploration, through many sites where these understandings exert their influence.

Throughout this, I contend that the discourse of outer space is inextricably linked to the discourse of all space. As I will discuss further in Chapter Four, analysing the ways we evoke spatiality in our discussions of the extra-terrestrial, I argue here that the broader discourse of gendered spatiality can be uniquely destabilised by spaceflight. In this way, this chapter and the one that follows represent a shift into a more theoretical and less textual analysis. In this I am guided by the work of scholars in geography and spatial theory, as I will shortly explain.

Feminism and Spatial Theory

The concept that Rose employs of the 'master subject' of geographical knowledge is an important basis for my theoretical approach. Donna Haraway elucidates the meaning of this figure in her 'Situated Knowledges', in which Haraway describes it as possessing a 'cyclopian, self-satiated eye'.[15] As Haraway argues, the construction of the 'master subject' as the possessor of exhaustive and objective scientific knowledge is limited both in that it is imbued with a particular race (white) and gender (male) and also in that the goal of exhaustive objectivity is not achievable.[16] Haraway claims that 'only partial perspective promises objective vision'.[17] In 'Situated Knowledges', Haraway calls for a feminist reclamation of the concepts of vision and perspective. Haraway argues that such reclamation can reincorporate the corporeality and the diversity of experience from which the 'master subject' of traditional scientific perspective attempts to distance itself. As I will explore later in this chapter, the perspective of spaceflight provides both examples of the construction of the 'master subject',

[14] Penley, p. 4.
[15] Donna Haraway, 'Situated Knowledges: The Science Question in Feminism and the Privilege of Partial Perspective', in *Simians, Cyborgs and Women* (London: Free Association Books, 1991), pp. 183-202 (p. 192).
[16] Haraway, 'Situated Knowledges', pp. 188, 190.
[17] Haraway, 'Situated Knowledges, p. 190.

and also opportunities to destabilise this concept, which I argue can contribute to the Haraway's project of 'Situated Knowledges'.

Rose's *Feminism and Geography* further elaborates on the way the 'master subject' figure has impacted upon the development of geography and the geographic subject. Toward this end, in *Feminism and Geography* Rose makes a clear and succinct statement of her approach as one which concerns the gender *of* geography, rather than the subject of gender within traditional geographic discourse.[18] In other words, Rose is interested in analysing the discipline itself for gendered attributes, not using the discipline as its stands to discuss gender issues. This is an important distinction not only for this chapter, but also for all that follows it, as I will discuss in my introduction to Part Two. For the purposes of this chapter however, it is particularly important because it relates to Rose's further discussion of the 'master subject' of the geographic discipline.

Rose and the Gender *of* Geography

In applying the concept of the 'master subject' to geography specifically, Rose illuminates how the field itself has insidiously privileged one particular perspective at the expense of all others. The key problem with this which Rose identifies is the construction of all perspectives, save the privileged 'master subject', as primarily characterised by their difference from the norm. Rose defines this subject in relation to geography as 'a white, bourgeois, heterosexual man', who, in the development of the discipline, sought primarily to 'render the world amenable to the operation of masculinist reason'.[19]

The ideal of this geographic 'masculinist reason' is a way of knowing, and a knowledge, which can be generally applied. Rose writes: 'Geographers desire knowledge of the whole world, but, more importantly for their claims to power through knowledge, they also desire a whole knowledge of the world.'[20] This 'knowledge of the whole world' has clear implications for spaceflight; for, as I will discuss further in this chapter, what better way to see the whole

[18] Rose, p. 4.
[19] Rose, pp. 6-7. As I have mentioned, see also Haraway, 'Situated Knowledges', p. 192.
[20] Rose, p. 7.

Earth than to see it from outer space? The goal of 'whole knowledge of the world' reveals the privileging of one, unmarked perspective; through the construction of the 'master subject', this can only ever be a masculine perspective, and a perspective which intrinsically denies the value of any other.[21] I argue that both of these aspects of what Rose terms 'masculinist reason' have important implications for analyses of the discourse of spaceflight.

This also has a clear relationship to Harvey's claim about 'the globe as a knowable totality'. Taking both Harvey and Rose into account along with Haraway, it is clear that the subjectivity which seeks what Rose calls 'knowledge of the whole world' and 'whole knowledge of the world' is historically coded as a masculine subject. That the perspective granted to an extra-terrestrial observer is discussed in such similar ways as the traditional construction of geographic subjectivity contributes, I argue, to the male dominance of human spaceflight.

In addition, in Rose's work on the history of the masculinist geographic subject, she argues that 'denial of…corporeality' is central to the subject's self-definition. As she further argues, this denied corporeality is applied to the construction of the Other, including women, and the denial functions to reinforce the masculinity of this subject.[22] I will return to this point in this chapter's final section when I discuss the figure of Galactic Girl and Virgin Galactic's visual branding. In addition to this, I find it productive to consider this aspect of Rose's argument in relationship to the work of Kathleen M. Kirby on the disciplinary origins of cartography. Kirby's work expands upon my consideration of Rose and Harvey's arguments about space and perspective, particularly through Kirby's work on the primacy of borders in cartographic vision.

Kirby on Cartographic Subjectivity

The relationship between cartographic borders and bodily-spatial borders is a key focus of Kirby's work on exploration and mapping discourse. In 'Re:Mapping Subjectivity: Cartographic vision and the limits of politics', Kirby argues that 'cartography selectively emphasizes

[21] Rose, pp. 6-7.
[22] Rose, pp. 31-3.

boundaries over sites': both the boundaries between delineated spaces and the boundaries between body and space.[23] Cartography, as Kirby illustrates, intrinsically privileges the boundaries between spaces over the spaces themselves, as this is how spaces become representations on a map. Kirby further argues that carography's emphasis on boundaries/borders extends beyond the material constraints of mapping. The emphasis on boundaries also applies to the construction of what Kirby identifies as the Enlightenment or Cartesian subject, the subject of the early exploratory ventures that gave Western spatial discourse its origins. Kirby explains:

> The similarity of mapped space and the mapping subject stems from the way the boundary between them is patterned as a constant barricade enforcing the difference between the two sites, preventing admixture and the diffusion of either entity. Cartography institutes a particular kind of boundary between the subject and space, but is also itself a site of interface, mediating the relationship between space and the subject and constructing each in its own particularly ossified way.[24]

In cartography, Kirby argues, the exploratory subject's body is defined by its remaining bounded from exterior space. This ultimate construction of boundedness is threatened by what is traditionally understood as the feminine attribute of bodily permeability.[25] This strictly bordered subjectivity is additionally threatened by the risk of the subject getting lost within the landscape. In this way, Kirby argues, cartography as a way for the subject to not be lost relies on two different kinds of borders – the borders drawn on a map, and the borders separating the body of the subject from its exterior.[26]

In Kirby's discussion of the Western subject 'being lost', she explains that it is necessary for the Western explorer to conceive of himself as separate from the landscape, in a

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[23] Kirby, 'Re:Mapping', p. 46.
[24] Kirby, 'Re:Mapping', p. 47.
[25] Kirby, 'Re:Mapping', p. 46. See also Rose, pp. 31-33. I will return to this aspect of Rose's argument in Chapter Four.
[26] Kirby, 'Re:Mapping', p. 47.

'position of mastery' above and outside of the territory itself.[27] This, Kirby argues, is one of the primary functions of cartography:

> ...to ensure that the relationship between knower and known remains unidirectional. The mapper should be able to 'master' his environment, occupy a secure and superior position in relation to it, without it affecting him in return. This stance of superiority crumbles when the explorers' cartographic aptitude deteriorates. To actually be *in* the surroundings, incapable of separating one's self from them in a larger objective representation, is to be lost.[28]

This has a particularly masculine association, illustrated by considering again Rose's argument about the 'master subject' and this subjectivity's need to deny its own corporeality. Without a pre-existing map, Kirby argues, the Western exploratory subject in a foreign land is always lost, because his perception of space requires that he be safely bounded from it. A female subject, Kirby goes on to argue, cannot occupy this subjectivity, because of the associations of femininity not only with the body but with a body that is not able to divest itself of spatial awareness.[29]

The boundary between self and space is of paramount importance to this subject because, Kirby argues, it is the only way for the Western explorer to '"master" his environment…without it affecting him in return.'[30] As Kirby explores, when the subject-space/interior-exterior boundaries are threatened, the integrity of this 'master subject' is dangerously undermined, and with it, the ability to act as an appropriate cartographic observer.

Drawing upon Rose's and Kirby's work on perspective, boundaries, and the subject, I will argue that the astronaut's perspective both exemplifies and problematizes the Western ideal of empirical subjectivity. While the astronaut literally personifies the ideal of a

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[27] Kirby, 'Re:Mapping', p. 48.
[28] Kirby, 'Re:Mapping', p. 48.
[29] Kirby, 'Re:Mapping', pp. 52-54; I will additionally return to this concept in Chapter Eight.
[30] Kirby, 'Re:Mapping', p. 48.

perspective separate from earth, the traditional associations of this perspective with the limited 'master subject' figure undermine claims that the perspective of astronauts is unique and inherently progressive.[31] As I will show, claims of the progressive nature of this perspective are common in the discourse of space culture, and this has important implications for analysing gender issues within the field.

Spaceflight and Perspective: *The Overview Effect*

One key aspect of spaceflight experience that receives a great deal of attention in the literature is the issue of perspective itself. Travelling to space grants an astronaut a particular perspective on Earth and its place in the cosmos. It is often argued, notably by many returned astronauts and, comprehensively, by Frank White in *The Overview Effect* that looking in on Earth from the outside creates a new, progressive, and inherently egalitarian perspective on humanity.[32] It is this concept of astronautic vision and its various manifestations to which I will devote the remainder of this chapter, beginning with the work of Frank White.

White argues that the experience of seeing Earth from a truly outside perspective has a far-reaching, positive impact upon the development of human consciousness. Specifically, White's claims centre on an idea of extra-terrestrial perspective allowing for a more egalitarian view of humanity through a realisation of our membership in a planetary whole, and that this realisation comes specifically from the ability to see the planet from outside. White maintains that this phenomenon of viewing the Earth from beyond it is unique to the experience of flight; in a limited sense, he argues, this is achievable from an airplane, but to truly experience it requires escaping the Earth's atmosphere.[33] The crux of White's argument is the idea that by

[31] In discussing perspective in this chapter, I do not refer to another Haraway figure, the 'modest witness'. Haraway's focus on the biological sciences in the outlining of the 'modest witness' does not relate as directly to my argument about the spatiality of extra-terrestrial perspective as do the frameworks of Rose and Kirby. For this reason, I have chosen to limit my focus more specifically to the geographic and cartographic approaches of Rose and Kirby. See Donna Haraway, *Modest_Witness@Second_Millennium.FemaleMan©_Meets_OncoMouse™* (London: Routledge, 1997).
[32] In addition to advancing White's own argument to this end, *The Overview Effect* also contains interviews with and references to many astronauts whose experiences support White's philosophical treatise.
[33] White, p. 4.

physically separating the observer from the Earth, the observation becomes inherently more objective.

In what follows, I take issue with White's assertion on two counts: first, I disagree with White's claim that this perspective is philosophically unique to the aerospace field; second, I find it difficult to accept White's contention that this perspective necessarily, or even plausibly, frees the observer from the constraints of cultural bias. These two points of contention are related. I will address the second point in more detail in my section on White's work. Regarding the first point, my critique is informed by David Harvey's assessment of the philosophical origins of Renaissance mapping techniques. While spaceflight is a recent human experience, Harvey's work suggests that the ideal of extra-terrestrial perspective is in fact much older. Further, as I will argue, this has important consequences for the cultural construction of astronautic vision.

'the globe as a knowable totality': David Harvey and *The Overview Effect*

In *The Condition of Postmodernity*, Harvey argues that the basis of the Western construction of the scientific observer is, ultimately, an extra-terrestrial perspective, as I discussed in the introduction to this chapter. Following from this, I argue that not only is the construction of astronautic vision as particularly objective not new, but is in fact a continuation of the same discourse of scientific observation that came to prominence in the Renaissance. Further, this carries with it the weight of traditional ideas of a masculine subject associated with Cartesian scientific ideals that Kirby's work identifies. The continuance of this discourse thus has important implications for contemporary discussions of gender in space programmes. Harvey's analysis demonstrates that what White has termed the 'overview effect', though perhaps individually realised in spaceflight, is ultimately one of the underlying concepts of Western spatial discourse. What White views as a unique perspective does not solely belong to the field of space travel, at least symbolically. While it may only be a recent phenomenon that humans

actually can see the globe from outside, I argue that they are taking the symbolic weight of a long history of thought with them.[34]

The concept of viewing the Earth from beyond it is one that is deeply intertwined with ideas of a bounded subject, able to perceive the Earth in its entirety because the subject itself can remain outside and separate from that which is observed. Throughout the history of modern thought this subject, coded as impermeable and disembodied, has invariably been coded as male. I argue that astronautic perspective is constructed in the same essential ways that the Western ideal of the scientific subject has been constructed since the Enlightenment, with all of the essential assumptions about the observer that this entails. Rather than intrinsically opening up new avenues of human knowledge, as White has argued, I argue that the literal realization of this extra-terrestrial perspective has merely allowed the traditional discourse of spatiality to be carried beyond our atmosphere.

On this point, my perspective has been further informed by Rose's *Feminism and Geography*, particularly in so far as Rose addresses the gendered aspects of the construction of Enlightenment cartographic observation. The geo-/cartographic observer/subject Rose addresses here is the same figure Harvey identifies as an essentially extra-terrestrial observer, and this has important implications for my interpretation of Rose's argument about the claims to objectivity in geographic perspective. Rose identifies the problem of the marked and unmarked observer in the development of this spatial perspective, in which the unmarked is very particularly a male observer. Aside from the one accepted perspective, Rose argues, all other perspectives are defined by their difference from the norm. As Harvey illustrates, the constructed observer in Renaissance mapping is one who looks at Earth from outside. This is an almost literal manifestation of what Rose terms 'knowledge of the whole world' and 'whole knowledge of the world'.

Some five centuries later, this perspective *can* be literally realised in the viewpoint of the astronaut. Yet despite the many social advances that have come in the centuries since the

[34] Haraway discusses several dimensions of the cultural influences on this external, extra-terrestrial perspective, in 'The Promises of Monsters'; see pp. 92-97.

development of these geographic principles, as I will discuss the discourse of spaceflight research and policy is still shaped by cultural assumptions about gender and the body, which are not borne out by objective reason. This forms part of my other criticism of White's theory; these assumptions, I argue, seriously contradict his claims that the 'overview effect' perspective offers an opportunity to shed the constraints of human culture.

Borders and Boundaries

The view of Earth from space is frequently discussed as a 'borderless' image of an Earth united, with no sovereign nations; in particular this forms a key point of White's analysis.[35] This kind of idealised view of an Earth without borders is clearly related to national identity, something with which White is particularly concerned. However, setting that aside, the idea of borders themselves is rooted in something deeper about our ideas of space.[36] The concept of bounded space applies not just to national borders, but to the border between inside and outside, between body and space. This is an important aspect of Kirby's analysis, but discussions of astronautic perspective also evoke and destabilise ideas of borders in important and somewhat complex ways. I will discuss what effect this has on bodily-spatial borders in more details in Chapter Four, however the relationship between those borders and national borders is an important question in and of itself.

The idea of a view from space as providing a borderless perspective on Earth is one of which White makes much, although he expresses this in ways that problematically reveal his own biases. On the subject of national borders and the view from space, White shares the thoughts of Apollo 9 astronaut Russell L. Schweickart:

> When you go around the Earth in an hour and a half, you begin to recognize that your identity is with that whole thing. That makes a change. You look

[35] See in particular White, p. 12, pp. 165-7.

[36] As I discussed in my introduction, I elide direct discussion of issues of national identity, vital though they are to discussions of space exploration, because this is regrettably beyond the scope of this project. See pp. 21-22.

> down there and you can't imagine how many borders and boundaries you cross, again and again and again, and you don't even see them.[37]

White also reports that Saudi Arabia's Prince Sultan Bin Salman al-Saud, whose journey on the Space Shuttle *Discovery* in 1985 coincided with the TWA 847 hostage crisis, reported: 'Looking at it from here, the troubles all over the world, and not just the Middle East, look very strange as you see the boundaries and border lines disappearing.'[38] The concept of a view of Earth from space lacking national borders is a common one, and is often invoked in the context of earthly conflict. However at least one astronaut has provided a substantial refutation of this idea. In her autobiography, Helen Sharman writes:

> I have heard it said that national borders cannot be seen from space, but this is not strictly true. Some parts of the border between Canada and the USA are clearly marked, for instance, because of the different agricultural methods each country uses and because the border runs in a straight line. France looks different from the other European countries, because of the way their fields are laid out.[39]

As Sharman suggests, human influence on Earth is not something that space travellers can fully escape, far removed though their perspective may be. The differences between nations can still be identified, at least sometimes.

The nation, meanwhile, is exactly what White wishes to do away with entirely under his 'overview effect'-influenced worldview. White discusses the idea of the nation as a sub-system of humanity, and argues that goals which serve the larger systems (like humanity as a whole) are 'higher purposes' than sub-systems (like the nation), precisely because these larger systems offer a more universal perspective.[40] Following Haraway's argument in 'Situated Knowledges', I would dispute White's assumption that a universal perspective can ever truly

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[37] Russell L. Schweickart, quoted in White, pp. 11-12.
[38] Sultan Bin Salman al-Saud, quoted in White, pp. 47-48.
[39] Helen Sharman, *Seize the Moment* (London: Victor Gollancz, 1993), p. 134.
[40] White, p. 137.

be realised; further, I will suggest that his own argument for such a perspective provides evidence that it is untenable.

White specifically refers to the Middle East as a site for the effects of the 'overview effect' on a desire for planetary unity at the expense of nationalistic strife and border disputes, writing that it 'is no accident that many astronauts cite the Middle East, seen from orbit, as the area that gave them the greatest feelings of sadness and the strongest wish for planetary unity'.[41] Any idea of an unbiased approach to issues of national identity, such as those invoked by White's vague reference to instability in the Middle East, is undermined by the sentence immediately following this one. White writes: 'Many conflicts arise because some people, like the Palestinians, have yet to pass through the nation-state phase, and they will have to be accommodated one way or another before it will be possible to move on to a planetary culture.'[42] In representing his own views on the Israel-Palestine conflict as part of the supposedly exhaustive perspective afforded by the 'overview effect', White betrays the futility of this venture. His appeal to a greater good borne out of an extra-terrestrial perspective is already undermined by the problematically specific origins of this perspective. In addition, by revealing his own bias in a complex human conflict, he exposes the weakness of any claims to ultimate unbiased perspective, whether from orbit or not.

Galactic Girl and Virgin's Vision

I depart here from the stories of actual astronauts to discuss one high-profile image of an astronaut who, although she is not strictly real, nonetheless travels into actual outer space: Galactic Girl, the imaginary woman astronaut with which Virgin Galactic spacecraft are emblazoned. As I will show, the design of Virgin Galactic's nose art raises issues of astronaut perspective, and especially of the gendered attributes of extra-terrestrial vision.

There is a great deal more symbolic depth to the design of the 'Mothership' and Galactic Girl, which I will discuss in more detail in Chapter Seven. The name of the 'Mothership', *VMS Eve*, invokes the mythical mother of humanity, and it is also explicitly

[41] White, p. 165.
[42] White, p. 165.

named for Richard Branson's own mother Evette. Galactic Girl's design is also based upon photos of Evette Branson in her youth.[43] Penley and Casper and Moore, as I have mentioned and as I will further discuss in my next chapter, point to the overwhelming tendency within space science and applications to position women as reproducers and nurturers before all else, to which I would argue the discursive construction of Virgin Galactic endeavours is strongly linked.[44]

In the desert of New Mexico in 2008, Richard Branson's space tourism company Virgin Galactic unveiled two pioneering spacecraft: *VMS Eve*, a 'Mothership' launch vehicle, and the capsule *Eve* launches, *VSS Enterprise*. *Eve* and *Enterprise* are emblazoned with images of Galactic Girl, a reworking of the Alberto Vargas-inspired Scarlet Lady pin-up seen on Virgin Atlantic aircraft.[45] Galactic Girl trades the former's red locks for a blonde ponytail improbably flowing from a bubble helmet, and the Union Jack for a flag bearing Virgin Galactic's enormous blue eye insignia.[46] That massive eye is also painted across the undersides of both crafts, eerily substantiating the unique perspective afforded to the space traveller, and visibly invoking White's concept of the 'overview effect'.

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[43] Karl Vick, 'Mother Ship Unveiled for $200,000 Place in Space', *The Washington Post,* 29 July 2008, p. A02. I apply further critical attention to the relationship between motherhood and Galactic Girl's sexualised pin-up imagery in Chapter Seven – see p. 169.

[44] See in particular Monica J. Casper and Lisa Jean Moore, 'Inscribing Bodies, Inscribing the Future: Gender, Sex, and Reproduction in Outer Space', *Sociological Perspectives* 38:2 (1995), pp. 311-333, pp. 311-313.

[45] Jack Preston, 'Virgin Atlantic goes for gold', <http://www.virgin.com/travel/virgin-atlantic-goes-gold> [accessed 30 November 2015].

[46] That the Galactic eye is blue is indicative of the Anglo-Saxon presumptions of this transatlantic/Anglo-American, extra-terrestrial operation. However, it should be noted that the eye depicted is, perhaps unsurprisingly, Richard Branson's own eye, and as the design firm charged with some of Virgin Galactic branded materials explains, the eyes of additional Virgin Galactic passengers are added to the design of Virgin stationery after their flights. See GBH, 'Virgin Galactic' <http://gbh.london/projects/virgin-galactic/> [accessed 2 November 2015].

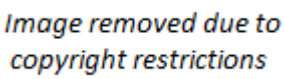

Figure 3.1: Galactic Girl[47]

Virgin Galactic's promotional materials are full of references to the spacefarer's vision, emphasising the size and placement of windows within the craft and highlighting quotations from astronauts about the experience of 'looking down on' the people of Earth.[48] Yet while the monstrous Virgin eyes and the humans within gaze back upon Earth, Galactic Girl herself arches up toward the heavens, her eyes closed. This, I contend, aligns Galactic Girl with the broader discourse of women in space that I have discussed in the preceding sections. Virgin's brand of space tourism is all about seeing, but their emblematic female astronaut does not possess her own perspective. She is there not to see, but to be seen.[49]

Galactic Girl, Gender, and Extra-Terrestrial Vision

Galactic Girl is emblematic not only of Virgin Galactic itself, but also of many of the traditional, gendered understandings of vision and perspective which I argue are deeply embedded within

[47] Source: Tom Wigley, <https://www.flickr.com/photos/amphalon/2215711757> [accessed 11 January 2013].
[48] Virgin Galactic, 'Virgin Galactic Booking Brochure', 2011 <http://www.virgingalactic.com/assets/downloads/Virgin_Galactic_Brochure.pdf> [accessed 12 August 2013].
[49] This relates to John Berger's account of the history of Western artistic representations of women in *Ways of Seeing*; John Berger, *Ways of Seeing* (London: Penguin, 1972), especially pp. 106-108 in which he discusses the lack of agency afforded to the women depicted, often nude, in the Western canon. Rose also references Berger, both in his discussion of nudity and his reading of the Gainsborough painting *Mr and Mrs Andrews,* which Rose specifically places in the context of geography. See Rose, pp. 91-99.

astronautic discourse. Rose, drawing from Laura Mulvey's foundational feminist theories of film and vision, argues that Western visual discourse implicitly positions woman as object, looked-at, and man as subject, looking in.[50] This has important implications for geography and cartography, because, as Rose argues, these disciplines strongly privilege visual perspective.[51]

As I have discussed, and as in spatial theory, one of the most frequent topics throughout writing on *outer* space is that of looking back on Earth. This discourse is strongly represented in the public relations material from Virgin Galactic, as well as in many broader discussions of astronautics. White's *The Overview Effect*, as I have mentioned, is one of the clearest examples of this. That Virgin Galactic's visual brand and promotional material greatly emphasise the visual aspect of space tourism aligns them with this broader aspect of space culture.[52] Importantly, both Virgin's branding and White's 'overview effect' concept focus entirely on the ability of the astronaut to *look*, even as Galactic Girl can only be *looked at*. Yet there is an aspect of Galactic Girl's design that should prevent this very phenomenon. Were Galactic Girl's helmet a real space helmet, it would be a primarily reflective surface. This has important implications for Galactic Girl which I discuss below, but I will first relate this to Debra Benita Shaw's argument about the cultural role of the space suit in containing, representing, and yet confusing, the definition of the subject.

Space Helmets and Vision

In 'Bodies Out of This World', Shaw discusses confusion among astronauts after photographs of them in their helmets are inaccurately identified in the media, something which, due to the reflective nature of the space helmet's outer coating, is a very common mistake. Shaw argues that the effect of this is to position the space suit itself as a symbol for a particular kind of heroic subjectivity, while simultaneously obscuring the individual astronauts themselves. Shaw writes:

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[50] See Rose, pp. 102-10.
[51] Rose, pp. 104-6.
[52] An additional, more cynical interpretation of this is that, given that Virgin Galactic's extremely expensive tickets only provide a few minutes of microgravity experience, the view from the window is probably the most effective selling point they can offer.

> The suit, then, becomes synonymous with a set of values which refer to heroism and thus to the Cartesian (masculine) subject identified by the Proper Name but the Name itself becomes curiously disconnected from the individual to which it actually refers. [53]

Symbolically, Shaw's argument further supports my own contention that this figure of the (helmeted) astronaut can be read as an example of the ideal observer assumed in traditional scientific and spatial theories, as illustrated by Rose.[54] Rose argues that, along with the master subject's denial of his own corporeality, the subject's body must function 'as a neutral container of rationality' without bodily dimension such as skin colour or gender.[55] For the helmeted astronaut, this becomes a visual reality. Photographs of suited astronauts with their visors down show not the astronaut's face but a fish-eye view of their own outward gaze. I argue that the astronaut's relationship to Rose's concept of the possessor of the masculinist gaze is illustrated in that the astronaut can look out, but cannot be looked upon.

The depiction of Galactic Girl, with her highly stylised space suit, is designed directly in contrast to this. With her transparent helmet and her closed eyes, Galactic Girl can be looked at but cannot look outside. This evokes traditional understandings of women's passivity and objectification; men as the possessors of the gaze, women as targets, as Rose discusses through Mulvey.[56] While positioned as a symbol for actual space exploration, Galactic Girl's portrayal sets her apart from the position of knowing subject.

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[53] Shaw, p. 125.

[54] Megan Stern analyses this same phenomenon but comes to a different conclusion – that this is a violation of the Cartesian subject's ideal as 'king of all he surveys', that, through the reflectivity of the visor, he is 'usurped by this very act of surveying' (Megan Stern, 'Imaging space through the inhuman gaze', in *Inhuman Reflections: Thinking the Limits of the Human*, ed. by Scott Brewster et al (Manchester: Manchester University Press, 2000), pp. 203–216 [p. 209]). Stern, however, focuses on the lunar landscape as exploratory subject, rather than the gaze back upon Earth. Additionally, Stern describes a construction of the observer as 'containing' the landscape, which (while similarly positioned against the violation of the landscape *occupying* the subject) I find a less compelling analysis than that of Kirby, who emphasises the need for the subject to stay bounded *against* the landscape. Stern also argues that the space suit functions to conceal the identity of the astronaut behind a reflective surface which 'signifies masculine authority, progress and conquest' (p. 208). In addition to occupying an idealised position by being literally outside of Earth, Stern suggests that the helmeted astronaut symbolically reproduces the image of the ideal exploratory subject. I argue that the image of the space suit conceals and homogenises the bodily attributes of astronauts, but ultimately contributes to the instability of this narrative – I will further elucidate this point in Chapter Four.

[55] Rose, p. 33.

[56] Rose, pp. 107-109.

I wish to argue that the imagined Galactic Girl functions within the social context of space travel to speak to broader understandings of (real) women in space. That her design visually reproduces these tropes of masculine subjectivity is not incidental – it implicates the discursive field Rose and Kirby identify, of the exploratory subject of Earth, who is presumed to be male. The privileged, extra-terrestrial view of Earth is ascribed to the actual space traveller and represented in the giant overseeing eye inscribed on the underside of the Virgin spaceships, but it is not granted to the woman designed to represent the venture. I would argue that this speaks to the difficulty women astronauts cause, by troubling the presumed masculinity of the observational subject. As Penley argues, and as the stories of real women astronauts indicate, they are still seen as 'out of place' in this position. In this way, a woman occupying a space suit problematizes assumptions about who properly possesses the extra-terrestrial gaze.

In the next chapter, I will continue to engage with spatial theory in discussion of astronaut subjectivity, however I will shift my focus to the relationship between spatial theory, aspects of the body, and gendered ideology. As I will show, spatial theory not only provides a useful framework for evaluating discussions of extra-terrestrial subjectivity; this subjectivity, I argue, can usefully inform broader discussions of bodies, gender, and spatial theory, on Earth and beyond.

Chapter Four: Gravity, Gender, and Spatial Theory

In this chapter, I will continue to follow the thread I began in Chapter Three, of applying a spatial approach to my exploration of space culture. Rather than focussing on extra-terrestrial vision and perspective as I did in the preceding chapter, in Chapter Four I examine how aspects of the body as conceptualised in spatial theory are represented in discussions of spaceflight experience. Further to this, I will argue in this chapter that the relationship between the extra-terrestrial and the cultural can go both ways. While spacefaring humans share a cultural reality with their terrestrial brethren, the experience of outer space does have unique characteristics, and I suggest that these can be used to inform spatial studies more broadly. Later in this chapter, I discuss some of the scientific research involved in human spaceflight, and highlight the influence exerted on it by both the spatial constraints of the extra-terrestrial and the cultural constraints of gendered discourses of the body. Where this research shows evidence of problematic constructions of gender, I argue that the differences between extra-terrestrial and terrestrial spaces can serve to underscore the instability of these constructions, and the urgent need for critique of this instability.

As Bell and Parker identify, and as I discussed in my introduction, there has been little critical attention paid to the field of space exploration, relative to related fields such as science fiction and technology.[1] I contend that this lack of critical attention may contribute to the continued presence of very traditional narratives of gender and sexuality in this literature, as discussed below. The heyday of human spaceflight research and practice was in the mid-20th century; in more recent research, discussions of gender and the body often still reflect an earlier era's assumptions, perhaps due in part to the lack of critical attention Bell and Parker identify. At the same time, outer space is a particularly extreme environment, with a particularly extreme set of bodily-spatial conditions to be negotiated by spacefarers and space researchers. In the context of this extremity, and of the techno-scientific prowess required to

[1] David Bell and Martin Parker, 'Introduction: making space' in *Space Travel and Culture,* ed. by David Bell and Martin Parker (Oxford: Blackwell, 2009), pp. 1-5 (p. 1). See also my discussion in the Introduction, see pp. 22-23.

sustain human life within it, these traditional understandings of the body and gendered spaces seem particularly out of place. Further than that, however, I argue that the extremity of bodily-spatial experience in outer space can be productively used to highlight the continued presence of traditional narratives of gender in terrestrial spatial theory.

Aspects of bodily experience in microgravity environments have, I argue, the effect of destabilising broader notions of interior and exterior space. I will relate this to Kirby's work on the importance of borders to the cartographic subject and to Rose's exploration of the gendered construction of the geographic subject to argue that spaceflight experience constitutes a threat to that subjectivity. Further, I will argue, as these theorists have done, that this threat carries gendered connotations. As Rose and Kirby have suggested, male subjectivity has been historically constructed as less bodily than female subjectivity. I will explore how, by destabilising the subjectivity of all astronauts, spaceflight experience has the capacity to undermine the presumed masculinity of the geographic subject.

Gravity and Spatiality

Outer space is perhaps the most extreme environment ever adapted for human habitation, where many basic assumptions about human habitation and the environment must be discarded.[2] The influence of Earth's gravity is one of the more noticeable aspects of these assumptions. Without gravity, the body necessarily experiences space in a different way; yet, as I will show, narratives of astronaut experience often use the same narratives of spatiality as earthbound discussions of space, which demonstrates the depth of associations between spatiality and Earth's gravity. As I will explore, this has productive implications for evaluating other influences on spatiality, including gender.

A human body perceives and uses space very differently under microgravity conditions, and as I discuss in this chapter, astronaut narratives often highlight this. Still, the words that they use and the stories that they tell about the spaces of outer space are

[2] For a fuller evaluation of the meanings of 'extremity' in, around, and beyond extra-terrestrial human experience, see David Valentine et al., 'Extreme: limits and horizons of the once and future cosmos', in *Anthropological Quarterly* 85 (2012) 1007-1026.

necessarily underpinned by millennia of our species' development within the influence of Earth's gravity. As I discuss further in this section, astronauts still talk about up and down or floor and ceiling in extra-terrestrial spaces which lack the orientation markers that give those terms their meaning. While this is not surprising – after all, spaceflight has been a part of human experience for a relatively short time – I argue that it is interesting in that it functions as a metaphor for broader aspects of cultural experience. Gravitational pull is a scientific principle, but it creates a cultural narrative about space. When we take this narrative into outer space, we take it away from the reference points that render it coherent; more specifically, when we take the story of how a human body experiences gravity on Earth's surface and put it into orbit, it loses much of its objective meaning. Inescapably, however, it still carries enormous cultural meaning. As I will show, cultural understandings of the human body do not disappear just because those bodies go into outer space.

This is important because at the same time that we do this with gravity, we are also taking with us a particular story about how gender influences our body's use of space. As Earth's gravity has exerted influence on the development of human culture, so have the history of male dominance and heterosexual norms exerted influence on cultural narratives, particularly narratives of the human body. In what follows, I demonstrate how logical problems caused by taking assumptions about Earth's gravity into a microgravity environment are easy to identify in spaceflight narratives; similarly, the appearance of traditional, subjective discourses of gendered difference in a contemporary scientific context invites interrogation and critique.

As I suggested in the previous chapter, science has a long history of resisting cultural critique by constructing itself as objective. While spaceflight research does come out of this tradition, I argue that there are also aspects of its own disciplinary specificity that may deny the influence of culture with particular vigour. Here, as discussed in my Introduction, my argument is informed by Donna Haraway's 'The Promises of Monsters', in which she argues

that outer space 'is coded to be fully general'.[3] Outer space is culturally constructed as beyond the influence of culture, which may contribute to the relative dearth of critical material focussed on it. I will argue in this chapter that this makes space a uniquely productive field for analysis of the influence of cultural ideas – in this case, the influence of gendered ideology on cultural understandings of spatiality. Though space is constructed as beyond human culture, I argue that when humans travel to space, they take a lot of cultural 'baggage' with them.

Baggage: Mass and Gender

The metaphor of 'baggage' is useful in examining how cultural assumptions influence spaceflight, particularly as literal 'baggage' (or cargo) has such importance – and represents such difficulty – in the space industry. The cost of transporting things and people into space is notoriously prohibitive; NASA's recent estimates are around $10,000 per pound, or roughly £13,000 per kilogram.[4] In some cases these figures lead to cost-benefit analyses in discussions of space policy which ultimately reveal value judgements about what – and, vitally, who – belongs in space. In other words, the literal baggage of extra-terrestrial travel provides evidence of the metaphorical baggage humans take with them into space.

Specifically, the additional expense added by weight in space missions has been historically invoked in gendered ways – particularly as a way to dismiss the inclusion of women in spaceflight. In a 1971 NASA memorandum (to which I will apply greater critical attention in Chapter Five), the authors of a study on psychological and sociological aspects of isolation make reference to the idea of male astronauts bringing their wives along as a way of relieving sexual tension. Ultimately, however, they dismiss this idea out of hand because of the additional weight the astronauts' wives would add to the ship's load.[5] These authors are not the only source to invoke this precise issue: Wernher von Braun, when asked whether women

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[3] Donna Haraway, 'The Promises of Monsters: A Regenerative Politics for Inappropriate/d Others', in *The Haraway Reader* (London: Routledge, 2004), pp. 63-124 (p. 92).

[4] See NASA. 'Advanced Space Transportation Program: Paving the Highway to Space.' < http://www.nasa.gov/centers/marshall/news/background/facts/astp.html > [accessed 10 January 2016].

[5] Nick A. Kanas and William E. Fedderson, 'Behavioral, Psychiatric, and Sociological Problems of Long-Duration Space Missions', *NASA Technical Memorandum X-58067* (1971), p. 38; I discuss this in much greater detail in Chapter Five, pp. 119-122.

would be considered for NASA missions, is quoted as crediting the director of NASA's Johnson Space Centre with the joke, 'we're reserving 110 pounds of payload for recreational equipment.'[6] Here, sexism and heterosexism clearly overlap, but even setting aside the problematic presumption of exclusive heterosexuality, the cultural bias in the treatment of women's roles is evident. The idea of a woman in space is first introduced as that of a male astronaut's wife or sexual partner, but considering the late entry of women into the American space programme as I have discussed, it is clear that ultimately not even these justifications are enough to render a female body worthy of its addition to a rocket's burden.

Gendered influences aside, the basic material reason for the high cost-per-kilogram of spaceflight is Earth's gravity. Travelling to space is not a feat of distance so much as a feat of strength: the fuel needed to escape the influence of Earth's gravity is far more than that needed to travel from the edge of the atmosphere to the moon, for example.[7] As I will continue to discuss, gravity is such an overwhelming presence in terrestrial life that a great deal of what we do and do not understand about human spaceflight ultimately hinges upon what we do and do not understand about gravity – or the lack of it. Getting into space is a battle between human technological ingenuity and gravity, and too much baggage can only interfere. Yet while advances in engineering make it more and more feasible to send more and more mass into space, the metaphorical baggage present in these gendered examples, and throughout the material I discuss in this chapter, also suppresses human access to extra-terrestrial spaces.

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[6] Bettyann Kevles, *Almost Heaven: Women on the Frontiers of Space* (New York: Basic Books, 2003), p. 41. This quote from von Braun is also analysed in Daniel Sage, 'Giant Leaps and forgotten steps: NASA and the performance of gender' in *Space Travel and Culture*, ed. by David Bell and Martin Parker (Oxford: Blackwell, 2009), pp. 146-163 (p. 159). Sage specifically addresses how this 'joke' and others like it speak to the relationship between sexism and heterosexism, a relationship to which I will also pay further critical attention throughout Part Two.

[7] See NASA, 'Escape Velocity: Fun and Games' <http://www.nasa.gov/audience/foreducators/k-4/features/F_Escape_Velocity.html> [accessed 10 January 2016]. Although this fact is mentioned in many of the texts I reference elsewhere, as none of them are physics texts and none provided specific sources I went searching for NASA's own resources about escape velocity, or the speed a vehicle needs to reach in order to break away from the influence of the gravitational pull of a large object like the Earth. I am chagrined to admit that the article of which I could make the most sense is filed under educational resources for pupils in the age range of five to nine years.

This interplay between material and cultural limitations is the foundation of this chapter's investigation of the spatiality of the extra-terrestrial. Extra-terrestrial spaces necessarily have unique material constraints, but as humans create human spaces-in-space, they take human cultural constraints with us. Many of these constraints centre on the human body, and as I will discuss, the body is a fraught subject within discussions of spatial subjectivity.

Perspective and the Body

As I discussed in the previous chapter, Frank White's assertions about the universalism of extra-terrestrial perspective are problematic for myriad reasons. For the purposes of this chapter, I return to White's examples but with a shift in my own perspective toward the relationship between White's claims and the problematic aspects Rose identifies in the construction of the geographic observer. The relationship between the concept of the 'overview effect' and David Harvey's work on the development of Western mapping suggests, I have argued, that the traditional geographic observer is the figure upon which White's philosophy implicitly relies. As Rose argues, aspects of female physiology - reproductive organs, menstruation, and childbearing – are traditionally perceived to violate this boundary between inside and out, body and space. Menstruation and childbirth, in particular, Rose describes as 'bodily processes which transgress the boundary between inside and outside the body', which confuse ideas of a bounded individual subject.[8] This, Rose argues, contributes to the male dominance of Empirical thought.

In making this argument, Rose refers to Iris Marion Young's account of childbirth as a particular, and a particularly gendered violation of this boundary, what Young calls 'the most extreme suspension of the bodily distinction between inner and outer.'[9] This, Rose argues, contributes to the male dominance of Empirical thought: the body of the 'master subject' is 'one with limited and carefully controlled passages between its inside and outside.'[10] With this

[8] Gillian Rose, *Feminism and Geography* (Cambridge: Polity Press, 1993), pp. 31-3.
[9] Iris Marion Young, *Throwing Like a Girl* (Bloomington: University of Indiana Press, 1990), p. 163.
[10] Rose, p. 32.

understanding of female physiology, the troubling of this interior-exterior separation constructs the ideal subject as always a masculine subject. However, this understanding of female physiology is socially constructed, not natural – all bodies are subject to violations of the border between interior and exterior. The distinction is drawn in traditional ideologies of gender which only recognise bodily processes associated with femaleness as violations of this boundary. As I discuss below although the bodily processes associated with female bodies thus provide clear examples of the troubling of bodily boundaries, all bodies can be troubled by the destabilisation of this border.

The gendered construction of the boundary between bodily interior and exterior space is also a key component of Kirby's argument about the primacy of borders from 'Re: Mapping Subjectivity'.[11] The whole-earth geographic view which Western thought has historically privileged and to which spacefarers hold a literal claim would seem to be the ultimate in mastery over the environment, as I have discussed in relation to Harvey. In this extra-terrestrial position, a human is literally outside of what we consider the geographic environment. This relates to Kirby's argument about the importance to the Western explorer of remaining outside the territory he explores; disorientation undermines the primacy of this subject, because it threatens the separation of the self from exterior space.[12] However, on the individual level, many narratives of spaceflight characterise the experience as one of great and deeply-felt disorientation for astronauts regardless of their gender.

In the next section, I explore examples of astronauts experiencing disruptions of this interior/exterior boundary. I argue that the sense of disorientation this can provoke for the astronaut complicates the construction of astronaut as subject in the Western spatial tradition. Debra Benita Shaw argues in 'Bodies Out of This World: The Space Suit as Cultural Icon' that the ways in which astronauts must confront their own bodies and bodily functions problematically contrasts with the ideal of the astronaut with the 'right stuff', which she

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[11] See Kathleen M. Kirby, 'Re:Mapping Subjectivity: Cartographic Vision and the Limits of Politics', in *Bodyspace*, ed. by Nancy Duncan (London: Routledge, 1996) pp. 45-55, especially p. 46, as I discussed in Chapter Three.

[12] Helen Sharman, *Seize the Moment* (London: Victor Gollancz, 1993), p. 48.

describes as a perfect physical body ruled by the thinking mind.[13] I develop her analysis further by employing Rose's writing on bodily boundaries of the geographic subject alongside Kirby's concept of 'being lost' as a framework for understanding disorientation and the troubling of perspective that results from the bodily experiences of astronaut subjects.

Embodiment and Spaceflight Experience

While I maintain that, following the analyses of Penley and Casper and Moore, the female body is viewed as a site of particular trouble to astronautics, the context of outer space involves many more sites of destabilisation for traditional narratives of bodily-spatial boundaries. As Rose demonstrates, on a deeper level it is *the body* – any body, not just female – that is problematic for the construction of the 'master subject'. Under this critical lens it is not just that women's bodies are a problem, but also that women are traditionally considered more bodily beings than men. This makes women more of a violation of the sanctity of interior-exterior boundaries, and therefore more troubling in traditional spatial discourse.[14] In the context of outer space, however, the difficulty and ever-looming risks of maintaining human life outside of our native environment mean that all astronauts are continually made aware of their own bodies in ways that complicate and undermine the primacy of interior-exterior boundaries for the subject. In the texts I examine in this section, bodily awareness becomes central through the biomedical monitoring to which astronauts are subjected.

Bodily Awareness, Biomedical Monitoring

From the beginning of the selection process, potential astronauts must undergo myriad medical examinations and procedures which I argue can be read as a confrontation of the permeability of the body's interior-exterior boundaries. In Helen Sharman's autobiography, the medical aspects of astronaut training are highlighted as difficult and disorienting experiences. 'If there's an orifice anywhere in your body,' Sharman recalls one doctor telling her, 'you can be sure we will put something in, or take something out.' She goes on to say, 'He did, and so

[13] Debra Benita Shaw, 'Bodies Out of This World: The Space Suit as Cultural Icon', *Science as Culture* 13:1 (2004), 123-144 (p. 140).
[14] Rose, p. 31-33.

did all the others'.[15] In Sharman's case this included multiple internal examinations of her gastrointestinal system and the removal of three of her wisdom teeth.[16] Another candidate, Sharman recalls, was required to have his tonsils removed.[17] All astronaut candidates go through a multitude of tests and procedures, thus becoming familiar with the inside of their bodies in a way that few people ever do during periods of health.[18] This is in itself disorienting, before a candidate even experiences the literal disorientation caused by the conditions of spaceflight. This concept of disorientation, both in (outer) space and in the distinction between space and body can be related to Kirby's discussion of the cartographic subject and 'being lost'. Kirby emphasises the necessity for the cartographer to maintain a bounded sense of self which cannot be permeated by the landscape. Being lost, in Kirby's analysis, destabilises the border between bodily interior and exterior space. In a similar way, I argue that spaceflight experience and its attendant disorientation can problematise the concept of a bounded self.

To return to Sharman, in her autobiography she recalls how spaceflight experiences of disorientation can relate to the experience of looking back upon Earth:

> In these first couple of hours in the Soyuz I was mainly learning how it felt to be in space, weightless in a capsule, and the differences there were in the way our outer reality is perceived. [...]the craft was rotating slowly so that the solar panels, now unfolded, would receive the maximum amounts of energy from the sun to convert into electricity. When I first went to the blister window I stared down at the ground and in order to keep oriented in the same way I instinctively inched my way around the rim. I looked back inside the capsule and everything suddenly seemed upside-down![19]

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[15] Sharman, p. 82.
[16] Sharman, pp. 81-82.
[17] Sharman, p. 121.
[18] Sharman specifically comments on an invasive test of kidney function which was required by the Russian doctors involved in Project Juno, but which no NHS hospital and few British private facilities were willing to conduct on otherwise healthy patients. See Sharman, p. 87.
[19] Sharman, p. 58.

The difficulty of orienting oneself – or not – in microgravity has been the subject of much scientific research as well as many a returned astronaut's anecdote.[20] Additionally, this literal disorientation in a microgravity environment can have severe effects on astronaut well-being.

Disorientation and the Body

One of the more immediately difficult aspects of this is what NASA terms 'Space Adaptation Syndrome', which is essentially motion sickness, brought on by the conflicting sensory data interpreted by a system that is accustomed to the laws of gravity. Mary Roach describes the experience of microgravity as 'uniquely perplexing sensory conflict'; without normal gravity, the cells which contribute to our sense of orientation 'are free to ricochet back and forth off the walls' of the inner ear as the result of a simple head swivel, which is interpreted by the brain as much more dramatic movement than is actually occurring.[21] At the same time, the brain's reliance on its normal understanding of up and down should not be underestimated; Roach quotes the recollection of an aerospace medical researcher that astronauts have reported 'sudden vomiting episodes after seeing a nearby crew member floating upside down'.[22] The concept of 'upside down' might not have any objective meaning in microgravity, but it retains importance in the human brain, as Roach's research and Sharman's experience illustrate.

The effect of this disorientation and illness is that when the space is unfamiliar, the astronaut is necessarily confronted with a new awareness of their own body. This is in turn a violation of what Rose describes as the impact of Enlightenment mind-body dualism on the ideals of geographic vision. The Enlightenment subject, following this binary logic, is ruled by the mind – the body is overridden by the mind's mastery. Because of the simultaneous construction of women as inherently more bodily, this contributes to the presumed masculinity of the subject.[23] This argument additionally expands Kirby's discussion of being lost

[20] See Mary Roach, *Packing for Mars: The Curious Science of Life in Space* (Oxford: Oneworld, 2010), particularly pp. 54-68.
[21] Roach, p. 83.
[22] Charles Oman, quoted in Roach, p. 85.
[23] Rose, p. 33.

as a violation of the Cartesian subject. The ideal cartographic or geographic observer is violated not just by becoming lost within a landscape, but also by being reminded of the body and its refusal to play by the rules of cognition.

The combination of close quarters and environmental extremes necessitates much in-depth discussion of bodily functions, an aspect of space travel with which the public often seem especially interested. As I mentioned earlier in discussing Lisa Nowak, the diapers she may or may not have worn brought to light the public's fascination with how astronauts relieve themselves.[24] Roach's best-selling book on the science of spaceflight devotes entire chapters to the negotiation of urine, faeces, vomit, sweat, intestinal gas, and semen in microgravity. The space traveller is confronted with these by-products of human existence in particular and particularly disorienting ways throughout the training for and experience of space exploration. That this disorientation is particularly visible in the field of spaceflight is evidenced by the public fascination with these issues in space.

And yet, I would argue that the astronaut continues to be positioned as the ideal exploratory observer. This is made explicit in White's work on the 'overview effect', when he suggests that this 'effect' will bring about an idealised future for humankind, but as I have argued, this is based in centuries of spatial observational discourse, as illuminated by Harvey's work on mapping. That this discourse is, as Rose and Kirby argue, imbued with gendered associations, further problematizes this subject position. The troubling of bodily boundaries specific to astronautics represents violation of the ideals of spatial subjectivity. However, as part of the legacy of gender bias in this discourse, this is the case particularly for women astronauts, as I have shown.[25]

In the next section, I discuss how the absence of Earth's gravity intersects with this ideal of bodily integrity in spaceflight research, and in particular, how the issue of menstruation becomes a key point in this discourse, echoing the denial of corporeality that Rose identifies in the 'master subject' figure. I will further argue that this aspect of space

[24] See p. 38 in my Introduction.
[25] See especially pp. 76-78 in Chapter Three.

culture provides productive opportunities for the extra-terrestrial to inform broader discussions of spatiality. Prior to this, however, I wish to address some further aspects of spaceflight and microgravity that hold important implications for perceiving the limitations of spatial theory.

Spatial Theory and the Extra-Terrestrial

The history of space biomedical research shows that we have a limited understanding of how gravity and our bodies interact, reminiscent of the old joke that fish don't know very much about water.[26] Human awareness of spatiality is so entangled with the experience of Earth's gravity that it is perhaps not surprising that we have historically struggled to understand gravity's impact. Gravity, in fact, has significant influence on how the human body develops and functions, but by necessity research into this often must take place in microgravity. In other words, perhaps we can only really understand gravity it by taking it away. This relates, as I will discuss, to both space biomedicine and to spatiality – extra-terrestrial and terrestrial. As stated elsewhere, one common thread that emerges from many astronaut narratives is how their perception of spatiality changes in response to an extra-terrestrial environment. Sharman provides a particularly cogent example of this phenomenon in her autobiography, saying:

> In absolute terms, the orbital capsule is not big. Had we been on Earth it would have felt like a tiny boxroom crammed with equipment, but once you are in space the weightlessness liberates you from the confines of a floor and gives you three dimensions in which to move around.[27]

What particularly stands out to me in this passage is the idea of microgravity *allowing* Sharman to move in three dimensions. Of course, humans already exist in three dimensions, but in a sense, Earth's gravity restricts us to experiencing the world in two. Sharman's experience suggests that gravity's restrictive effect on our spatial experience might only be noticeable when that constraint is removed.

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[26] This is an old joke which, interestingly, White makes into a key portion of his philosophy in *The Overview Effect*, albeit in reference to terrestrial perspective rather than to gravity. See Frank White, *The Overview Effect: Space Exploration and Human Evolution* (Boston: Houghton Mifflin, 1987), pp. 6-10.
[27] Sharman, p. 53.

Microgravity and Mapping

I had my own moment of realization about the gravitational aspect of spatial experience as a result of something from Rose's discussion of one particular aspect of human geography research – a subset called time-geography. As I discussed in Chapter Three, *Feminism and Geography* argues that the traditional discourses of various geographic disciplines have been largely masculinist, and have excluded women both through ignoring women's spatial experience and also through constructing a masculine subject masquerading as a neutral one. Rose's discussion of time-geography specifically highlights problems with both of these aspects of geographical masculinism. Time-geography involves representing both space and time using diagrams in which space is represented as a two-dimensional map, with time represented by 'upward' movement. The subject of the diagram is traditionally represented by a simple line, plotting movement around the map as well as upward to show the passage of time accompanying the physical movement.

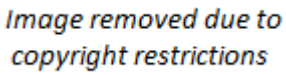

Figure 4.1: Rose's Time-Geography Diagram[28]

[28] From Rose, p. 21.

I have been struck by a minor observation about time-geography diagramming which, trivial though it may seem, is important to my analysis of the relationship between (outer) space and spatial theory. With the upward movement representing the passage of time, a time-geography diagram is unable to accurately represent any kind of upward physical movement – including, in an extreme case, travel into extra-terrestrial space. In this way, time-geography offers a particularly stark example of the limitations gravity places on mapping techniques. The two-dimensionality of time-geography is one example of just how integral gravity is to our understanding of space, and how the influence of gravity is easily overlooked. I further argue that this is very like the influence of historical, institutional masculinism, such as Rose identifies – both are everywhere, and both tend to be hidden. Additionally, I argue that this is related to Rose's critique of time-geography's use of a problematically unmarked subject, which I will discuss shortly.

First, to return to gravity, it is possible that representations of three-dimensional space as two-dimensional are used unproblematically because, in a way, gravitationally-limited experience of three-dimensional space *is* two-dimensional. Without great technological intervention, human movement through space is constrained by the force of Earth's gravity, keeping humans invisibly tethered to the ground. This operates on a trivial level, such as in my observation about the limitations of time-geography diagramming, but it also operates on a much broader level throughout the science of human spaceflight. On this broader level, I argue that it can become part of an insidious history of maintaining the masculinity of both the spatial and the extra-terrestrial.

Rose argues that bodily boundaries, although important to all geographic sub-disciplines, are especially important to time-geography. The subject of time-geography, after all, is always the movement of bodies through space; in this framework, the integrity of the body against exterior space and against other bodies is assumed throughout. Time-geography does not make allowances for interaction between bodies – for 'no bodily passion or desire' as

Rose puts it.[29] Meanwhile the body is revealed to be a particular kind of body: blank, self-contained and fiercely individual – a true Enlightenment subject. Strictly bounded against exterior 'space' by the skin, this unmarked, rational, outward-gazing body which presumes objective universalism is intrinsically coded as masculine.[30]

Alongside this problematic construction, the constraining effect of Earth's gravity in time-geography takes on new metaphorical weight. Both of these constraints – gravity and bodily gendered difference – operate on more than one level, existing as both scientific and cultural constraints simultaneously. As I discussed earlier, Rose identifies the perceived violation of the body-space split through menstruation and childbirth as the source of the gendered coding of bodily integrity. Perhaps unexpectedly, the intersection of these themes bears a significant influence on the science and practice of spaceflight, particularly where women astronauts are concerned.

Microgravity and the Human Body

As I have suggested above, astronauts undergo intensive biomedical monitoring before, during, and after spaceflight, both in the interest of their individual health and towards the goal of furthering our understanding of human health in an extra-terrestrial environment. This is very much a developing field, but it is one that is affected by the same cultural baggage that I argue is present in the origins of the discipline. Evidence of a presumption of masculinity is identifiable in even very recent space physiology research, particularly where bodily interiority is concerned. This bears striking resemblance to the gendered aspects of spatial discourse that Rose identifies, as I will show.

One clear example of this phenomenon concerns two very mundane bodily functions: urination and menstruation. Everybody urinates, including astronauts: not everybody menstruates. Throughout the history of astronautics, astronauts have been predominately male; although the percentage of women in the global astronaut corps is growing, it is still very rare that someone who menstruates travels to space. However, it does happen, and along with

[29] Rose, p. 31.
[30] Rose, p. 33.

speculation about every other bodily function, the question is raised: is menstruation in microgravity a problem?[31]

Without gravity, biomedical science researchers have for decades assumed that menstrual fluid would not easily exit the uterus, leading to increased risk of retrograde menstruation and other problems, which as I have discussed is frequently presented as a special consideration to be taken into account when considering women for space missions.[32] This is the case in Buckey's *Space Physiology*, discussed in Chapter One.[33] Buckey acknowledges the existence of a study which implies there is no increased risk of retrograde menstruation in space, but otherwise speculates that, as there has been no formal study specifically of retrograde menstruation in spacefaring women, spaceflight 'might increase the risk of endometriosis and create atypical presentations of the disease'.[34] Buckey omits from his discussion of retrograde menstruation an invited review entitled 'Gender Issues Related to Spaceflight: a NASA perspective' in a 2000 special issue of the *Journal of Applied Physiology*.[35] This article is an extremely detailed overview of a very broad range of health-related research data collected by NASA over the course of the entire American space programme. Regarding menstruation, the authors found that across the history of human spaceflight, women who have spent extended time in microgravity are no more likely than the general population to have experienced retrograde menstruation at any time, during or after spaceflight.[36]

The statistical data indicate that gravity does not have a significant effect on menstruation. Urination, on the other hand, is very much related to gravity – specifically, our

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[31] Roach addresses this to a limited extent in *Packing for Mars,* as do Casper and Moore, who additionally examine the social implications of menstruation in the field, identifying among women in NASA a reluctance to discuss this aspect of their spaceflight experience, which the authors attribute to a desire to emphasise sameness over difference in such a male-dominated arena: see Monica J. Casper and Lisa Jean Moore, 'Inscribing Bodies, Inscribing the Future: Gender, Sex, and Reproduction in Outer Space', *Sociological Perspectives* 38:2 (1995), pp. 311-333 (p. 317).

[32] See pp. 39-43 in Chapter One.

[33] Jay C. Buckey, Jr., *Space Physiology* (Oxford: Oxford UP, 2006).It is worth noting that Buckey is enthusiastic about the inclusion of women in space missions, and as such my intention here is not to criticise him individually but to illuminate some of the assumptions present in this recent publication.

[34] Buckey, p. 215.

[35] Deborah L. Harm et al., 'Invited Review: Gender issues related to spaceflight: a NASA perspective', *Journal of Applied Physiology* 91 (2001): 2374-2383, pp. 2380-2381.

[36] The difference between women astronauts and the control group is not considered statistically significant by the researchers. Harm, pp. 2380-2381.

sense of needing to urinate relies on gravity, as it is triggered by the pressure of urine against the nerves in the bladder. Without normal gravity, surface tension has a greater influence on urine within the bladder, keeping it separated from the walls until the bladder is overfull; astronauts sometimes need to schedule toilet breaks to avoid having serious complications arise from an overfull bladder that they have not noticed.[37] And as the *Applied Physiology* article reports, urinary problems are a serious risk factor in spaceflight, and have indeed caused serious problems for astronauts on many missions.[38]

I argue that, given this, it can only be the influence of gendered ideology that causes menstruation to be discussed as a 'problem', as suggested by Casper and Moore, while urination is not considered in the same terms.[39] I further contend that this is deeply related to the construction of a masculine subject in spatial theory. As Rose discusses, the importance of the boundary between bodily interior and exterior space is paramount to the construction of the rational observer; further, the representation of an impermeable subject is one of the strongest threads in Western spatial discourse which contributes to the presumption of a masculine subject. Aspects of women's physiology like menstruation are perceived as a disruption of the separation between interior and exterior space, while aspects of everyone's life that involve bodily substances passing from the interior into exterior space – such as urination – tend to be elided in this discourse of an impermeable subject. In this way, among others, the neutral subject becomes a male subject, and a female subject becomes a special problem.

This comes to the fore in the history of space exploration in another way that involves bodily functions – the design of a space toilet.[40] In looking at space toilets, I draw from a

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[37] This is gleaned from Roach's interview with Scott Weinstein of NASA's Johnson Space Centre; see Roach, p. 69.

[38] Harm et al., pp. 2377-2378. See also: J. A. Jones et al., 'Genitourinary issues during spaceflight: a review' *International Journal of Impotence Research* 17 (2005) 64-7, which interestingly avoids any mention of menstruation whatsoever, despite also speculating on potential problems with conception and use of reproductive technology, menstruation apparently being, in their analysis, an unrelated process.

[39] Casper and Moore, pp. 317-318.

[40] I will return to discussion of space toilet design in Chapter Six, with particular attention on how the design of space toilet facilities relates to discussions of sexual culture in space.

different area of terrestrial spatial theory, specifically, architectural theorist Joel Sanders's work on the space of the public toilet.[41] Sanders claims that we assume that terrestrial public toilets are designed the way that they are because of 'purely functional requirements specified by anatomical difference'. This both draws from and reinforces the idea that all differences related to gender and sexual identity are purely biological. However, as Sanders says, 'Just one look inside the typical domestic bathroom shared by both sexes discloses the ways in which segregated public restroom facilities answer to the requirements of culture, not nature.'[42]

The layout and design of extra-terrestrial toilets is bound to these 'requirements of culture' in a similar way, and in fact this holds great importance in the history of astronautics, particularly for women. This is the claim of former NASA flight surgeon Patricia Santy as I discussed in Chapter One. Of NASA's decision to admit women in the 1980s, she writes:

> The issue of privacy, linked as it was to sexuality and personal hygiene, had long been a big factor in NASA's reluctance to include women as astronauts, and the development of the private toilet – probably more than any other reason – encouraged NASA to believe that females could finally (and without embarrassment to the agency) be integrated into Shuttle missions in a way impossible during earlier missions.[43]

Santy's claim is remarkable for its intensity. I suspect that claiming that the private toilet was the primary reason women were allowed into NASA is an oversimplification.[44] Yet, Santy's underlying idea about the way that these issues are discussed is compelling. This speaks to a cultural narrative that has developed around the space of a toilet. The space of a toilet is fraught with the issues, Santy raises, and these issues are importantly imbued with gendered

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[41] Joel Sanders, 'Introduction', in *Stud: Architectures of Masculinity*, ed. Joel Sanders (New York: Princeton Architectural Press, 1996), pp. 11-25.
[42] Sanders, p. 17.
[43] Patricia Santy, *Choosing the Right Stuff: The Psychological Selection of Astronauts and Cosmonauts* (Westport: Praeger, 1994), 51.
[44] Mary Roach discusses part of Santy's argument, as well as that of a former Air Force colonel who had been involved in the selection of Mercury astronauts, in *Packing for Mars,* where she raises suspicion that the toilet issue may have been not a '*reason'* but an 'excuse' (p. 242). As I discussed in more depth in my first chapter, there were certainly a range of broader systemic factors behind the historic exclusion of women from space programmes, particularly NASA; regardless of this, the fact that gender is so strongly discursively associated with the development of space toilet facilities is an important point in and of itself, which Santy is uniquely positioned to address. See Roach, pp. 241-243.

associations. Santy demonstrates that this is the case whether it is a terrestrial public toilet or a multi-million-dollar feat of engineering orbiting the planet.[45] I contend that looking at these issues specifically in an extra-terrestrial context is of particular value, in part because of the very extremity that requires such complex negotiation of simple bodily functions. Just as microgravity forces confrontation with the instability of human stories about space and how we use it, the extremity of the extra-terrestrial can bring attention to the stories we tell about bodies, and how they're different, and what they need.

Specifically, the ideas of gendered difference that underpin the texts I have discussed seem out of place in this context. Extra-terrestrial space is a space of much technological advancement, and which requires such scientific precision and accuracy that there would seem to be little room for this cultural 'baggage'. That it is identifiable in this discourse nonetheless is a concern. As I have argued throughout Part One, cultural understandings of spaceflight traditionally limit access to space to a restricted subject – a subject who is inextricably entangled with a history of masculine subjectivity which renders outer space symbolically inaccessible to women. This chapter marks the end of Part One of this thesis. In Part Two, I will continue to explore this idea of cultural access. I have argued in this chapter and those preceding it that the discourse of spaceflight privileges access for male subjects. In Part Two I will argue that heterosexuality is similarly privileged in discussions of who and what 'belongs' in outer space.

[45] I will further investigate issues of both terrestrial and extra-terrestrial toilets in light of Santy's claim and queer theory in Chapter Six.

Introduction to Part Two: Sex in Space

Ultimately, asking the question of whether men or women are better suited for spaceflight may be like asking whether all-male families are better than all-female families. Just as families generally work better when they include members of both sexes, successful space crews should be made up of people with complementary skills who can work together.

Jay C. Buckey, *Space Physiology*[1]

Heteronormative thinking about society is seldom so cartoonish.

Michael Warner, *Fear of a Queer Planet*[2]

In Part One I argued that outer space is perceived as a space belonging to men, through both historical exclusion of women from space programmes and through the discursive construction of the spaces and bodies involved in space travel. In Part Two I will be making the parallel argument that outer space is constructed as a heterosexual space. Parallel though this point is, I will argue that while in some ways the heterosexuality of space is constructed similarly to its male-centrism, in other ways the sexuality of space is enforced very differently.

In addition to expanding upon some of the feminist work I have also employed in Part One – particularly through further engagement with Donna Haraway – my argument in Part Two largely draws from queer theory, mainly the work of Lauren Berlant and Michael Warner, Lee Edelman, Gayle Rubin, Patrick Califia, and Elizabeth Freeman. I expand upon this critical framework by incorporating the work of art historian Elizabeth Guffey and critic Lucy Lippard, whose work on retro aesthetic in art and design forms an important basis for my argument in Chapter Seven.

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[1] Jay C. Buckey, *Space Physiology* (Oxford: Oxford University Press, 2006), p. 208.

[2] As I will discuss, in this passage Warner is referring specifically to the heteronormativity of messages sent into outer space. Michael Warner, 'Introduction', in *Fear of a Queer Planet,* ed. by Michael Warner (Minneapolis: University of Minnesota Press, 1993), pp. vii-xxxi.

Explicit Sex, Implicit Sex

Before approaching these broader contextual issues, however, it is important to acknowledge that there are examples from the space industry of practical, even explicit discussions of concrete sex acts. Similar to the discussions of bodily functions I covered in Chapter Three, there seems to be a great deal of public fascination with sex in outer space. This features prominently in Mary Roach's *Packing for Mars*, from which I also drew much of the material about other bodily functions in Part One. Roach even devotes an entire chapter to the fascination both within and beyond NASA in the specifics of extra-terrestrial sex.[3] While she finds more rumour than fact in her discussions with NASA sources, there are other examples of NASA's dealing with sex interspersed throughout Roach's book, as well as in other sources, which I will discuss further in the chapters that follow.

However, while I will address actual discussions of sex, I often find examples of the sexuality of space when sex acts are not being discussed, as will become clear as these chapters progress. The first epigraph I have chosen for Part Two is a particularly clear case of implicit assumptions about sexuality appearing in a seemingly unrelated arena. This passage is from the book *Space Physiology,* to which I have already applied some critical attention in Chapter One. It speaks to unexamined assumptions about gender, sexuality, and the 'family', and to the way that these assumptions infiltrate scientific practice. In a supposedly objective discussion of physiology research, I would argue that the assertion that people have essentially different, gender-dependent professional skills is an inappropriate one, even within the text's own terms, let alone from the perspective of my own feminist and queer theoretical approach. Further, the assumption that a 'family'—the precise meaning of which is unclear in this context—is best composed of more than one gender is at best irrelevant; it could additionally be read as asserting the inferiority of lone or same-sex parents, which is even less relevant to the subject of biomedicine in microgravity.

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[3] See Mary Roach, *Packing for Mars: The Curious Science of Life in Space* (Oxford: Oneworld, 2010), pp. 229-46.

Additionally, comparing the crew of a spacecraft to a family is one example of how professional and domestic spaces are blurred in spaceflight discourse. As I discussed in Chapter One, this blurring disproportionately impacts discussions of women in space, and in this passage, Buckey unwittingly reinforces this even while attempting to advocate gender equality. It is often the case, as I have argued, that when women are introduced to the professional environment of a spacecraft, their presence prompts a shift in the conversation toward 'families' and children. This passage from Buckey is an example of how this can function in a relatively oblique manner. However indirectly, Buckey makes gender a question of family, and family, as I will argue in Chapter Five, is constructed with a particular sexuality that suffuses the culture of space exploration.

Heteronormativity and Space

The concept of heteronormativity is vital to all of the chapters which follow. The definition of heteronormativity that I use is drawn from the work of Lauren Berlant and Michael Warner, and is succinctly stated in their article 'Sex in Public':

> By heteronormativity we mean the institutions, structures of understanding, and practical orientations that make heterosexuality seem not only coherent—that is, organized as a sexuality—but also privileged. …It consists less of norms that could be summarized as a body of doctrine than of a sense of rightness produced in contradictory manifestations—often unconscious, immanent to practice or to institutions. Contexts that have little visible relation to sex practice, such as life narrative and generational identity, can be heteronormative in this sense, while in other contexts forms of sex between men and women might not be heteronormative. Heteronormativity is thus a concept distinct from heterosexuality.[4]

[4] Lauren Berlant and Michael Warner, 'Sex in Public', in *Intimacy,* ed. by Lauren Berlant (Chicago: University of Chicago Press, 2000), pp. 311-330 (p. 312).

Several aspects of this are important for my analysis. Primarily, the distinction between heterosexuality and heteronormativity is important both because of its broad cultural importance, and because of certain specific aspects of researching spaceflight. I aim to show in Part Two that extra-terrestrial exploration is based on a presumption of heterosexuality which pervades research and writing on the subject, and which has an inherently restrictive effect on who and what is perceived as belonging in outer space. Further, I will argue that this is relevant more broadly than within the limited number of people who have travelled to outer space, due to the broader role of space in culture that I have discussed[5], and which I will further explore here in the context of sexuality.

As I outlined in the overall introduction, this distinction is also important because 'heterosexual' is an identity label, which by the nature of my research I cannot always accurately ascribe to the subjects I discuss. In part, focussing on heteronormativity allows me to avoid speculating on the identity labels of individual people whose sexual orientation may not be clearly or directly addressed. More importantly, as Berlant and Warner identify, it is heteronormativity, rather than heterosexuality, which exerts the strong and oppressive force of privileged identity and cultural belonging. This is the key aspect of the sexuality of the extra-terrestrial which I wish to address, rather than the sexual identities of any individuals involved in spaceflight.

Additionally, while in some of Part Two I will discuss sex acts, the implications of sexual culture often manifest in areas of culture not overtly identified with sexuality – including, I will argue, spaceflight itself. Berlant and Warner discuss this very issue further, later in 'Sex in Public', in the list they provide of aspects of heterosexual culture, to which I will return in Chapter Five. I will argue in part in this chapter that, given how space travel is constructed in contemporary culture, 'going to outer space' could very well be added to Berlant and Warner's list. As I will show, myriad aspects of human spaceflight research which are not overtly sexual

[5] See pp. 22-23 in my Introduction.

are nonetheless entangled with heteronormative ideas of identity, sexual practice, and the future.

Queering Outer Space

Throughout Part Two I will look at examples of how space culture is subject to the heteronormative structures that other critics have identified in human culture more broadly. I will additionally move beyond this and discuss how the temporal and spatial disorientation of space culture may hold potential for broader criticisms of heteronormative cultural ideals, particularly in Chapter Eight. As in Chapter Four, in which I put forth a similar argument for reading feminist potential in the disorientation of extra-terrestrial space, here I will draw upon examples from the industry to suggest that space may hold potential for expanding more general queer projects around space, time, and the body. The theoretical works I will employ in Part Two illuminate the ways in which space culture is both representative of, and potentially destabilising to, broader cultural assumptions about bodies, sexuality, and the future.

In Chapter Six, Gayle S. Rubin's ground-breaking 'Thinking Sex' forms an important basis for part of my analysis, particularly through her concept of the 'charmed circle' of sanctioned sexual behaviour.[6] In addition to this, Rubin's essay provides an example of a similarity between studies of sexuality and studies of space. Similarly to the introduction to Bell and Parker's *Space Travel and Culture,* which is partially concerned with making a case for allowing study of space in the humanities and social sciences, Rubin's 'Thinking Sex' also acknowledges that sex may strike her readers as an unnecessary or unimportant pursuit.[7] I contend that not only are both sexuality and spaceflight are worthy topics for critical analysis, but also that they are worthy topics to analyse in tandem. Theories of sexuality have rarely

[6] Gayle S. Rubin, 'Thinking Sex: Notes for a Radical Theory of the Politics of Sexuality', in *Deviations: A Gayle Rubin Reader* (Durham: Duke University Press, 2011), pp. 137-181 (p. 152).
[7] See Rubin, pp. 137-138. Michael Warner also refers to this problem in his introduction to *Fear of a Queer Planet*, interestingly, also in the same section in which he discusses space through the example of the Pioneer Plaque; I discuss this in more detail in Chapter Five, pp. 131-133; Michael Warner, 'Introduction', in *Fear of a Queer Planet,* ed. by Michael Warner (Minneapolis: University of Minnesota Press, 1993), pp. vii-xxxi (pp. xxi-xxiii).

been invoked in the study of spaceflight, and throughout Part Two I aim to expand the field of cultural studies of space in this area. At the same time, I will argue that the unique conditions of space make space culture a particularly dynamic and rich topic for the study of sexuality more generally. The culture of space, as I will show, is not divorced from sexual culture as a whole. However, space's unique cultural position can serve as an important catalyst to expand upon the theoretical framework of sexuality studies more broadly. I devote the next four chapters to two questions: What is the sexual culture of spaceflight? And, what does this say about sexual culture, for a spacefaring society?

Chapter Five: Sexual Culture in Space

As I discussed in the introduction to Part Two, part of my analysis of sexuality in space concerns the use of the idea of the (heteronormative) 'family' in space culture. As I will argue, this construction of 'family' is inherently heteronormative. In this section I will use the work of Donna Haraway, Michael Warner, and Lauren Berlant to explicate how the ideas of 'family' and of 'normal' sexuality function in culture, and I will use biomedical, psychological and sociological texts from the space industry to illustrate how these ideas impact upon space culture. In Part One, I examined the presumed masculinity of extra-terrestrial space, and the impact this has on both women astronauts specifically, and on understandings of astronaut bodies more generally. In this chapter and those that follow, I turn my focus to the influence of heteronormativity in these spaces. Like the influence of institutional sexism, I will argue that heteronormativity in spaceflight has important implications for how extra-terrestrial space is conceptualised, and not exclusively for queer subjects. Additionally, just as in Part One I explored how the particulars of outer space can provide unique opportunities for broader feminist cultural critiques, I discuss in this chapter and throughout Part Two how space can be a particularly productive subject for queer critique.

The first section of this chapter concerns two specific examples of heteronormative thinking in space science literature, read alongside Berlant and Warner's framework of heterosexual sexual culture as laid out in their article 'Sex in Public'. Following this, I dedicate the second section to exploring, through Haraway and Warner, the relationships among heterosexuality, 'the family', and the future – a series of relationships to which I will return from a different perspective in Chapter Seven. Through this analysis, I will focus on how the association of heterosexual kinship with the future exists alongside an association between outer space and the future. I argue that these coincident relationships render space culture particularly prone to 'cartoonish' examples of heteronormativity, as Warner writes of the Pioneer plaque in Part Two's second epigraph.

Further to this, and as I will continue to argue throughout Part Two, the particular ways in which heteronormativity emerges in space-related discourses make space an important subject for queer critique. This is not to say that the heteronormativity of space is materially different to the heteronormativity that dominates sexual culture more generally; I do not believe that it is. I do however contend that because of both the ways in which space itself is constructed and the ways in which sexuality is represented in space culture, the question of sex in space is an important and timely one for sexuality studies at large. Specifically, I argue that it is productive to put space and sexuality into conversation with each other because of the role that constructions of the future play in both sexual culture and space culture – and the simultaneous role those cultures play in constructions of the future.

Sexual Culture and Scientific Practice

Prior to the discussion of Haraway and Warner's work on sexuality, the future, and space, I devote the following section of this chapter to two specific examples of discussions of sexuality in scientific literature from the space industry. As I discussed in the Introduction, examination of scientific research forms an important part of my analysis because these texts provide direct access to aspects of space culture which are not as directly addressed in autobiography or even in science communication. I also mentioned in the Introduction that my choice to investigate biomedical sciences led to surprising discoveries about the ideologies of gender and sexual culture which lie at the heart of some of the claims made in this scientific literature. In this chapter I elaborate on these discoveries and apply queer theoretical analysis to further illuminate these aspects of the texts I will discuss.

Between the examples on which I focus in this chapter lies more than three decades of both space science research and broader social change. Despite this, I argue that their marked similarities suggest that heteronormative assumptions about astronauts have remained substantially unchanged in this time. The first of these examples is a 1971 NASA memorandum on the psychological and sociological research relevant to propositions of long-duration spaceflight. As I will argue, the content of this document is overtly sexist and heteronormative,

almost to the point of absurdity. For the second example, I return to Buckey's 2006 text *Space Physiology*, the source of the first epigraph to Part Two, as an important example of how heteronormativity infiltrates contemporary space biomedical practice.[1] Buckey's text lacks the open prejudice of the earlier memo, however as I will show, it still reproduces the same heteronormative assumptions, and in only a superficially different manner. It is also notable that both of these texts discuss sexuality and interpersonal relationships in subjective styles which do not clearly fit with the supposedly objective scientific tone of the texts more broadly. This subjectivity provides some justification for my critique; as I will show, these examples are stepping outside of their own professed scientific disciplines when they speak about sexuality.[2] These are cultural ideas and as such they demand cultural critique. The break from a scientific approach has also shaped the way I have approached the texts I use in Part Two. Specifically, the strangeness of the shift in these examples from scientific objectivity to the reinforcement of cultural norms has guided both my use of theory and my tone in this chapter, as well as those that follow.

Notes on Theory and Tone

In discussing the examples in this chapter's first section, I refer again to Berlant and Warner's 'Sex in Public', this time in reference to their list of aspects of heterosexual sexual culture, which I will reproduce and discuss in more detail shortly. In their somewhat arch list, which includes such items as 'being nepotistic' and 'buying economy size', they illustrate how heterosexual sexual culture asserts itself as a norm in ways which are not widely perceived as

[1] Jay C. Buckey, *Space Physiology* (Oxford: Oxford University Press, 2006).

[2] Of course 'speaking scientifically' is an enormously problematic concept in itself, as I have addressed to some extent in Chapters Three and Four. This is a point on which my analysis is indebted to Haraway, especially her 'Situated Knowledges' – see Donna Haraway, 'Situated Knowledges: The Science Question in Feminism and the Privilege of Partial Perspective', in *Simians, Cyborgs and Women* (London: Free Association Books, 1991), pp. 183-202. In my discussion of Buckey in this chapter I am not actually critiquing the concept of scientific reason within the context of his scientific findings, although the objectivity assumed in this work is also subject to cultural critique. My focus in my analysis of scientific research in this chapter is rather that the texts fail even on their own terms when they incorporate material which is so undeniably based upon subjective cultural mores, as I will discuss further.

sexual.[3] Regardless, they argue, these seemingly non-sexual affairs are all characteristics of privileged sexuality, and the privileged nature of *hetero*sexuality is part of why these things are not perceived as sexual. Heteronormativity is so entrenched that it can be difficult to detect, because it disguises cultural mores as facts. As I will argue in this chapter, the invisibility of heteronormative sexual culture can result in the inclusion of subjective (and, frankly, bizarre) material in texts which otherwise employ a tone of supposed objectivity. As Berlant and Warner among others have argued, heteronormative sexual culture is rendered invisible by the very fact that it constructs itself as natural and normal.[4] This is also why bringing light to this material is, I argue, so important to analyses of space culture. Unquestioned, this subjectivity masquerading as scientific investigation risks further reinforcing limitations on who and what is perceived as belonging in outer space.[5]

Berlant and Warner's 'Sex in Public' is extremely useful in illuminating these issues thanks to their cogent articulation of both the concept of heteronormativity and the concept of sexual culture beyond the sex act. There is also another reason why I choose to read the examples closely alongside this piece in particular. Berlant and Warner acknowledge that their list of aspects of sexual culture is at least partially humorous, however they go on to explain that it still sincerely illuminates what they refer to as the 'constellation of practices' that reinforce the primacy of heteronormative culture, and thus solidify 'the cruelty of normal culture even to the people who identify with it.'[6] In a similar vein, I cannot pretend that all of the artefacts I examine in this chapter, and in those that follow, can or should be accepted on an entirely serious level. Nonetheless, as I will argue, they are deeply important to an analysis of the gendered and sexualised aspects of extra-terrestrial spaces.

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[3] Lauren Berlant and Michael Warner, 'Sex in Public', in *Intimacy,* ed. by Lauren Berlant (Chicago: University of Chicago Press, 2000), pp. 311-330 (p. 319).
[4] Michael Warner writing alone in *Fear of a Queer Planet* also lucidly argues this point; I discuss this in some detail in this chapter's second section. Michael Warner, 'Introduction', in *Fear of a Queer Planet,* ed. by Michael Warner (Minneapolis: University of Minnesota Press, 1993), pp. vii-xxxi.
[5] Here I return to Penley's *NASA/Trek* and her discussion of how gender and sexual possibilities are limited by NASA's public construction as a masculine, heterosexual institution; in addition, I will further flesh out these ideas of who and what belongs in the cultural spaces of outer space in Chapter Six. Constance Penley, *NASA/TREK: Popular Science and Sex in America* (London: Verso, 1997).
[6] Berlant and Warner, pp. 319-20.

Further, Berlant and Warner's contention that heteronormativity exhibits 'cruelty […] even to the people who identify with it' concerns another important part of the foundation of this chapter, and indeed the thesis as a whole. As they claim, the universality of heteronormativity is oppressive not only to individuals and identities which are subjugated to heterosexuality, but even to privileged individuals and identities. Many of the theoretical works I discuss in Part Two have this in common, including 'Sex in Public' and the work of Donna Haraway, as I discuss in this chapter: they specifically articulate that heteronormativity harms not just queer subjects, but everyone.

I will discuss this in more detail as I address each theoretical text in turn, because this is key to my argument that issues of sexuality in spaceflight compel scrutiny. Regardless of the identities of the individuals who participate in spaceflight, the universality of heteronormativity's 'cruelty' combines with the reach of space culture beyond individual astronauts to make this topic less niche than it may appear. A queer perspective on spaceflight is neither just about queer subjects, nor just about spaceflight.[7]

'Sex in Public' and Sex in Space

As I explained in the introduction to Part Two, when I speak of heteronormativity I refer to Berlant and Warner's definition from their 'Sex in Public'. This article also includes what I have earlier referred to as a list of aspects of heterosexual culture; Berlant and Warner present this list as a series of examples of how sexual culture operates both in the service of the idealised sex act, and seemingly separately from it. The sex act is the core of heterosexual culture, but much of the cultural work that goes on to support this construction happens in an apparently non-sexual manner. They write:

> The sex act shielded by the zone of privacy is the affectional nimbus that heterosexual culture protects and from which it abstracts its model of ethics, but this utopia of social belonging is also supported by and extended

[7] I will explore this concept further in this chapter, and I will return to it throughout Part Two, but especially in Chapters Six and Eight.

> by acts less commonly recognized as part of sexual culture: paying taxes, being disgusted, philandering, bequeathing, celebrating a holiday, investing for the future, teaching, disposing of a corpse, carrying wallet photos, buying economy size, being nepotistic, running for president, divorcing, or owning anything 'His' and 'Hers.'[8]

Berlant and Warner acknowledge that this list is at least partially humorous and that it is neither exhaustive nor intended to condemn the activities described.[9] As I have mentioned, the humorous aspect of this list is part of the reason I refer to it. The examples I discuss in this section are certainly difficult for me to read with a straight face (so to speak), and I contend that this is also part of what makes them important. The following case studies are, frankly, strange, and they do not seem to clearly fit into the scientific texts from which they are extracted. That very fact underscores how heterosexual culture is taken for granted in activities far beyond the normative sex act. Based on the examples I discuss below, I would argue that a productive addition to Berlant and Warner's list could be: *going to space.* To explain this, it is necessary to discuss just what is meant by 'going to space', and what other cultural concepts are entangled with it. In this chapter I will look specifically at how the idea of the future is interwoven with the idea of space. This has important implications for reading the heteronormativity of these texts, as I will argue.

'The question of direct sexual release': Sex in NASA, 1971

The first text I will consider is a 1971 NASA memorandum on the subject of isolation and crew health in long-duration space missions. The future of space is at the heart of this document, for at the time, long-term spaceflight was purely speculative. I concentrate on one passage in particular from this document, which focusses on what the authors refer to as 'direct sexual release'. I have selected this extract because the treatment of sex and sexuality in this passage reveals underlying sexist and heterosexist assumptions in the scientific practice at NASA in this

[8] Berlant and Warner, p. 319.
[9] '…to make it and to laugh at it is not immediately to label any practice as oppressive, uncool, or definitive.' Berlant and Warner, p. 319.

era. As I argue later, some of these assumptions persist into more recent research. In 1971, however, they are exceptionally blatant.

This passage is one of few direct references to sex in NASA documents, which speaks to the culture of avoidance that Casper and Moore identify.[10] This passage also highlights the conflation of the topic of sex and the topic of gender that I have discussed in Part One, and in a particularly stark manner. Sexism and heterosexism are closely linked in this document, as this passage shows.

The paragraph reads, in its entirety:

> The question of direct sexual release on a long-duration space mission must be considered. Practical considerations (such as weight and expense) preclude men taking their wives on the first space flights. It is possible that a woman, qualified from a scientific viewpoint, might be persuaded to donate her time and energies for the sake of improving crew morale; however, such a situation might create interpersonal tensions far more dynamic than the sexual tensions it would release. Other means of sexual release (masturbation, homosexuality) would be discouraged because of the confined quarters and the lack of privacy on such a mission. Thus, it appears that methods involving sublimation are more practical than these more direct alternatives.[11]

There is a great deal to unpack in this passage. First, it provides a particularly clear example of the secondary status afforded to women in the American space programme at the time; it is apparently unthinkable that a woman might go into space as anything other than a male astronaut's sexual partner, this despite the fact that Valentina Tereshkova had gone to space, by herself, nearly a decade prior to this memorandum. Here, as in the early years of NASA

[10] See Monica J. Casper and Lisa Jean Moore, 'Inscribing Bodies, Inscribing the Future: Gender, Sex, and Reproduction in Outer Space', *Sociological Perspectives* 38:2 (1995), pp. 311-333, pp. 318-319.
[11] Nick A. Kanas and William E. Fedderson, 'Behavioral, Psychiatric, and Sociological Problems of Long-Duration Space Missions', *NASA Technical Memorandum X-58067* (1971).

generally, women are considered only secondarily – when they are considered at all. Still, the authors speculate, the combination of scientific expertise and sexual availability could possibly justify a woman's additional weight.

The idea of an unpaid scientist-prostitute is, however, ultimately rejected due to the negative impact she might have on 'interpersonal tension' (the tension among the men, it is presumed, not for the woman being 'persuaded to donate her time and energies'). The idea of female sexual partners thus summarily dismissed, the memorandum now suggests two alternatives, both clearly distasteful to the authors. Masturbation and homosexuality are proposed only to be rejected out of hand, for the reasons of 'confined quarters' and 'lack of privacy'. This rationale forms a bizarre juxtaposition with the logic behind the rejection of a woman's 'time and energies' as a means of release: in effect, Kanas and Fedderson are arguing that autoerotic or homosexual sex acts both require more physical space and more seclusion than does sex with a woman.[12] This implicit claim seems absurd, however, on closer analysis it simply reflects the underlying assumption that heterosexual intercourse is normal, good, and universally accepted as such. The implication in the appeal to the need for space and privacy is that homosexuality and masturbation are both so dangerous to the social maintenance of a space crew that more space and privacy would be of greater concern were anyone to indulge in such activities. Sex with a woman, by contrast, requires less concealment and separation, because of the privileged cultural position occupied by such an act. Masturbation and homosexuality 'would be discouraged' not because these activities objectively require more space or discretion than heterosexual sex, but because they are not supposed to happen at all.

[12] In September 2015, Adam Cole spoke with Nick Kanas about this passage from the 1971 memo. Cole reports that Kanas claims this was 'tongue in cheek'. This does not influence my interpretation of the influence of normative ideologies of sex and gender in the passage. The Cole piece additionally raises a number of issues I have addressed in Part One, as his inspiration in writing it is the fact that, when the public were asked to submit questions for a discussion session with several people from NASA, all of whom happened to be women, the most-asked question was, as the article's title states, 'What Happens When You Get Your Period In Space?'. That this was the most common question asked by the public in 2015 is something to which Cole applies no critical attention. I attempted to contact Cole regarding this via his Twitter but he did not respond. See Adam Cole, 'What Happens When you Get Your Period in Space?', *NPR,* 18 September 2015 <http://www.npr.org/sections/health-shots/2015/09/17/441160250/what-happens-when-you-get-your-period-in-space> [accessed 21 September 2015].

Heterosexual sex is further distinguished from the looming 'other means of sexual release' by the contrast in terminology. Masturbation and homosexuality are just that: '(masturbation, homosexuality)'. Heterosexual intercourse – among, presumably, one woman and, presumably, several men (however, presumably, not all at once, though I can only speculate) – is simply a woman's 'time and energies'. This euphemistic treatment reinforces the boundary between normative and deviant sex and demonstrates the reverence granted to the former.[13] It also situates the question of sex in space within the question of women in space. As I have argued and will continue to argue, the conflation of women with sexuality is common in the space industry, and this example is no exception. In addition to this, the way that masturbation and homosexuality are parenthetically included implies parity between these two as apparently equivalent 'other means of sexual release'. For this reason, I argue this cannot be considered recognition of homosexuality as an identity, or even as a sexual behaviour in and of itself. Both masturbation and homosexual behaviour are here raised as threats to normativity, to be dealt with only in the absence of women. Indeed the authors clearly assume they would occur only in an all-male crew. This false dichotomy further reinforces the favoured status of heteronormative sex by assuming its universality. At the same time, this also reflects a specific culture of concern over the prospect of male astronauts turning to one another for sexual or relational satisfaction after long periods of mutual isolation, a concern which is also referenced in Casper and Moore's research.[14]

I will now turn my attention to the more recent, yet very similar, example of Buckey's discussion of sex in *Space Physiology*. As I discussed in Chapter Three, Buckey's *Space Physiology* is constructed with a particular air of authority, both through the credentials of

[13] Fundamental to my reading of this, in addition to 'Sex in Public', is the work of Gayle S. Rubin in defining the framework of the 'charmed circle' and 'outer limits' of sex in her 'Thinking Sex'. Gayle S. Rubin, 'Thinking Sex: Notes for a Radical Theory of the Politics of Sexuality', in *Deviations: A Gayle Rubin Reader* (Durham: Duke University Press, 2011), pp. 137-181. I will refer to this work in more detail in Chapter Six.

[14] I will discuss this concern identified by Casper and Moore in more detail in Chapters Six and Eight.

Buckey himself and through the composition of the text itself.[15] It is also relatively recent – its publication in 2006 renders it far more relevant to contemporary spaceflight than the 1971 memorandum. Still, the treatment of sexuality bears marked similarities to that of the earlier text. In addition to the general presumption of heteronormativity, the texts share two other distinctive elements, as I have mentioned: they both confuse the issues of gender and sexuality, and they both diverge from scientific objectivity when addressing the topic of sex.

'for a greater good (fidelity)': Sex in Contemporary Space Science

Buckey's discussion of sexuality occurs in two chapters, one entitled 'Psychosocial Support: Maintaining an Effective Team', and one entitled 'Gender: Identifying and Managing the Relevant Differences.'[16] In many respects, Buckey addresses gender and sexuality in relatively progressive ways, as I have discussed in Chapter Three. Additionally, in the earlier psychosocial support chapter, Buckey even goes so far as to acknowledge the existence of homosexuality: 'because a significant percentage of the population is homosexual,' he writes, 'single-gender missions do not necessarily preclude intimate relations.'[17]

Still, Buckey's text makes some problematic assumptions about both gender and sexuality. I have discussed the gendered components of this in Chapter Three; in terms of sexuality, the text falters on a number of points. First, the presumption of a binary and fixed understanding of sexual orientation and 'intimate relations' is obvious, and this necessarily limits Buckey's analysis. Even the much earlier Kanas and Fedderson research into isolation and crew relations acknowledged the potential for homosexual behaviour among otherwise 'normal' crewmen; it is thus notable that Buckey makes no mention of this prospect in his analysis.[18] That this is the only mention of such intimate possibilities is notable considering the detail of his later discussions of sexuality in his chapter on gender. The detail, however, is

[15] See p. 42 in Chapter One.
[16] Buckey, pp. 35, 42, 207-221.
[17] Buckey, p. 42.
[18] As I mentioned, Kanas and Fedderson's work does not consider homosexuality as an identity category, just as a possible behaviour; while Buckey's acknowledgement of homosexual identity shows the increased acceptance of gay people in modern scientific practice, he simultaneously fails to address any sexual possibilities beyond the boundaries of strict identity category.

notably turned toward not only heteronormative, procreative intercourse, but toward very specific aspects of human sexuality, for which Buckey does not always provide clear evidence of relevance to the field of spaceflight.

Under the subhead ‘Single- versus Mixed-Gender Crews’, Buckey provides the following stream of statistics:

> As already mentioned, mixed-gender crews can experience sexual jealousies and rivalries. This has occurred at Antarctica [27]. Also, the drive for sex is a strong and important part of human nature. A recent National Opinion Research Center (NORC) survey reports that married couples in the age range of the astronaut corps have sexual intercourse approximately 60—70 times a year [33]. On one hand, infidelity is common in everyday life and might easily occur when people are in close contact for a long time in a confined environment. On the other hand, people can restrain their sexual urges. The NORC survey mentioned above summarized scientific surveys about extra-marital relations. Overall, these data indicate that extramarital affairs are less prevalent than popular media accounts would suggest. Approximately 3—4% of currently married people have a sexual partner besides their spouse in a given year. Only about 15—18% of ever-married people have had a sexual partner other than their spouse while married [33]. In other words, in everyday life, even though many people work closely with members of the opposite sex, they still manage to remain faithful. One conclusion is that many married people know not to seek out or encourage other relationships that would damage their marriage. During times of war, many couples remained faithful through long separations. In Naval service, although some married sailors have been involved in extramarital relationships during long separations, many have not. In fact, the Uniform Code of Military Justice makes adultery illegal in the military.

> Individuals with normal sexual urges have honored vows of religious celibacy. Almost 30% of unmarried individuals (which includes those who may have been widowed or divorced) in the 40—49 age group reported having no sex at all in the previous 12 months in the NORC survey [33]. Often sexual tension can be relieved without intercourse (e.g. masturbation). Studies suggest that about 45% of married women and 85% of married men masturbate regularly [34]. Overall, the data show that while sex is a powerful urge, it is also possible for people to control this urge for a greater good (fidelity) and to abstain from sexual intercourse when necessary.[19]

The number and variety of unexamined assumptions Buckey makes here about relationships, lifestyle, and behaviour are interesting, as is the introduction of any of this information with no clearer transition than what is seen within the paragraph.[20] Many questions are invoked by this passage. Why does Buckey offer the illegality of adultery in the military as evidence of the prevalence of marital fidelity? Why, indeed, does he present the concept of fidelity alongside issues of scientific importance to human health? Why is masturbation relevant to this discussion at all, and particularly why is it the masturbation of married people that we are asked to contemplate?

The lack of transition into the statistics on masturbation among married couples is particularly notable, and does not clearly follow even the logic of the remainder of the passage. Further, there is in fact no discussion of physiology at all in this passage. What, then, is Buckey's point? His stated intention is, of course, to explore the unique challenges of gender relations among spaceflight crews – certainly, an important topic. However, the lack of clear connection between the statistical survey data and the information which follows from this

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[19] Buckey, pp. 217-218.

[20] I wish to emphasise that I have omitted no contextual material from this excerpt. None of the surrounding text provides any clear rationale for the choice of material to include.

point in the chapter – which is primarily about the physiology of reproductive and urogenital health – speaks to the impact of culture upon space biomedical research.

The idea of marital fidelity as a universal 'greater good' is not a scientific one.[21] Nor, arguably, are surveys based on self-reported data of the highest standard of empirical respectability. Ultimately, Buckey imagines a space crew full of heterosexual, married (to spouses who remain on Earth) astronauts who share his morality around sex and marriage. Further, he exposes these assumptions in the chapter of his physiology book which purports to be focussed on gender. Again, the topics of gender and sexuality are conflated in this research. This reveals that even in the recent era of spaceflight, where women are—though still a minority—commonplace, the astronaut is still presumed to be a male figure, and a heterosexual one. This explains the continuing tendency to discuss sex and women in the same breath – in this case, to discuss sex in a section dedicated to gender. The idea that sexual possibilities are related to gender – where discussions of 'gender' are mainly discussions of reasons to and not to include women – exposes the assumption that space is otherwise populated with heterosexual men. This assumption is important because when it appears in scientific and industry practice, it grants itself objective weight. That even space biomedical science assumes that space is a place for heterosexual men first and foremost places real conceptual limits on who and what belongs in space, a topic to which I will return in Chapter Six.

As I argue in the following section, the issue of what Berlant and Warner call 'social belonging' is entangled with not only sexual culture but also conceptions of the future in myriad ways. While on one hand, space culture is simply a part of this broader phenomenon, I also contend that there are specific aspects of space that reinforce these connections. As I will discuss in the following section, it is that question of the future – which, perhaps, Berlant and

[21] It is also worth noting that Buckey writes for an audience in a branch of the United States federal government, and at the time of his writing same-sex marriage was not federally recognised. Despite his explicit acknowledgement of homosexuality as something that exists, this is another small example of how he continues to presume a heterosexual norm among the astronaut corps.

Warner synecdochically reference in their list item, 'investing for the future' – which I argue forges the link between space culture and heteronormativity that extends beyond the general context of heteronormative culture, and operates in ways specific to the topic of spaceflight.

Space, Sex, and the Family

As I discussed in the introduction to Part Two, in *Space Physiology,* Buckey also invokes the idea of 'the family' in his discussion of space crews. In this example, the link between space discourse and the idea of the family is particularly clear in the use of a specifically heterosexual family as a model for ideal crew relationships. In the examples I have discussed in this chapter, the heterosexual family is not so directly referenced. However, these examples still invoke the idea of the heterosexual family through the cultural and sexual norms that are reproduced.

As theorists in gay and lesbian studies and queer theory have argued, culture as a whole privileges heterosexuality and a particular image of the heterosexual family above other sexual orientations and familial and social arrangements. I will shortly discuss in more detail several theorists who have argued this in texts which form the foundation of my own argument regarding the heteronormativity of space. As I discussed in Chapter One, other scholars have compellingly argued that outer space is part of human culture, and so it is available for cultural study and critique. I contend that it thus stands to reason that space culture is constructed as heteronormative: mainstream culture is heteronormative, and space is part of culture, so to conclude that heteronormativity exists in space culture is not necessarily a surprise. However there are aspects of space in particular which may make just such a conclusion surprising.

Donna Haraway argues that space is culturally constructed as something which exists outside of or beyond the reaches of human culture.[22] At the same time, as I will discuss further, space is culturally associated with the future in complex and important ways. I will argue in this chapter that this connection to the future provides a rich field in which to analyse

[22] As I discussed in the Introduction: see p. 5. Donna Haraway, 'The Promises of Monsters: A Regenerative Politics for Inappropriate/d Others', in *The Haraway Reader* (London: Routledge, 2004), pp. 63-124, p. 92.

the heteronormativity of space. The link between space and the future, I argue, complements a heteronormative view of 'the family' which privileges heterosexual reproduction as humanity's way of accessing the future. While the heteronormativity I identify in space discourse is certainly not divorced from sexual culture more generally, I will argue that the threads of heteronormativity, the future, and outer space intersect in ways that specifically impact on the construction of outer space as a heteronormative space, and of astronauts as presumed heterosexuals.

In this section, I discuss two theorists who have explored connections among heterosexuality, the future, and outer space: Donna Haraway and Michael Warner. Space is not the primary focus of either of the texts I will focus on by these authors, but both use examples from space culture in the service of arguing their points about heteronormativity, and I will use their work to support my own argument about the instability of reproductive narratives of spaceflight. As I will show, spaceflight is connected to cultural ideas of the future in particular ways, and as these theorists argue, cultural ideas of the future are imbued with heteronormativity. As Haraway and Warner suggest, cultural ideas about sex and 'the family' restrict those who fall outside of the boundaries of these ideas from symbolically accessing space. The relationships among space, the future, and sexual culture bolster the construction of space as a place of heterosexuality. As I will show throughout this chapter, this inhibits the objectivity of space science research, and ultimately limits who is perceived as belonging in, or having access to, outer space. I will further explore the connections between space, reproduction, and the future in Chapter Seven, where I will illustrate further links between these associations and the aesthetics of space culture. In this chapter, my focus will be more generally on how these theorisations of sexuality and the family impact upon the discourse of human futures in space.

Donna Haraway: Heterosexuality and the Future

As I discussed in my Introduction, Haraway draws a distinct connection between space and cultural ideas of the future in her essay 'The Promises of Monsters: A Regenerative Politics for

Inappropriate/d Others'. In illustrating the cultural role of both space and the African wilderness, Haraway writes that 'Space and the tropics are both utopian topical figures in Western imagination, and their opposed properties dialectically signify origins and ends' for humanity; while the wilderness is associated with human beginnings, '[s]pace is not about "man's" origins on earth but about "his" future.[23]

Elsewhere in her work, Haraway illustrates how the idea of the future is also implictly constructed as heterosexual – and how this has an oppressive impact on society at large. In *Modest_Witness@Second_Millennium.FemaleMan©_Meets_OncoMouse™*, Haraway explores how the unity of the human species is celebrated through a heteronormative, reproductive idea of 'family'. Through this limited source of universalised community, Haraway argues, such celebrations of human connectedness in fact reinforce division and limit the cultural possibilities afforded to members of the human species. In this way, Haraway argues, ideas of the future and of humanity itself become bound to the universalisation of heterosexuality in a way that is ultimately damaging to 'the human collective'. As she writes, what is left out or 'not collected in a reproductive family story does not finally count as human.'[24]

Haraway discusses two artefacts: *Fossil Footprint Makers of Laetoli*, a 1970s painting by Jay Matternes of the pre-*homo sapiens* hominids speculated to have left footprints found preserved in volcanic ash, and *The Family of Man*, the coffee table book from the Museum of Modern Art in New York which reproduces its 1955 photographic exhibit of the same name. In discussing *Fossil Footprint Makers of Laetoli* and *The Family of Man*, Haraway argues that these artefacts 'stage the relations of nature and culture mediated by the heterosexual, reproductive, nuclear family as the figure of human unity and diversity.'[25]

This has important implications for non-normative sexual identities and practices, but it has broader significance for understanding the nature of sexual identity and practice itself. In

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[23] Haraway, 'Promises', p. 92.
[24] Donna Haraway, *Modest_Witness@Second_Millennium.FemaleMan©_Meets_OncoMouse™* (London: Routledge, 1997), p. 243.
[25] Haraway, *Modest_Witness*, p. 241.

writing about *The Family of Man*, Haraway illuminates how universalised and naturalised these images of the heterosexual family are to our understanding of humanity. *The Family of Man*, Haraway writes, is a 'vehemently antiracist' vision of human community, but one which uses as its universal language the language of heteronormative family. Instead of its intention to emphasise harmony through (racial) difference, the image of 'multihued children' which Haraway terms 'seeds of the future' only serves the 'multiplication of sameness'.[26] This reproductive unity draws a line around a naturalised sexuality, using images of the procreative family, to the exclusion of all other forms of being human. Familial or communal ties that exist outside of this structure are thus defined as less than human.

The anti-racist ideal of human unity Haraway identifies in this book bears great similarity to much of the discourse around space, which tends to posit an idealised future of international cooperation and the dissolving of racial boundaries; the work of Frank E. White on the 'overview effect' which I explored in Chapter Three is a particularly clear example of this, and as I argued there, this idealised construction contains many problematic elements. As Haraway explains here, the use of heteronormative assumptions about gender and sexuality services this idea of a diverse-but-unified humanity, while doing a great disservice to the true breadth of human diversity.

Read alongside Haraway's own work on space as 'man's' future, her work here on heterosexuality and the future illustrates how male dominance, heteronormativity, and outer space are conceptually linked. Haraway also draws a parallel in this section between the 'small step for man' taken by Neil Armstrong in the first moon landing and the fossilised footprints of the 'First Family' of Laetoli in discussion of the cultural position of the heteronormative family. Haraway calls the moonwalkers the 'space-faring descendants of the First Family', which evokes her own articulation of space as humanity's future and the African wilderness as its past in Western thought.[27] Through space culture's connection to the future, cultural

[26] Haraway, *Modest_Witness*, p. 243.
[27] Haraway, *Modest_Witness*, p. 241.

associations between the future and reproductive kinship are embedded within space discourse, including the examples I have previously discussed in this chapter. The idea of a 'First Family' referenced in Matternes's painting evokes the Biblical figures of Adam and Eve, as Haraway identifies.[28] These figures are also visually referenced in the images inscribed on the Pioneer Plaque, which Michael Warner uses to discuss the heteronormativity of social theory in his introduction to *Fear of a Queer Planet*, a text which further elucidates the links among space, heteronormativity, and constructions of the future.

Michael Warner and the Pioneer Plaque

Despite the astronomical implications of the Warner-edited collection, *Fear of a Queer Planet* is mostly not about space. However, importantly for my project, in his introduction Warner uses an example from the space industry to illustrate the necessity of applying a critical lens to sexual culture. Warner discusses the Pioneer Plaque, which was sent into space aboard NASA's *Pioneer 10* spacecraft and carries images deemed ideal to express something of the essence of humanity to whatever extra-terrestrial being may one day intercept it. As discussed in Chapter Two, Carl Sagan was responsible for the images inscribed on this plaque, designed to last the millennia it might take to ever reach an intelligence that could understand it. It is also designed to serve as a representative of the culture that produced it. It is for this reason that Warner critiques its use of an image of a heterosexual couple for this purpose.[29]

As I argued in Chapter Two in discussing Joe Davis's extra-terrestrial radio transmissions, Warner also claims that messages sent to space reflect the culture of Earth more than any potential extra-terrestrial culture. Choosing to represent human figures in a way that would be recognised in Sagan's own culture as a heterosexual couple, Warner argues, says more about earthbound cultural anxieties than it does about anything else. In the second epigraph to this chapter, which is drawn from Warner's analysis of the Pioneer Plaque, Warner is referring to the human figures when he writes that heteronormativity 'is seldom so

[28] Haraway likens the destruction depicted in the painting to '[e]xpulsion from Eden'. See *Modest_Witness,* p. 241.
[29] Warner, pp. xxi-xxiv.

cartoonish'.[30] Implicit in this choice of an image to represent humanity is, Warner argues, a disavowal of the fear of the book's title – that Earth might be a queer planet. Warner writes:

> To a native of the culture that produced it, this bizarre fantasy-image is immediately recognizable not just as two gendered individuals, but as a heterosexual couple […] It testifies to the depth of the culture's assurance (read: insistence) that humanity and heterosexuality are synonymous. This reminder speeds to the ends of the universe, announcing to passing stars that earth is not, regardless of what anyone says, a queer planet.[31]

The way that the Pioneer Plaque is positioned as a representation of the entirety of humanity to the entirety of the cosmos places it in a unique cultural position, one which is uniquely afforded by space as an avenue of transmission. This grandiosity of the Pioneer Plaque, as Warner illustrates, speaks to space's cultural positioning more generally; the Plaque's announcement, 'to the ends of the universe', is the ultimate claiming of a cultural identity and position. This suggests that if humans insist to the very cosmos that 'earth is not […] a queer planet', it must really be true.

At the same time, the choices made in how to represent humanity to potential extra-terrestrials says less about what we think of those extra-terrestrials than it does about what we think of ourselves. As Warner writes, 'the depth of the culture's assurance […] that humanity and heterosexuality are synonymous' is uniquely apparent when the affirmation of a heterosexual humanity is blasted across outer space. That representing the human species is so fundamentally bound to an image of heteronormativity speaks to both the magnitude of heteronormativity and the cultural weight of space as a medium or an audience.

Space and the Future

Warner demonstrates how space provides a mode of universalisation for heteronormativity. In addition to this, the connection between heterosexual reproduction and visions of the future

[30] Warner, p. xxiii.
[31] Warner, p. xxiii.

relates to space through the association between space travel and the future, as I will discuss. As Haraway argues (as does Lee Edelman, as I will explore further in Chapter Seven), the idea that the future is intrinsically related to heterosexual reproduction is culturally situated and not strictly natural, although it is constructed upon the underlying belief that it is natural above all else.

Similarly, the belief that space and the future are intrinsically linked is both potent and, upon analysis, unstable. When David Bell and Martin Parker refer to the Apollo programme as 'a future that never happened', they refer to both of these aspects of space's futuristic spirit.[32] When the question of sex arises in the space industry, the common assumption of heterosexuality often manifests as a conflation of sex with childrearing. This is not an unusual manifestation of heteronormativity, however I contend that the heteronormativity of space culture is particularly likely to operate in this way because both heterosexuality and space itself are so strongly associated with the future.

The future is the subject of much writing about space, including the examples from Kanas and Fedderson and Buckey, although neither directly addresses this. At the time of the 1971 memorandum, spaceflights had only reached relatively short durations, so the need to research potential crew impacts in the longer term was only hypothetical. By 2006, Buckey had decades of research into the long-term experiences of astronauts on both the Soviet and International space stations, yet Buckey still situates his text as serving a future goal. It is not just heteronormativity that has remained despite the thirty-some years between the texts I discuss in what remains of this chapter; both also speak in service of the eventual aim of crewed missions to Mars. In 2006 as in 1971 and in 2015 as I write, human spaceflight to Mars was and remains purely speculative. Yet Buckey begins his preface to *Space Physiology* with

[32] I will explore Bell and Parker's discussion of the temporal positioning of outer space in much greater detail in Chapter Seven. David Bell and Martin Parker, 'Introduction', in *Space Travel and Culture,* ed. by David Bell and Martin Parker (Oxford: Blackwell, 2009), pp. 1-5 (p. 4).

the sentence: 'The possibility of sending people to Mars no longer resides solely in the realm of science fiction.'[33]

On the preceding page, Dave Williams concludes his foreword to the book by sharing his 'dream' of a human flight to Mars 'by the fiftieth' – that is, by the fiftieth anniversary of the Moon landing in 1969. As I write in 2015, the goal of a mission to Mars by 2019 already looks less feasible than it may have seemed even in 2006.[34] Still, regardless of the feasibility of this future, the fact that space research looks toward the future is one of the ways in which heteronormativity lurks in discourse that is intended to be universalising. In these texts, assumptions about who and what will ensure a future in space speak to the heteronormativity underlying space culture.

In Chapter Seven, I will pick up the thread of space's temporal positioning once again, and I will expand the question of the future through the concepts of temporal disorientation, queer temporality, and retrofuturism. Prior to this, in the next chapter I will discuss in more detail the question of who and what belongs in space, particularly focusing on sex acts and queer theories of space.

[33] Buckey, p. ix.
[34] I will briefly discuss the more high-profile speculative Mars mission of late, the Mars One project, in the Conclusion, including the widespread criticism it has garnered for its stated goal of a Mars mission.

Chapter Six: Space for Sex

Has anyone ever had sex in space? While it is not my intention to address this question directly in this chapter, it is very relevant that there is certainly no shortage of people asking this question.[1] The texts I discuss in this section come from media and industry sources; despite these varied origins, these stories all bear marked similarities to each other, beginning with their shared interest in the question of sexual activity beyond the Earth's atmosphere. Asking the question itself, I will argue, betrays certain cultural assumptions about sexual behaviour; the markedly uniform ways in which it is asked, I will further argue, reveal even more about sexual culture in space.

Discussions of sex in space tend to focus on the same three specific issues: privacy, hygiene, and logistics. These three concerns have roots in the practicalities of spaceflight: privacy in the cramped conditions of a spacecraft is hard to come by; without normal gravity, movement is difficult, particularly when more than one body or object is involved; and in the highly efficient and carefully maintained environment of a spacecraft, personal and environmental hygiene are both difficult and exceptionally important. Practical though these concerns may seem, they are not entirely or solely practical and they provide a wealth of evidence of the influence of cultural assumptions about sex. More specifically, the concerns raised about sex in space point to a very specific idea of what sex is, and as I will argue, this is one source of the heteronormativity of space.

In making an assumption about what kinds of sex acts may occur in space, these texts reveal underlying assumptions about what kind of people are imagined as having access to space. I have written in Chapter Five about how similar assumptions are revealed in the space

[1] For one discussion of the range of interest in this topic, see Mary Roach, *Packing for Mars: The Curious Science of Life in Space* (Oxford: Oneworld, 2010), especially pp. 192-208. On a personal note, when I presented an early version of Chapters Five-Six at the Cosmographies conference at Falmouth University in July 2014, the general consensus among audience members with industry connections was that it was well known within the Russian space programme that a pair of *Mir* cosmonauts had at some point engaged in an extra-terrestrial sex act. My research has uncovered no official acknowledgement of this. What I have uncovered is widespread speculation, especially about a particular pair of *Mir* cosmonauts, as I will discuss later in this chapter, which makes me sceptical of the appeals to authority from those Cosmographies attendees.

industry through heteronormative thinking about the future and 'the family'. In this chapter I turn my attention to more direct discussions of sex in extra-terrestrial spaces. I will approach these while focussing on the three common concerns which tend to be raised, as I have mentioned: privacy, hygiene, and logistics.

Albert A. Harrison, a psychology professor who worked in psychological aspects of spaceflight offers a particularly clear example of the importance of these three problems for extra-terrestrial sex acts in his book *Spacefaring: The Human Dimension*.[2] In a chapter devoted to what spacefarers might do while 'off duty', Harrison writes:

> Spaceflight conditions will affect the sheer mechanics of sex. Microgravity invites experimentation with previously impossible positions and acts. However, spaceflight also makes sex physically difficult and, by some North American standards, unappetizing. There is little or no privacy. Lovers cannot count on gravity to stay in place—a consideration that led one inventor to develop a special leather harness that anchors one partner by the hips while nonetheless permitting undulating motions.[...] Air filtration systems are imperfect and personal hygiene facilities are limited, meaning that it is not so easy to clean up afterward. Of course, as people who have had sex in the backseat of a VW bug or in the boiler room of a tramp steamer know, none of this is prohibitive. It's just that for now, sex, like almost every other activity, will proceed without the comfort and amenities we are used to on Earth.[3]

In this passage, Harrison raises all of the most prominent concerns in discussions of sex in space: privacy, cleanliness, and gravitational and spatial constraints. Elsewhere in this chapter, he also addresses the influence of both morality and politics on such discussions,

[2] Albert A. Harrison, *Spacefaring: The Human Dimension* (Berkeley: University of California Press, 2001).
[3] Harrison, p. 195.

claiming that NASA avoids discussing sex directly because 'sex outside of marriage (or even within marriage but at taxpayer expense) still runs against the grain of some Americans'.[4]

The use of the specific examples of the 'backseat of a VW bug' and 'boiler room of a tramp steamer' perhaps say more about the author's generational and cultural background than about the question of sex in space, however they are still interesting examples and ones which speak to the broader context of space's sexual culture. Harrison's allusion here to public sex may seem to align sex in space with earthbound sexual deviance. As I will discuss in this chapter's first section, sex in space is indeed constructed with a fraught relationship to ideas of public and private space. Additionally, Harrison makes mention of the 'previously impossible positions and acts' which may be enabled by microgravity, an allusion to sexual possibility which diverges from a strictly normative view of human sexuality. At the same time however, as I will argue, discussions of sex in space often display a disciplinary response to the possibility of such deviance even as they allude to it.[5]

As I have discussed both in the preceding chapter and in Part One, discussions of sex in space are often implicit, and often conflated with discussions of gender, familial relations, and broader morality. As I will discuss in this chapter, however, there are examples of sex being discussed more directly, and so queer studies texts which similarly address sex acts thus provide a useful lens for this section. Using these theoretical works alongside examples of discussions of sex in space, I will argue that space culture uniquely struggles with its own treatment of sex. While on one hand, there is a great deal of interest and excitement around sex in space and its attendant possibilities, at the same time there is great cultural disorientation around what this could mean for sexual culture more broadly. I argue that the discomfort around sex and sexuality in space speaks to a fear that when humans leave the

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[4] Harrison, p. 195. Harrison's assumptions about the sensibilities of Americans/North Americans in these passages bear further study, beyond the limited scope of this thesis.

[5] Harrison's allusion here evokes Foucault's call for the possibilities of 'pleasure with very odd things, very strange parts of our bodies, in very unusual situations' – see Michel Foucault, 'Sex, Power and the Politics of Identity', in *Ethics: Subjectivity and Truth*, ed. by Paul Rabinow, trans. by Robert Hurley and others (London: Allen Lane, 1997), pp. 163-174, p. 165. I imagine this similarity is unintentional, and as I argue here Harrison is employing this idea to rather different ends.

Earth, they may also leave behind some of the ideas of propriety and goodness around which the sexual culture of Earth is structured.

Where my discussion of Berlant and Warner's 'Sex in Public' focussed on how sex is implicitly represented in seemingly non-erotic aspects of heterosexual culture, the theory I use in this chapter illuminates the cultural context of direct discussions of sexual acts. Later in this chapter I will use the work of Gayle S. Rubin and Lee Edelman to further explore the cultural positioning of sex. First, I begin with a brief discussion of *Public Sex* by Patrick Califia, following which I will return to some of the material I discussed in Chapter Five. I will additionally explore some high-profile stories of astronauts and cosmonauts who have been the subject of public speculation about their sexual practices.

Privacy: Sex and Public/Private Space

Using *Public Sex* to look at spaceflight provokes the question of whether outer space itself is a private or public space. As I discussed in my first chapter, I follow feminist theories of space to reject the traditional view of a strict boundary between public and private spaces. [6] Regardless, on a purely practical level, information about space missions, particularly NASA missions, is relatively easily available to 'the public'. NASA documentation and imagery are often in the public domain under American copyright law, and NASA materials are subject to Freedom of Information Act requests in America.[7] Thus at times in this chapter I will refer to spacecraft as public spaces, and the conversations around these issues as public conversations. At the same time however, I will use examples from the space industry to trouble the idea of a clear boundary between public and private, and Califia's work forms the foundation of my argument to this end.

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[6] Despite this I am compelled by Jodi Dean's argument that outer space is a public space. In *Aliens in America* she discusses how NASA worked to construct space as a public space through television and popular consumption both in the *Apollo* programme of the 1960s-70s and in fictionalised form in Ron Howard's 1995 film *Apollo 13*. See especially pp. 62-65 in Jodi Dean, *Aliens in America: Conspiracy Cultures from Outerspace to Cyberspace* (Ithaca: Cornell University Press, 1998).

[7] Mary Roach discusses this, particularly in terms of some more salacious material produced in the course of NASA's toilet-related research, as I will discuss further in this section. See Roach, p. 238.

Public and Private Space(s)

Califia comments extensively on the distinction between public and private as both spatial and legal concepts. Importantly, Califia argues that what is generally referred to as 'public sex' often takes place in circumstances which are arguably private. As Califia says:

> People sitting behind the closed door of a bathroom or of a movie booth in an adult bookstore can reasonably assume they have privacy. You could make the same assumption if you were sitting in your car in a deserted location late at night. All of these are favored locations for so-called public sex. If people are going to see what is going on in these places, they must intrude.[8]

Here Califia points out how the nature of so-called 'public sex' can in itself destabilize the strict delineation between public and private space. In these cases, during normative spatial use, the space is considered a private one; however when a sex act is taking place there, the space becomes public for the purposes of criminalising behaviour. That the same spaces can be coded as public or private depending upon usage and, perhaps, upon legislative convenience, is an important property of spaces Califia identifies as 'sex zones', which he argues never exist solely for the purpose of sex, and instead overlap with other 'zones' of usage, both normative and illicit.[9] To return to an example from Chapter Five, the Kanas and Fedderson memo provides evidence of this phenomenon in its discussion of the prospect of homosexual or autoerotic behaviour.[10] The implication, which I discussed, that sex between male and female crewmembers requires less privacy than sex among male crewmembers (whether alone or together) indicates that the idea of 'private' space is contingent upon the activity occurring in the space. It might be private enough for sex acts that are heterosexual – not so if the acts are homosexual or masturbatory.

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[8] Patrick Califia, *Public Sex: The Culture of Radical Sex* (San Francisco: Cleis Press, 2000), p. 20.
[9] Califia, pp. 216-17.
[10] Nick A. Kanas and William E. Fedderson, 'Behavioral, Psychiatric, and Sociological Problems of Long-Duration Space Missions', *NASA Technical Memorandum X-58067* (1971). In Chapter Five see 119-122.

Interestingly, Mary Roach reports that even prior to the Kanas and Fedderson memo, masturbation was a topic which received official, though limited, attention within NASA, as well as the Russian space agency. Concern about any kind of infection is high within space biomedicine, as I suggested in Chapter Three. Roach writes about medical advice that astronauts engage in what NASA referred to as 'self-stim' regularly in order to avoid prostate infections, which could be brought on by long-term abstinence from seminal release.[11] That this conversation has provoked some discomfort within the agency is clear from Roach's text – 'ignoring,' she writes, 'seems to have been the basic approach to the human sex drive' since the first mentions of therapeutic 'self-stim' in the Apollo era.[12] Yet while official space agencies may wish to ignore sex, the public significantly do not share this desire. I turn now to a different usage of the term 'public' in discussing the popular attention granted to issues of space sex in very specific cases. Still, these examples provide further evidence of how fraught the idea of public and private space is within space culture.

Space Sex in the Public Eye

A great deal of media attention has been paid to the sexual aspects of particular astronaut narratives. One prominent example of this is the story of Jan Davis and Mark Kee, two astronauts who married each other during training and then flew together on a NASA mission in 1992. Davis and Kee's Shuttle missions provoked a great deal of press interest in the topic of sex in space – as though a married couple were automatically more inclined to have sex than any other astronauts.[13] Another particularly prominent example is the story of Yelena Kondakova and Valery Polyakov, two cosmonauts who worked on *Mir* together in 1997. Though Kondakova was married to another man (also a cosmonaut) at the time there was

[11] Roach, pp. 190-191.
[12] Roach, p. 190.
[13] 'Sex in Space? Married Astronauts Aren't About to Say' reads a particularly direct headline from the time, cited as a 1992 *Wisconson State Journal Headline* by Matt Novak writing for Smithsonian.com. See Matt Novak, 'Sex and Space Travel: Predictions from the 1950s', *Smithsonian*, 18 October 2012 < http://www.smithsonianmag.com/history/sex-and-space-travel-predictions-from-the-1950s-81300280/> [accessed 6 February 2013]. Novak's article also includes interesting predictions from a sexology journal in 1956 relating to the sexual needs of (male) astronauts on future missions, which bear striking resemblance to the Kanas and Fedderson work of nearly 15 years later.

great speculation about her relationship with Polyakov, to which Roach refers, as does Peter Pesavento.[14] The latter reports that during a televised question and answer session with *Mir* crew in 1997, a caller asked about sex in space and was met with tension and disdain from Kondakova and the rest of the crew.[15] In addition to these examples, in this section I will briefly return to Lisa Nowak, to discuss how her story prompted some public discussion of astronaut sexuality.

In Chapter One I wrote about the story of Lisa Nowak's very public unravelling; as I argued there, in addition to providing opportunities for the press to play on tropes of female incompetence and the infamous diapers, the sexual aspects of her case received widespread attention.[16] However her high-profile arrest in 2007 brought not only the question of astronauts' body waste to the fore, but also the question of astronauts' sex lives. Not only was Nowak romantically linked to another astronaut – albeit one with whom she had never shared a NASA mission – but there were overtones of deviant sexuality. Adultery at least was confirmed, and then there was the discovery of what was described in the media as sadomasochistic pornography on a floppy disc found in her trunk.[17] As I have discussed this was of great interest to the tabloid press, who seemed to relish the headline opportunities afforded by the more tawdry aspects of the story. It also prompted discussions specifically of sex in space.[18] NASA has cultivated an image of asexual professionalism, but such a high-profile

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[14] See Roach, p. 197; Peter Pesavento, 'From Aelita to the International Space Station: The Psychological and Social Effects of Isolation on Earth and in Space', *Quest* 8:2 (2000) 4-23 (pp. 4-5).

[15] Pesavento finds it pertinent to mention that Kondakova prefaced her answer to this question by 'tossing her flaming red hair ever so slightly'. Pesavento's interest in Kondakova's hair is repeated on the following page, on which he captions a photo of the cosmonaut with a note indicating that it is 'of her prior to redying her hair while on board the craft' (pp. 4-5). I have already reflected upon Pesavento's male-centric view of astronauts in Chapter One. Regrettably, my copy of Pesavento's article is in black and white so I am unable to experience Kondakova's hair as it was intended.

[16] See pp. 36-38.

[17] As I wrote briefly in Chapter One, this particular artefact is perplexing because of its material nature – a floppy disc of pornographic images in 2007 is anachronistic at the very least. See Orlando Police, 'Orlando Police Department Charging Affidavit 2007-47314'.

[18] For one more contemporary example, see Christopher Beam, 'Do Astronauts Have Sex?' *Slate*, 7 February 2007 <http://www.slate.com/articles/news_and_politics/explainer/2007/02/do_astronauts_have_sex.html> [accessed 29 August 2015].

case of such problematized and dangerous sexuality brought the issue of sex in space to a prominent position in the Nowak story.[19]

Just as the Nowak story entangles excretion and sexuality, Roach's informants from the NASA excretory research archives share a strange story which has sexual overtones, and which invokes the issue of just how 'public' an agency NASA is. In the early days of NASA toilet research, volunteers were recruited to relieve themselves on camera so that engineers could study the physical properties and behaviour of faeces, urine, and the excretory organs in order to better design toilets that would work without gravity. Despite this footage being 'classified as limited distribution', one of Roach's informants claims that it 'regularly travelled beyond its prescribed limits'. Roach quotes the informant saying, '[t]hey were very, very popular, those films'.[20] 'Eventually', Roach writes, the female volunteers 'got wind of what was happening and refused to participate in any more filming.'[21] When someone within the contracted toilet engineering agency realised the danger that the films could be requested through a Freedom of Information Act request, the footage was destroyed, and it appears from Roach's investigation that no more such research was undertaken (or at least filmed).[22]

NASA recognised the public relations problem inherent in the existence of these videos, but whether there was concern about the unprofessional use of the videos within the agency, Roach does not say. The interest in these videos is not described as overtly sexual, however I argue it is made so through the intimate nature of the content and the violation of the subjects' expectation of privacy. Implicit in this is the conflicted relationship between 'privacy' and the 'public' that I argue characterises NASA's negotiation of extra-terrestrial cultural space. In order to facilitate the design of a 'private' toilet, research on this most 'private' of acts had to be done; however the looming threat of 'public' access – along with the excessively 'public' distribution of the videos to satisfy prurient interests – brought the

[19] Roach further discusses this institutional atmosphere of professionalism and avoiding even the idea of sex: see pp. 197-198.
[20] Roach, p. 237.
[21] Roach, p. 239.
[22] Roach, p. 239.

research to an end. In a similar way, the Lisa Nowak story brought uncomfortable attention to aspects of astronaut lives that the agency would prefer to be kept private. The tension between the idea of astronauts' private lives and the space agency's positioning within the public sphere exists alongside the broader cultural tension between the ideas of private and public space. Sex in space necessarily exists in a troubled realm between private and public spaces.

As in the stories above, in the next section I will discuss in more detail how sexual issues are entangled with the scatological through the design of the space toilet. Although I will primarily address the extra-terrestrial concern around hygiene and sex, the thread of the public/private binary is continued through this section, and I use the work of Lee Edelman to illuminate this. Edelman's work on the spatial sexualisation and anxieties around earthbound toilets holds great significance for extra-terrestrial facilities, as I will explore.

Hygiene: Spatial, Sexual, and Lavatorial Anxieties in Spacecraft

In discussing toilets, the idea of public and private space is even more confused. This confusion is sourced both from the vocabulary used to refer to toilets more broadly, and from the question I have already discussed of whether space itself is a public or private space. The toilet in contemporary Western culture is a space where one normally expects a certain degree of privacy, as Califia points out. Yet the 'public toilet' is a visible and widely understood part of this culture. Lee Edelman's work on queer theory and the toilet highlights how within the space of the public men's toilet, 'public' and 'private' spaces are even more finely demarcated, between the 'public' urinal space and the 'private' cubicle space. I will discuss Edelman's work further in this subsection. His writing usefully illustrates the broader cultural context for the social construction of the space toilet, as I will discuss. As I have already mentioned in Chapter Three, the engineering of a space toilet is complex and evokes issues of bodily disorientation which I have argued have gendered implications. In this subsection I will discuss how the toilet holds further implications for understanding the sexuality of space culture.

The Edelman essay 'Men's Room', to which I will refer later in this section, comes from the Joel Sanders-edited collection *Stud: Architectures of Masculinity.*[23] Sanders's introduction to this collection also addresses the spatial and symbolic logic behind the design of the standard public 'restroom' in America. Saunders argues that this logic is largely predicated on external spatial division from the 'ladies' room'. As I will discuss later, Edelman expands on this by discussing the implications of interior separation between the generally un-partitioned space of urinals from that of structurally discrete (and discreet) toilet cubicles. In the introduction, Sanders focuses on how these divisions bolster the idea that gender roles are natural rather than cultural. As he explains:

> The common assumption that purely functional requirements specified by anatomical difference dictate the spatial layout and fixture design of restroom architecture reinforces the reigning essentialist notion of sexual identity as an effect of biology. Just one look inside the typical domestic bathroom shared by both sexes discloses the ways in which segregated public restroom facilities answer to the requirements of culture, not nature.[24]

In this way, the layout and partitioning of space is constructed as a response to bodily necessity, rather than to the cultural narratives associated with bodies and their functioning. In some ways, the space toilet seems in opposition to this. For one, there has never been gender segregation of these facilities; the answer to the requirements of mixed-gender crews was to create a space which could indeed be 'shared by both sexes'. Yet this is not simply a 'domestic bathroom', as is made clear by the volumes of material written within and around NASA on the development of the American (and, later, International Space Station) space toilet.

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[23] Joel Sanders, 'Introduction', in *Stud: Architectures of Masculinity*, ed. Joel Sanders (New York: Princeton Architectural Press, 1996), pp. 11-25; Lee Edelman, 'Men's Room', in *Stud: Architectures of Masculinity*, ed. Joel Sanders (New York: Princeton Architectural Press, 1996), pp. 152-161.
[24] Sanders, p. 17.

Toilet Provisions, Gender and Sexuality

As I mentioned in Chapter Three, former NASA flight surgeon Patricia Santy makes the bold claim that the design of 'private' toilet facilities was the primary reason that NASA allowed women in the Space Shuttle programme in the early 1980s. Santy's discussion of the development of the Shuttle toilet does not solely speak to the issue of 'woman as problem' that I discussed in Chapter Three, however. The full passage in Santy's *Choosing the Right Stuff* reads:

> The issue of privacy, linked as it was to sexuality and personal hygiene, had long been a big factor in NASA's reluctance to include women as astronauts, and the development of the private toilet – probably more than any other reason – encouraged NASA to believe that females could finally (and without embarrassment to the agency) be integrated into Shuttle missions in a way impossible during earlier missions.[25]

As I argued in Chapter Four, Santy's claim that gender equality in an organisation of the American government hinged, as late as the 1980s, on these ideas of privacy and propriety is striking. Further, that Santy explicitly relates this to the question of sexuality speaks to the ambiguous entanglements of all of these issues: gender equality, 'personal hygiene', bodily functions, private and public spatiality, and sanctioned sexuality.

That all of these issues are so firmly entrenched within the technological development of an extra-terrestrial toilet speaks to the broad cultural implications of our relationship with the toilet, both as a device and as a space. In particular, it is Santy's description of privacy – 'linked as it was to sexuality and personal hygiene' – to which I wish to draw attention. It is important to note that Santy is not speaking of privacy as a general concept, but specifically of the privacy of a toilet, when she here invokes the issues of both sex and cleanliness. Santy does not elaborate on this point, however it is clear that to Santy, the space of a toilet is linked

[25] Patricia Santy, *Choosing the Right Stuff: The Psychological Selection of Astronauts and Cosmonauts* (Westport: Praeger, 1994), p. 51.

to sexuality in a way that makes this space a potential site of moral danger for the American space programme.

I would speculate that Santy's concern here centres on the idea that men and women must be separated from one another during certain 'intimate' activities, lest bodily intimacy be conflated with sexual intimacy. Regardless of Santy's specific concerns, however, cultural understandings of the toilet more generally betray an anxiety around this space that specifically hinges on an idea of actual sex acts which may take place in toilet space. The further cultural association between this and specifically gay male sexuality both impacts upon and is potentially destabilized by the homosocial history of spaceflight, a point on which I will elaborate in this section.

Though Santy claims here that the toilet only became a source of anxiety for the space programme when mixed-gender crews were considered, I argue that the anxiety around space toilets is a broader phenomenon, as evidenced by the prurient interest in them both within and outside of space programmes. To analyse this, I turn to Lee Edelman's work on toilets and the ways in which sexuality and propriety are understood in these spaces. I argue that through the gendered aspects of toilet design, there is evidence of the impact of the logic of earthbound 'public toilets', in which public and private distinctions are both of paramount importance and highly unstable. In this section I will draw from two Edelman texts: 'Tearooms and Sympathy' and the aforementioned 'Men's Room'.[26] Drawing upon Edelman's queer reading of the cultural space of public toilets, I argue that this is related to spaceflight's enforcement of heteronormative culture, but also, that it provides evidence of how spaceflight itself can destabilise these cultural norms.

Homosocial Anxiety

Edelman argues that anxieties around sexuality and the toilet are a principle of heterosexual culture, particularly heterosexual male culture. In his essay 'Men's Room' Edelman argues that the layout of the standard Western men's public toilets is designed in such a way as to both

[26] Lee Edelman, 'Tearooms and Sympathy, or, The Epistemology of the Water Closet', in *Homographesis* (London: Routledge, 1994) pp. 148-170.

allay and to showcase these anxieties. The division of urinal space from toilet cubicle space, Edelman argues, separate urinary and faecal usage of the space into the 'relatively "public" status' of the urinal and the more 'private' toilet cubicle. Through this, Edelman claims, 'The law of the men's room decrees that men's dicks be available for public contemplation at the urinal precisely to allow a correlative mandate: that such contemplation must never take place'.[27]

I discussed in Chapter Three some of Mary Roach's reporting on the widespread interest in body waste in space programmes. More specifically, however, Roach finds in the NASA archives some examples of homosocial bonding around relieving oneself in early NASA missions, which I find particularly interesting in light of Edelman's claims about the anxieties driving the construction of toilets on Earth.[28] As delineated 'private' space was not a high priority in the design of these early spacecraft, there was no 'toilet' in terms of either the object or the space; as Roach explains, Gemini- and Apollo-era NASA 'toilet' facilities for defecation consisted of little more than a plastic bag.[29] Therefore in the Apollo crafts, space was not divided into 'toilet' and 'not toilet', but neither was what passed for 'toilet' provision divided into 'urinal' and 'cubicle', as in Edelman's analysis. I argue that this lack of spatial division results in destabilisation of the social structures that govern the space of a 'men's room', in the uniquely public context of a government-sponsored space programme.

Roach quotes astronaut Jim Lovell reminiscing about how the difficult excretory conditions could foster bonding between astronauts. In the Gemini-era bag system, bagged faeces had to be mixed with an antibacterial solution before storage. 'The test of a good friend', Lovell told Roach, 'was to hand the bag to your crewmate and have him get that germicide completely mushed in with the faecal material […] I'd go, "Here, Frank, I'm busy."'[30] Roach also reports on examples from Apollo mission transcripts during which so-called 'escapees' of faecal matter were a source of amusement for crews plagued by the difficulties

[27] Edelman, 'Men's Room', p. 153.
[28] See Roach pp. 229-234.
[29] Roach, pp. 229-230.
[30] Roach, p. 230.

of managing their own body waste.[31] This is not to argue that the jokes and the social bonding that went on around defecation on single-sex crews indicate homosexual behaviour or interest among these crews. In quarters so cramped and with 'facilities' so fraught, the realities of bodily waste likely cannot be ignored, and such jocularity and intimacy is easily viewed as a coping strategy.[32] Still, it is the very fact that early space missions required this confrontation of such intimate matters that I argue destabilises the broader cultural context of excretion, particularly for the construction of heterosexual masculinity. The anxieties around privacy, intimacy, and transgressive sexuality in the space of a public toilet are not divorced from the real experiences of astronauts working and living (and excreting) in spacecraft.

Edelman argues that heteronormative anxieties are encoded into the space of the public toilet; the men's room 'is the site of a particular heterosexual anxiety about the potential inscriptions of homosexual desire and about the possibility of knowing or recognizing whatever might constitute "homosexual difference"'.[33] Specifically Edelman argues that the segregation within the men's room of spaces intended for urination and for defecation serves as a threat to the outer segregation of 'men's' and 'women's' toilets. The cubicle space itself is segregated because it contains dangerous erotic potentials which, in Edelman's framework, disturb the primacy of heterosexuality by evoking the possibility of anal pleasures, coded as both homosexual and as psychoanalytically infantile.[34] The excretion facilities provided in early, single-gender NASA missions crossed all of the boundaries traditionally established by the spatial demarcations common in earthbound toilets. I argue that given Edelman's analysis these spacefaring disruptions of traditional codes of privacy and decorum cause anxiety which is alleviated through the overwhelming heteronormativity of the cultural spaces of space.

That the homosocial environment of early NASA missions caused anxiety is additionally supported by Casper and Moore's research. They report a story from one of their NASA

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[31] Roach, p. 230.
[32] Roach describes it as a 'unique and comic form of intimacy' (p. 272). Roach also finds documentation of the extent to which the bag system caused physical, psychological, and environmental problems for the astronauts and the spacecraft – see in particular pp. 230 and 232-233.
[33] Edelman, 'Tearooms and Sympathy', p. 160.
[34] Edelman, 'Tearooms and Sympathy', pp. 161-163.

informants who recalls that two unnamed Apollo astronauts entered a post-flight press conference holding hands, and announced to the media that they had become engaged to each other during their mission to the moon. This was reportedly greeted with great amusement by those in the room.[35] While certainly this speaks to the public acceptability of homophobic jokes in the era, importantly, the joke works because on a certain level, this is what the space industry was afraid might happen. This anecdote speaks to a broader culture of discomfort and worry around supposedly deviant sexuality in an alien environment. Casper and Moore go on to speculate that, despite the many other reasons for inclusion of women in NASA missions, there may be an element of avoidance of 'what it perceives as negative implications of homosexuality' in NASA's selection of mixed-gender crews.[36] I argue that this anxiety is also present in some of the more logistical discussions of sex acts in space. The discussions around logistical aspects of sex in microgravity make a number of assumptions about what constitutes a sex act which, I argue, reveal the assumption of heterosexual, procreative intercourse above any other sexual behaviour. Further, throughout these conversations about the details of sex acts in the extra-terrestrial, gravity is the fundamental concern, which I argue is a key element of the construction of heteronormativity in space culture.

Logistics: The Gravity of Sex

My fourth chapter was devoted to examining how gender and microgravity impact upon each other in particular ways in space research, and how this has important implications for spatial research more broadly. In addition to this, the issue of gravity is of great interest in discussions of sex in space, and as I will argue this focus on gravity provides evidence of the presumption of heteronormativity that pervades human spaceflight. The question of sex in outer space is often presented as a question of logistics, as I have already discussed to an extent in this chapter so far. Given the unique constraints on movement in microgravity conditions, how can

[35] Monica J. Casper and Lisa Jean Moore, 'Inscribing Bodies, Inscribing the Future: Gender, Sex, and Reproduction in Outer Space', *Sociological Perspectives* 38:2 (1995), 311-333 (pp. 320-321).
[36] Casper and Moore, p. 321.

two bodies coordinate their actions in order to successfully have sex? The proposed answers to this question reveal underlying assumptions about sexual culture and sex acts – as does, indeed, the question itself.

Bodies in Motion: Assistance and Devices

G. Harry Stine's *Living in Space: A Handbook for Work and Exploration Beyond the Earth's Atmosphere* provides one of the more high-profile (though likely apocryphal) accounts of space sex research, which Mary Roach investigates in her *Packing for Mars.*[37] In Stine's story, the logistics of microgravity sex supply the primary difficulty that spacefaring lovers would need to overcome. Stine tells of a group of NASA researchers who took the matter into their own hands:

> Back in the 1980s, some clandestine experiments were conducted very late at night in the neutral buoyancy weightless simulation tank at NASA's George C. Marshall Space Flight Center in Huntsville, Alabama. The experimental results showed that yes, it is indeed possible for humans to copulate in weightlessness. However, they have trouble staying together. The covert researchers discovered that it helped to have a third person to push at the right time in the right place. The anonymous researchers—who would have been fired if their activity had been revealed—discovered that this is the way the dolphins do it. A third dolphin is always present during the mating process. This led to the creation of the space-going equivalent of aviation's Mile High Club known as the Three Dolphin Club.[38]

Mary Roach found no evidence to support the story of this clandestine NASA research, and she provides several reasons for doubting its veracity.[39] Nonetheless, Stine's story has

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[37] G. Harry Stine, *Living in Space: A Handbook for Work and Exploration Beyond the Earth's Atmosphere* (New York: M. Evans and Company, 1997). For Mary Roach's investigation, see Roach, pp. 194-196. Roach deems Stine's story a fabrication, as I will discuss.

[38] Stine, p. 182.

[39] These include how unnecessarily complicated it would be to use NASA resources instead of 'a backyard swimming pool', and her own discussions with NASA astronaut Roger Crouch, who simply dismissed the idea that microgravity is so restrictive that any additional help beyond 'arms and legs'

gained enough traction among space aficionados that there is even a published pictorial demonstration, from a book called *Sex in Space* by science journalist Laura S. Woodmansee:

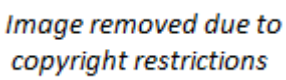

Figure 6.1: Woodmansee's representation of the 'three dolphin position'[40]

Woodmansee has taken liberties with representing the 'third dolphin' as an *actual* dolphin.[41] Regardless, Stine here is displaying the same basic concern that Harrison voices in *Spacefaring: The Human Dimension*, which prompted Harrison's unnamed inventor to develop that 'special leather harness': without gravity, staying together and making appropriate movements might be much more challenging. This concern is also behind the development of the 2suit, a garment designed to be worn by two people to facilitate co-operative movement and physical intimacy in outer space. The 2suit has gained enough traction in the periphery of spaceflight research that it was one of the subjects of an episode of the History Channel documentary series *The Universe*.[42] The episode 'Sex in Space' features the inventor Vanna Bonta and her husband testing the 2suit in a microgravity simulation flight. Given the brief periods of weightlessness facilitated in these simulations (as well as, presumably, the presence of a filming crew and other microgravity flight participants) the couple only demonstrated the

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would be needed. In addition, Stine's description of how dolphins mate is not accurate according to marine biologists Roach consulted. See Roach, pp. 194-196.

[40] In Woodmansee's text this image is captioned 'The basic position with help from the third dolphin'. Laura S. Woodmansee, *Sex in Space* (Burlington: CG Publishing, 2006), p. 62. Woodmansee's whimsical text includes several other photographic representations of possible extra-terrestrial sexual positions, many of which incorporate physical restraints like those suggested in sources to which I refer elsewhere in this chapter.

[41] Although I do not address this here, I believe there is further analytical potential in interrogating Woodmansee's choice, and I discuss in the Conclusion potential intersections between animal studies research and further investigation of ideological influences on discussions of sex in space.

[42] 'The Universe: Sex in Space', *The History Channel*, 2 December 2008.

ease with which two individuals wearing their separate halves of the 2suit could adhere their Velcro panels to one another. The suit's openings, it can be seen in the video, correspond to a position in which two people would be adhered at the chest and pelvis, facing each other; the missionary position in zero *G.*

Many discussions of sex in space highlight the idea that the alien environment provides unlimited possibilities for extra-terrestrial intimacy – yet with an example like the 2suit, it seems that one very specific possibility is being idealised. While the suggestions of restraints and even a third party might seem to suggest non-normative sexual practices, at the same time, I argue that to imagine a sex act without gravity would require such complicated measures betrays a very limited view of the sex act. Sex here is clearly being defined as heterosexual intercourse – one man, one woman, and one position. The 'third dolphin', the 'leather harness', and the 2suit, strange though they may appear, are all evidence of the overwhelming heteronormativity of these discussions, for as deviant as they may seem on the surface, these are solutions to a problem that only exists if sex is defined very narrowly. As I mentioned, Roach quotes the astronaut Roger Crouch dismissing the idea that astronauts would need such measures in order to stay together.[43] The tendency in discussions of sex in space to go to such lengths to ensure it could happen despite microgravity seem in fact to be desperately trying to ensure it could happen without any substantial deviation from the norm of heterosexual, potentially procreative intercourse. Revealed through this is the underlying assumption that some sex acts are 'good' and others are 'bad'; but importantly, there are ways in which aspects of 'bad' sexuality can (or must) be incorporated into 'good' sexuality in service of the greater goal of idealised heteronormative intercourse.

'Thinking Sex' in Space

In analysing this aspect of discussions of sex in space, I will now turn to Gayle S. Rubin's writing on the difficulty of drawing a line between 'good' and 'bad' sex. In 'Thinking Sex', Rubin proposes two visual frameworks through which the cultural positioning of various sex acts can

[43] Roach, pp. 175-176.

be interpreted. One is the 'charmed circle' versus the 'outer limits' of sex, in which a series of sexual practices are arranged into binaries, of which one always exists in 'the charmed circle' of 'good, normal, natural, blessed sexuality' and one is relegated to 'the outer limits' of 'bad, abnormal, unnatural, damned sexuality'.[44] Within the 'charmed circle' lies sex that is, among other things, heterosexual, monogamous, within a marriage or at least relationship context, in private, between two people, and involving bodies only. On the 'outer limits' lies homosexual, promiscuous, unmarried, public, in groups or masturbatory, and sex involving objects, restraints, or other sadomasochistic practices.[45] On first glance many aspects of these suggestions for extra-terrestrial sex would seem to fall into the 'outer limits' of sex. However, as I have argued, the seemingly deviant tendencies within discussions of space sex arise from a commitment to the basic norms of heteronormative sexuality above all else. Rubin additional provides a second framework which helps to support my argument in this arena.

Rubin's pictorial representation of what she calls 'the struggle over where to draw the line' addresses how the 'line' between 'good' and 'bad' sex is not always as straightforward as the border between the 'charmed circle' and the 'outer limits'. Sexual culture's privileging of certain acts over others takes place on a shifting scale, within which lies what Rubin terms the 'major area of contest' in which acts which incorporate some elements of the 'outer limits' nonetheless may fall over 'the line' within the realm of sanctioned sexuality.[46] On this scale, Rubin reiterates the identification of heterosexual, monogamous, married, private, reproductive sex acts as the cultural ideal of sex. However, within the 'area of contest' lies a sliding scale of behaviours that include unmarried or even promiscuous heterosexual sex, masturbation, and long-term committed same-sex couples. Beyond the 'area of contest' lies a list of acts which Rubin identifies as still lying far beyond the reach of broad cultural approval, including sadomasochism, other fetishes, and commercial sex. Rubin illustrates here the difficulty of drawing 'the line', despite the clarity of the marginalisation of certain more

[44] Gayle S. Rubin, 'Thinking Sex: Notes for a Radical Theory of the Politics of Sexuality', in *Deviations: A Gayle Rubin Reader* (Durham: Duke University Press, 2011), pp. 137-181 (p. 152).
[45] Rubin, 'Thinking Sex', p. 152.
[46] Rubin, 'Thinking Sex', p. 153.

'abnormal' sexual practices. Much sexual behaviour in fact lies somewhere between the two poles identified in the 'charmed circle' and 'outer limits' of cultural acceptance.

'Thinking Sex' was first published in 1984; since then, the definition of this 'line' and the position of various activities on either side of it has undoubtedly shifted, and Rubin addresses this to an extent in the supplements she has written to accompany later publications of the essay.[47] For the purposes of my analysis, I am not concerned with which activities land precisely where between the 'major area of contest' and 'the line' beyond which lies 'good' sexuality; I am instead concerned with the existence of the 'major area of contest' and its troubled relationship with 'the line' itself. I contend that discussions of sex in space are situated problematically within the 'area of contest' due to the material conditions affecting these discussions, including gravity. Despite this, I argue that the underlying heteronormativity of space culture situates the broader concept of extra-terrestrial sex within the bounds of 'good' sex. By discussing sex in space as a matter of how best to replicate that which is considered the most 'good' kind of sex on earth, even the introduction of unorthodox elements ultimately serves heteronormative sexual culture.

Further, by privileging heterosexuality, these texts symbolically restrict access of queer subjects to extra-terrestrial spaces. As I have discussed in this chapter and in Chapter Five, I argue that this is enacted through continually conflating discussions of sex with discussions of women's inclusion, sex with reproduction, and space crews with heteronormative families. It is also reinforced by the underlying assumption of penetrative intercourse, and the related logistical concerns about successfully accomplishing this without Earth's gravity. Whatever possibilities may be imagined for microgravity sex, they are overwhelmed by this message: sex is between a man and a woman, and may result in pregnancy. In this discourse, sex is equated with heteronormativity, and the prospect of sex in space thus reinforces the message that space is a place for heterosexual subjects.

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[47] These are included in *Deviations* as chapters 6-8; 'Afterword to "Thinking Sex: Notes for a Radical Theory of the Politics of Sexuality"', pp. 182-189; 'Postscript to "Thinking Sex: Notes for a Radical Theory of the Politics of Sexuality"', pp. 190-193; 'Blood under the Bridge: Reflections on "Thinking Sex"', pp. 194-223.

In the next chapter, I will continue to explore how space culture privileges heterosexuality through a discussion of the temporal disorientation of space alongside theoretical work on queer temporality. In this I will move away from such direct discussions of sex and sexuality, however as I will argue, the temporal and aesthetic dimensions of space provide further opportunities for the reinforcement of heteronormativity.

Chapter Seven: Retro- and Reproductive Futures

In the introduction to *Space Travel and Culture,* David Bell and Martin Parker identify the difficulty of space travel's temporal positioning as 'a future that never happened, or a history that seems not to connect with our present'.[1] In this, they highlight the complexity of the relationship between space, time, and a sense of loss. While space travel seems to be an inherently futuristic enterprise, it is at the same time deeply nostalgic. The space age is an era now long past, but the way that this past is evoked in future plans for space exploration supports Bell and Parker's claim that the past fails to link clearly to our present. In this chapter, I will explore this temporal disorientation in the context of critical work on 'retro' aesthetics, and the relationship between this and queer theories of time.

Here I will analyse parallels between David Bell and Martin Parker's discussion of the temporality of space travel and the aesthetic concept of retrofuturism. As I will show, there are marked similarities in the definitions of these concepts, even to the words used by the authors I draw upon here. More important than these superficial similarities, however, is the relationship I discuss between the Space Age and the development of the retro style, as well as the social ramifications of this. This relationship is established by the art historian Elizabeth E. Guffey in her book *Retro: The Culture of Revival,* and I use this work, in addition to the work of art critic Lucy Lippard, to explore the way that time and the future are constructed in space culture.[2] Lippard's work, further, posits that the retro turn in art has specific socio-political uses and meanings, which I will discuss further as I explore the problematic aspects of space travel's constructions of time. As I explained in the Introduction, my choice to use these theoretical texts relates to the importance of art to my project, but also, as I will show, Guffey and Lippard's work provides vital analytical weight for my arguments about the connections between visual culture, sexual culture, temporality, and space travel.

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[1] David Bell and Martin Parker, 'Introduction', in *Space Travel and Culture,* ed. by David Bell and Martin Parker (Oxford: Blackwell, 2009), pp. 1-5 (p. 4).
[2] Elizabeth E. Guffey, *Retro: The Culture of Revival* (London: Reaktion, 2006); Lucy Lippard, *Get the Message?: A Decade of Art for Social Change* (Boston: E P Dutton, 1984).

I relate these concepts to my central question of the sexuality of space through the work of Elizabeth Freeman and Lee Edelman on queer temporality.[3] As I will show, Freeman's concept of 'temporal drag' can be used to expand upon Guffey's argument about retrospection as a cultural force, while Edelman's work on futurity and the child relates to Guffey and Lippard's discussions of temporal disorientation and social movements. Throughout, I relate all of these works to space through not only the similarities to Bell and Parker, nor only through Guffey's historical and linguistic positioning of retro as a concept from the space age, but also through examples from the aerospace field where sexuality is obliquely referenced in discussions of temporality. As I will show, space is often constructed as a place of the future; the future-focus of spaceflight, further, gives rise to new heteronormative constructions in addition to those I discussed in the previous chapters.

Space Travel and the 'Retro Future'

In Chapter Three, I discussed Virgin Galactic's mascot Galactic Girl. As I discussed in that chapter, the use of the style of pin-up art and the impractical space suit in Galactic Girl's design is an example of retrofuturistic aesthetic in contemporary space technology. Retrofuturism is an artistic style based on the past's conception of the future, and the aesthetics of retrofuturism are, as I will discuss in this chapter, historically connected to spaceflight. Bell and Parker's analysis of spaceflight's temporal positioning resonates in this example; what they describe as 'a future that never happened' is precisely the subject of retrofuturistic art and design.

Galactic Girl provides a clear, concrete example of how an aesthetic concept can relate to the field of spaceflight; the choice of her image to adorn the Virgin Galactic vehicles shows a clear relationship between a future-focussed enterprise and a retro, pin-up aesthetic. In the case of Galactic Girl, this operates as part of corporate branding, and as I discussed in Chapter Three, in a way which reinforces the marginalisation of women in the aerospace industry. Yet

[3] Elizabeth Freeman, 'Packing History, Count(er)ing Generations', *New Literary History*, 31:4 (2000) 727-744; Lee Edelman, *No Future* (Durham: Duke University Press, 2004).

at the same time, as with the work of Aleksandra Mir as I discussed in Chapter Two, art is one of many ways of culturally 'accessing' space for non-astronauts. I will further discuss in Chapter Eight why the concept of sexuality is particularly useful to address from a perspective that includes artistic practice, through the work of queer space artist Frank Pietronigro.

First, however, I will directly address the concepts of retro and retrofuturism in the context of spaceflight, and alongside Bell and Parker's analysis of how the temporality of space travel is culturally constructed. Retrofuturism, in particular, mirrors the complexity of this view of time, in that it overtly treats periods of time as fluid and non-linear, as I will show. In retrofuturism, as in the discourse of spaceflight, the past and the future come together in complex ways, and the artists and critics who work with retrofuturism raise important and relevant questions about how our culture interprets space and time.

Retrofuturism

Illustrator Bruce McCall, whose retrofuturistic illustrations have frequently been featured as *New Yorker* magazine covers, defines retrofuturism as 'looking back to see how yesterday viewed tomorrow.' [4] He describes his artistic practice as, in part, 'techno-archaeology', or as he explains, 'digging back and finding past miracles that never happened.'[5] The similarities between this and Bell and Parker are clear, even to the phrase itself, both involving things 'that never happened'. In McCall's art, like in space culture, the subject is a muddied and complex relationship between past and future. Further, both of these ideas evoke a sense of loss for something that never was, and that never will be. There is an inherent impossibility to yesterday's idea of tomorrow. In McCall's words, these visions of the retrofuture are 'always wrong, always hilariously, optimistically wrong.'[6] This is also reminiscent of the discourse of spaceflight: there is so much optimism and speculation, always tempered by so many setbacks,

[4] Bruce McCall, 'What is retrofuturism?', *TEDTalks/Serious Play*, (Pasadena: Art Center College of Design, 2008) <http://www.ted.com/talks/bruce_mccall_s_faux_nostalgia> [accessed 10 January 2015].
[5] McCall.
[6] McCall.

whether financial, cultural, political, or, as in recent safety failures of Virgin Galactic's space tourism programme, more disastrous.[7]

McCall's TED talk on retrofuturism provides a comprehensive outline of the term, for which he claims responsibility.[8] McCall also discusses examples from his work of what he calls faux-nostalgia, or 'the achingly sentimental yearning for times that never happened'.[9] Again, the similarity is striking between these concepts and Bell and Parker's view of space travel temporality – 'a future that never happened'.[10] Further, and importantly for my analysis, both Bell and Parker's writing on space and McCall's artwork suggest a broader cultural context for this kind of temporal disorientation.

The popularity of McCall's work and his own self-reflective practice provides evidence that spaceflight is not the only arena in which this conflation of past and future exists. I argue that this shows that there is a greater cultural phenomenon at work which can be identified in both space culture and in the world of art and design. Art critic Elizabeth Guffey also identifies this broader cultural context of retro aesthetics in the aforementioned *Retro*. Guffey's work illuminates not only how the temporal disorientation of 'retro' impacts upon art and culture more broadly, but also, how the term and concept themselves relate to spaceflight.

Retro Art, Retro Culture, and Space

In *Retro,* Guffey explores the artistic importance of 'retro' in depth, as well as examining the development of the concept and term itself. Guffey discusses a wider range of artistic revivals than I will address here; she does not limit her analysis to the Space Age or its related concepts. However, as she explains, there is a specific connection between popular use of the term 'retro' and the Space Age through the development of – and popular awareness of –

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[7] A recent and highly-publicised setback for commercial spaceflight, in October 2014 Virgin Galactic's SpaceShipTwo rocket plane crashed in the Mojave Desert, killing the co-pilot and seriously injuring the pilot. Kenneth Chang and John Schwartz, 'Virgin Galactic's SpaceShipTwo Crashes in New Setback for Commercial Spaceflight', *New York Times,* 31 October 2014 <http://www.nytimes.com/2014/11/01/science/virgin-galactics-spaceshiptwo-crashes-during-test-flight.html> [accessed 30 November 2014].

[8] On the subject of the term itself, McCall says in his TED Talk, 'My work is so personal and so strange that I have to invent my own lexicon for it.' McCall.

[9] McCall.

[10] Bell and Parker, p. 4.

space technology. Guffey explains that the prefix 'retro', used as a word in itself, was linked to increasing awareness of the 'retro rockets' used in rocket launches:

> When 'retro' rockets helped to popularise the term in the early 1960s, the term was closely linked to space-age technology. Essential for providing a counter thrust against the rocket's main momentum, the retro rockets were used at a vital moment to alter the spacecraft's course. Without them the rocket would lose its trajectory or fail to decelerate properly for landing. Activated at a critical state, the rockets provided a necessary boost backwards. Like these rockets, retro may look back but it also provides a final boost toward something new. Janus-like, the retro past cannot be uncoupled from popular conceptions of the future.[11]

Guffey illustrates that our contemporary concept of 'retro' is thus unavoidably rooted in the mid-20th century, and in the materiality of space travel itself. That this concept of retro aesthetic explicitly draws upon space technology is particularly useful for my analysis of temporality in space culture. This passage speaks to the complexity of our understanding of our own temporality, particularly in reference to space. Both past and future can only ever be viewed through a cultural lens which bonds them inextricably to each other.

In this way Guffey's analysis resonates with Bell and Parker's claim about space's temporal positioning. Through the frame of the 'retrorocket', the temporality of spaceflight appears non-linear; 'a future that never happened'; a past that does not 'connect with our present'. Even as more nations gain spacefaring status, and as space tourism and private enterprise promise expanded access to space, our perspective retains a disjointed temporality. Further, just as spaceflight needs not only an outward-facing rocket but also a countering 'retro' force, our ideas of future space ventures are so entangled with the past that looking forward inevitably requires a backward glance.

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[11] Guffey, p. 165.

However, I argue that this point about the aerospace origins of the concept of retro may indicate that speaking about these issues through the lens of space culture may hold particular importance. That this complex relationship between past and future indicated with the concept 'retro' has, at least in popular use, this historical association with spaceflight indicates that spaceflight could be a particularly useful way of addressing temporal disorientation more broadly. I will return to this point in Chapter Eight when I discuss the potential for space culture to reflect back on queer theory more broadly.

On the subject of the relationship between past and future, however, there are additional ways in which the cultural contexts of both retrofuturism and spaceflight are in alignment. Guffey's work also helpfully addresses the implied failures in what Bell and Parker refer to as a 'future that never happened'. In this sense of failure, which I will later discuss with reference to queer temporality, lie further potential connections between spaceflight and heteronormative sexual culture.

Losses of the Future

The complex connection, or indeed disconnection, between past and future of which McCall and Bell and Parker speak involves a sense of loss. Guffey offers one explanation of this disconnect in claiming that there is something of the past that appeals to the imagination in a way that more recent technological development does not:

> The past thirty years have experienced profound discoveries in science and technology, including advances in quantum and information sciences, bio- and nanotechnology. But these new innovations have done little to capture the popular imagination in the way that futurist magazines like Amazing Stories and Mechanix Illustrated vividly projected life-changing scientific advance during the inter-war years. Retro is a symptom, rather than an

> end; we are pulled to the past, because our visions of the future remain unformed.[12]

Here Guffey argues that expanded, accelerated technological development of the late 20th and early 21st centuries has failed to provide us with a clearer vision of the future than that provided by the speculative futurism of an earlier generation. Scientific progress notwithstanding, increased technological development does not necessarily equate to more accurate insights into the future; the future is, ultimately, unknowable in an objective sense. For this reason, and given the relatively short history of spaceflight and the limited resources for scientific experimentation during that time span, much research on space is necessarily highly speculative.[13]At the same time, there are many examples of how this speculation is often accompanied by retro elements, some of which, such as Galactic Girl, I have already discussed.[14] The preceding passage offers one reading of this tendency. Guffey suggests that the more fantastical technological predictions of earlier eras hold more appeal than anything offered to us by more recent scientific advancements and thus, our ideas of the future are continually pulled back by the force of retro.

In considering spaceflight, many of the most notable technological and exploratory milestones happened many decades ago, during the height of the space race. While progress in the aerospace field has not stagnated since the Moon landings, the culture around space is, as Bell and Parker identify, still bound to the Apollo era in a complex manner. To put this in Guffey's terms, we are 'pulled to' spaceflight's past even as we look upward and outward toward future space exploration. I will return to Guffey later in this chapter for further

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[12] Guffey, p. 166.

[13] There are a number of discussions of this issue in the NASA essay collection *Critical Issues in the History of Spaceflight*, ed. by Steven J. Dick and Roger D. Launius (Washington: NASA Office of External Relations, 2006), see especially Sections I and II, 'Motivations for Spaceflight' and 'Human and Robotic Exploration' respectively, pp. 7-163.

[14] A recent and government-funded example is NASA's release in 2015 of a series of self-consciously retro-styled 'travel posters' for recently-discovered far-away planets Kepler-16b, Kepler-186f, and HD 40307g. Billing this campaign as the 'Exoplanet Travel Bureau', the posters envision suited astronauts visiting alien worlds currently far beyond our human spaceflight capacity, in a visual style which recalls a 1960s-70s travel agency. *Exoplanet Travel Bureau* (Pasadena: NASA Jet Propulsion Laboratory, 2015) <http://planetquest.jpl.nasa.gov/exoplanettravelbureau> [accessed 6 May 2015].

discussion of the socio-political implications of being 'pulled to' the past in discussing the future. First, however, I will address how this concept of the 'pull' of the past relates to queer temporality through the work of Elizabeth Freeman, whose 'Packing History, Count(er)ing Generations' discusses the past's relationship to the present in the concepts of queer identity and time, in a way that I argue importantly echoes Guffey's claims about temporality and aesthetics.

Space, Time, and Sex

In 'Packing History, Count(er)ing Generations', Freeman coins the term 'temporal drag' with, as she puts it, 'all of the associations that the word "drag" has with retrogression, delay, and the pull of the past upon the present'.[15] Freeman advances this term to explain how bodies and identities can hold 'temporal incongruity' through 'a crossing of time'. [16] For this 'crossing', Freeman uses the example of a young lesbian-identified student whose appearance and self-identification she found surprising because, as Freeman says, 'she dressed like my feminist teachers had in college.'[17] This student's body and identity represented to Freeman something out of time – the past exerting force on the present, through the staking of an identity claim both within and outside a contemporary social movement. In 1993, Freeman writes, this kind of alignment with an earlier generation of feminism and sexuality 'registered the failure of the "generational" model to capture political differences between two women who had race, class, nationality, and sexual preference in common.'[18] The 'generational' model, Freeman argues, is destabilised by the complex, non-linear, perhaps even retrograde temporality that exerts influence on present identities.

There are clear superficial relationships between Freeman's 'temporal drag' and Guffey's 'retro', not least of which are the shared lexicon of 'retrogression' and 'pull'. More importantly, Freeman's identity-focussed work provides a useful bridge between Guffey's *Retro* and sexual culture by providing an important additional perspective on temporal

[15] Freeman, p. 728.
[16] Freeman, p. 728.
[17] Freeman, p. 727.
[18] Freeman, p. 728.

disorientation: how 'retro' influences not only art and design, but the body itself. Speaking on generational references in feminist art, Freeman claims that:

> …contemporary sexual and gendered publics, in refusing to mourn properly and instead preserving melancholic identifications, might propel us toward a barely-imagined future. If identity is always in temporal drag, constituted and haunted by the failed love-project that precedes it, perhaps the shared culture-making projects we call "movements" might do well to feel the tug backwards as a potentially transformative part of movement itself.[19]

This passage, with which Freeman closes 'Packing History, Count(er)ing Generations', invokes an image which is strikingly similar to Guffey's illustration of the 'Janus-like' nature of the 'retro past' and 'popular conceptions of the future'.[20] This similarity is clearly useful for my analysis, yet I wish to exercise caution toward Freeman's call for social 'movements' to make use of looking to the past. There is liberating potential in temporal disorientation, as I will discuss in more detail in the next chapter, and Freeman's framework elucidates these liberating possibilities for the 'drag' of the past on the present. However Guffey and Lucy Lippard explore how retrospective ways of approaching the present and future can have socially and politically regressive impact, as I will discuss. Guffey shows that to uncouple the past and future would, like the interdependence of the rocket and retrorocket, likely be futile; Freeman's 'temporal drag' usefully articulates how this futility, then, can be used productively by social movements. However, as Lippard discusses, retro also holds the potential to reinforce marginalisation through 'retro' ideas about gender, sexuality, race, and class.

Guffey argues that the rise in popularity of 'retro' as a concept points to the inherent future-focus of retro thinking. Rather than simply turning toward or alluding to the past, Guffey claims that retro 'gently nudges us away from older ideas of 'Modernity' and towards an uncharted future'.[21] Guffey goes on to argue that this 'nudge' that retro affects can have an

[19] Freeman, p. 743.
[20] Guffey, p. 165.
[21] Guffey, p. 12.

ironic and darkly comic aspect in its treatment of the serious problems related to the past, such as the mid-century's obsession with nuclear threats.[22] However, this ironic distance notwithstanding, there is also a tendency which Guffey identifies for retro aesthetic to be used in an identifiably non-progressive way. Guffey acknowledges this tendency in artistic practice, referencing Lucy Lippard's critique of 'sexist, heterosexist, classist, and racist violence' in work that uses retro themes; Lippard calls this trend a 'reactionary wolf in counter-cultural sheep's clothing.'[23] Lippard identifies retro as a backlash against progressive social change via a return to the aesthetic of an earlier time where sexism, heterosexism, classism and racism were less likely to be challenged.

Lippard further addresses the issue of 'irony' and 'distance' in these works, warning that 'irony alone, irony without underlying passion, becomes another empty formal device.'[24] At the same time, Lippard argues that 'distance' in retro art can take two forms, one 'active', where it is used for intentionally political effect, and one 'passive', where the artists 'see offensive racist or sexist words and images as a neutralized and harmless outlet for any perverse whim'.[25] Lippard points out that 'some retrograde punk artists share with the Right Wing an enthusiasm for the '50s' and claims that ultimately, though indebted to the more socially progressive Dada and Pop Art movements, are ultimately 'primarily reactionary offspring' of these forbearers.[26] To put this back into Guffey's terms, while retro can look to the past with a humorous eye, it can also bring something of the past with it. In Lippard's analysis, when this is done uncritically, it brings with it some of the regressive politics of the time to which retro calls back.

These attributes of 'retro' from Guffey's and Lippard's analyses deeply inform my analysis of space culture. Both the socially regressive potential of looking backward, and the way that hindsight can service an inexorable movement toward the future, speak to the social

[22] Guffey, p. 12.
[23] Guffey, p. 15; Lippard, p. 165.
[24] Lippard, p. 167
[25] Lippard, p. 167
[26] Lippard, p. 166.

and temporal complexities of contemporary space discourse. Like McCall's retrofuturism, this also relates to the temporal disorientation of spaceflight as identified by Bell and Parker. Just as retro provides new ways of looking forward by looking backward, space travel's position is somehow always of the future and the past, even when situated in the present day. The relationship between looking backward and looking forward mirrors Bell and Parker's comments on the temporal positioning of space travel in that it is somehow both our past and our future, without ever forming an entirely linear timeline. At the same time, the social and political risks of evoking a past era impact upon contemporary discussions of space travel, particularly where gender and sexuality are concerned.

Specifically, I argue that the political danger of retro appears in contemporary space discourse precisely because of the relationship between sexism, heterosexism, and the future, in that these concepts are discussed, intermingled, and often conflated in the context of space. The future as conceptualised for human spaceflight is a future that is inherently procreative, which is constructed as heterosexual; in turn, this has implications for the role of women in the discourse. I discussed in Chapter One how both the practical and the aesthetic aspects of representations of women in space seem rooted in an earlier era of spaceflight. The tendency for women to be perceived as an aberration, and for their worth to be implicitly bound to their reproductive capacity is emblematic of the historical exclusion of women from the field. As I have and will continue to argue, the discursive evidence of this continues even as spaceflight becomes more accessible to women. In the following section I expand on some of what I have covered in Part One (and, to a lesser extent, in the two previous chapters) regarding the conceptualisation of women astronauts as potential mates for male astronauts. I further expand on this analysis by exploring the procreative implications of discussions of human futures in space within the context of queer theories of time and heteronormative futures.

Future and Family

The temporal disorientation Bell and Parker identify is related to broader cultural associations with the 'retro' concept, in terms of both the unsteady relationship between past and future,

and the potential for traditional social ideologies to negatively impact utopian future thinking.[27] In both historic and contemporary space programmes there is substantial evidence of sexist and heterosexist presumptions in thinking about the future. In my analysis of this, I draw upon Lee Edelman's concept of 'reproductive futurism' outlined in *No Future: Queer Theory and the Death Drive*.' Edelman defines reproductive futurism as the underlying logic that ties the child to the abstract future, through heterosexual reproduction, heteronormative family structure, and the stigmatisation of anything deemed to not contribute to this procreative understanding of the future. Edelman argues that the insidiousness of reproductive futurism is that it positions itself as a universal good for all of humanity, while inherently privileging heteronormativity.[28]

Edelman's framework of 'reproductive futurism' hinges on the cultural position of the figure of the child. This child is a symbolic one; as he describes regarding the use of children in the film *Philadelphia,* 'the "innocent" child performing its mandatory cultural labor of social reproduction' can be used as a 'disciplinary' image against a stigmatised, oppositional queerness, a queerness which cannot belong to the child itself.[29] He argues that the figure of the child in political discourse is such that an argument constructed as protecting children is 'like an ideological Mobius strip, only *permitted* one side.'[30] In constructing a political argument as one in service of the future through children, 'a globally destructive, child-hating force is posited' – so that to challenge children-as-future is to challenge *everything* – there is thus no reasonable second side to this argument.[31] Edelman argues that this futurism is 'always purchased at our expense'; reproductive futurism privileges the imagined child above all else, especially anything that does not seen to contribute to that child.[32] By constructing this

[27] I return to the concept of utopia in much more detail in Chapter Eight, particularly through the theoretical framework established by José Esteban Muñoz in *Cruising Utopia* – see José Esteban Muñoz, *Cruising Utopia: The Then and There of Queer Futurity* (New York: New York University Press, 2009).
[28] Edelman's 'reproductive futurism' relates very clearly to Donna Haraway's discussion of the 'family of man' as I discussed in Chapter Five, see pp. 129-131.
[29] Edelman, p. 19.
[30] Edelman, p. 2.
[31] Edelman, p. 112.
[32] Edelman, p. 2.

one-sided argument for a reproductive future, Edelman claims that anything seen as opposition – such as the queer subject – is 'stigmatized as threatening an end to the future itself.'[33]

There are a number of anecdotes that hint at space programmes privileging forms of kinship that ensure the future production of children, at the expense of the familial realities of some astronauts. Importantly, as I discussed in Chapter One, ideas of reproduction and kinship come to the fore for women astronauts differently than they do for men. This is illustrated by experiences of two women astronauts, both addressed by Constance Penley in *NASA/Trek,* as well as a more recent case I will discuss regarding Sally Ride. These stories illustrate how women in space are expected to contribute to an ideal of reproductive futurism, regardless of the personal importance of their own families. Though these examples explicitly relate to gender in ways that I have addressed in Part One, they also broadly implicate what Penley terms 'NASA's compulsory heterosexuality'.[34]

Women Astronauts and Failed Futurism

Constance Penley writes that Canadian astronaut Roberta Bondar struggled to convince NASA to allow her mother to meet her upon her return to Earth from a Space Shuttle *Discovery* mission. While they objected to Bondar's mother, NASA is said to have been happy to allow the families of Bondar's crewmates. The rest of the *Discovery* crew, of course, were men, and the family members there to greet them were their wives and children.[35] This story is reflective of the continuing discomfort NASA apparently had with women astronauts at the time, with what Penley terms 'special treatment', playing on Bondar's own professed fondness for the equal consideration she felt men and women received in the astronaut corps.[36] Further than this, however, I believe it speaks to the relationship between space, time, and heteronormativity. Space is seen as a place for the future, and the future is, as Edelman

[33] Edelman, p. 113.
[34] Constance Penley, *NASA/TREK: Popular Science and Sex in America* (London: Verso, 1997), p. 71, as I will discuss in greater length.
[35] Penley, p. 53.
[36] Penley, p. 53.

identifies, traditionally seen as a time for children. By extension, heteronormative futures are ensured by reproductive heterosexual sexuality. The ideal of heteronormative kinship is thus the familial relationships that ensure production of children, which in turn has an inherently future orientation. An unmarried, childless woman is failing to live up to this implied ideal of a future in space. For an adult, a parent, in contrast to a spouse and children, is a turn toward the past in kinship terms. This is a violation of the reproductive futurism of space culture.

Galactic Girl's design alludes to some of the inconsistencies in this aspect of heteronormative kinship. This highly sexualised image is retro-futuristic in its use of pin-up aesthetic and its improbable space suit; meanwhile, the sexualised nature of this figure perhaps goes without saying, although I have also argued as much in Chapter Three. I also mentioned in Chapter Three that the figure of Galactic Girl is entangled with ideas of motherhood in two ways: the 'mothership' launch vehicle she is painted on is named the *VMS Eve*, a name which evokes not only the mythical mother of Judaeo-Christian creation, but also Richard Branson's own mother, Evette. Even more directly (and uncomfortably), Galactic Girl's face is based on photographs of Evette Branson in her youth.[37] The tensions in this artefact's simultaneous sexualisation and relationship to motherhood speak to the instability of the normative narrative of kinship that privileges procreation at the expense of actual family connections. Richard Branson's actual mother is elderly; her reproductive potential has been realised. Her image seemingly needs to be recuperated into a young, objectified, retro-futuristic spacegirl pin-up in order to reclaim the symbolic status of motherhood in this future-focussed construction of kinship.

There are additional examples of this highly specific kind of kinship regarding actual women in space. When Helen Sharman was asked by Project Juno sponsor Interflora to send some flowers from *Mir* to someone on Earth, the company made it clear to Sharman that they would prefer she send them to a romantic partner. Sharman chose instead to send flowers to

[37] Karl Vick, 'Mother Ship Unveiled for $200,000 Place in Space', *The Washington Post,* 29 July 2008, p. A02.

her mother, which she indicates in her memoir did not sit well with the flower company.[38] Sharman's report that Interflora were unhappy with her mother as the flowers' receiver suggests that this was seen as a similar violation to Bondar's. For Project Juno, the commercial viability of the mission was a key concern, which would have inspired the corporate involvement in this display of extra-terrestrial kinship. Yet Penley's account of the Bondar story suggests that this concern about kinds of kinship is a part of space culture as well as corporate spin.

There is another, more recent example of this phenomenon in the choice of cover photo for Lynn Sherr's 2014 biography of Sally Ride. The photo conspicuously features Ride's left hand, with which she appears to be adjusting her flight helmet. Within the helmet, Ride's smiling face can only just be seen. In contrast to this, the ring from her marriage to Steven Hawley is plainly visible, and composed so that it lies prominently between her face and the title text. Though Sherr's book makes much of Ride and her partner Tam O'Shaughnessy wearing matching rings on this same finger, it is the ring symbolising her relationship with a man which is featured on the cover.[39]

Image removed due to copyright restrictions

Figure 7.1: The cover of Sherr's biography of Ride.[40]

[38] Helen Sharman, *Seize the Moment* (London: Victor Gollancz, 1993), pp. 103-4.
[39] Lynn Sherr, *Sally Ride: America's First Woman in Space* (New York: Simon and Schuster, 2014). Sherr discusses the purchase of Ride and O'Shaughnessy's rings on p. 236, and refers back to them repeatedly; see especially pp. 295-6.
[40] See Sherr.

Sherr references this ring once in the text, in reference to the NASA pre-flight press conference to which Ride first wore it. At this conference, among questions that mainly centred on Ride's womanhood, one reporter asked, 'Do you have any plans to be the first mother who has travelled to space?'[41] By this stage in space history, there were plenty of astronaut fathers, including Commander Richard Crippen of the mission in question. However, for women, as this exchange shows, the question of procreation receives greater focus. Yet in fact, Ride could not have been the first spacefaring mother, as that honour already belonged to Valentina Tereshkova. Tereshkova married male cosmonaut Andriyan Nikolayev shortly after her 1963 flight, and gave birth to their daughter in 1964.[42] The birth of a child to two astronaut parents was a matter of some medical interest due to concerns about radiation and fertility, concerns which are still the focus of much space medicine, as I discussed in Chapter Five.

The fertility of this cosmonaut couple was important not only for the Soviet space programme but for space science around the world. One small example of this can be found in a 1972 British secondary school science book called *Space Biology*, which I chanced upon in storage in the Cardiff University library system.[43] *Space Biology* uses the example of Tereshkova and Nikolayev's daughter as proof that the extreme conditions of space leave human reproductive capacity intact: 'Two Russian cosmonauts, Andrian Nikolayer *[sic]* and Valentina Tereshkova, married and had a perfectly healthy child, showing that the radiation they had experienced in deep space had caused no obvious genetic damage', reads the caption on a photo of the cosmonaut couple holding their smiling infant.[44] Throughout *Space Biology*, this is the only mention of the existence or possibility of a woman in space. Though this book was written nearly a decade after Tereshkova's historic flight, it refers throughout to astronauts as 'men' only, and its sole acknowledgment of Tereshkova is simply that she

[41] Sherr, p. 147-8.
[42] David J. Shayler and Ian Moule, *Women in Space: Following Valentina* (Chichester: Praxis, 2005), p. 48.
[43] C.F. Stoneman, *Space Biology* (Middlesex: Penguin, 1972). The back cover of this text, from the Penguin Biology Topic Books series, reads in part, '*Space Biology* looks mainly at what we can learn about man from our progress so far in the exploration of space.'
[44] Stoneman, p. 64.

successfully reproduced. Thus this passage speaks to not only the importance of Tereshkova's and Nikolayev's child, but to the role of women in space more broadly.

In *NASA/Trek*, Penley comments on the tendency for women astronauts to write children's books about spaceflight, pointing out both that Helen Sharman's autobiography is, as I discussed in Chapter One, the only English-language book of its kind for an adult audience, and also that most women astronauts who have written books have chosen to write for children, in which Penley claims 'space is as innocent as childhood is presumed to be'.[45] Penley argues that women's experiences with technoscientific adventure are more culturally justifiable when they are constructed for children's education, and the proliferation of children's books by women astronauts forms part of this broader cultural setting; additionally, the 'innocence' Penley identifies in these books is a form of depoliticisation that distances the authors from the specifics of space policy. Although *Space Biology* is written by a man, Stoneman's gendered focus is indicative of the same cultural phenomenon Penley points to in her argument about children's literature. These artefacts speak to the way that women are considered primarily as procreators in space discourse, while men are not subject to the same presumptions. Both the Stoneman text and the astronaut-authored texts Penley references reinforce the idea that women's accomplishments are best framed for children, and thus for the future.

Despite the 'innocence' and depoliticisation of children's literature about space, Penley does point to an 'inadvertently political' moment in *On the Shuttle: Eight Days in Space*, a book co-authored by Roberta Bondar and her sister Barbara, who is an established author both for children and for adults on the topic of education. The book, Penley explains, includes a photo of 'Bondar's *Discovery* crew and their "loved ones", all of whom seem to be heterosexual spouses, except for Bondar's sister Barbara.'[46] Penley claims that this book, particularly in the context of her earlier discussion of Bondar's difficulties with NASA's desire for an idealised image of astronaut kinship, 'allows Bondar to reauthorize herself as a scientist,

[45] Penley, pp. 70-1.
[46] Penley, p. 71.

doctor, and astronaut, a multidimensional role not precluded by NASA's compulsory heterosexuality'.[47] NASA's compulsory heterosexuality, here, is about bolstering an image of a future in space as a future of heterosexual reproduction, and Penley argues that Bondar uses the book as an opportunity to affirm the personal importance of the non-reproductive kinship relationship of sisterhood.

Retrograde Futures

As I discussed in Part One, the gendered component of these stories has an important relationship with the experiences and the history of women in space, but by analysing them alongside the work on queer temporality and retro I show how they also relate more broadly to the sexual culture of spaceflight – a thread along which I will continue in Chapter Eight. As I discuss in that chapter, attempts to communicate in or with the extra-terrestrial are inherently future-focussed, because of the timescales involved in transporting objects and transmitting data across the vast distances of outer space.[48] These stories provide evidence of how individual astronauts are impacted by the reproductive futurism of space discourse; but as I will argue in Chapter 8, reproductive futurism impacts upon even 'unmanned' methods of accessing outer space.

First, however, I will return briefly to Guffey before transitioning to a more in-depth discussion of queer theory in the next chapter. Retro, Guffey claims, 'is a symptom, rather than an end' – we turn to the past because the future is uncertain.[49] Expanding upon this, I posit that retro's nature as a 'symptom' of this uncertainty is, in fact, how it can become an end in itself. The cultural need for the promises of the future is apparent in both Edelman's analysis of reproductive futurism and in the stories Penley and I address around astronaut kinship; the future's inherent uncertainty, I argue, combined with this cultural anxiety around futurity, the child, and normative reproduction, is a prominent force behind the cultural power of retro. As

[47] Penley, p. 71.
[48] This is made explicit in the work of Trevor Paglen, as I discussed in the Introduction and to which I will return in Chapter Eight. See Trevor Paglen, *The Last Pictures* (Berkeley: University of California Press, 2012)
[49] Guffey, p. 166.

I will argue in the next chapter, the particular position of space travel, culturally and temporally, provides unique opportunities to identify this phenomenon, as well as some unique potential to critique it.

Intriguingly, alongside identifying the relationship between the word 'retro' and popular awareness of spaceflight retrorockets, Guffey also notes a celestial connection with an earlier popular use of the prefix in the astronomical term 'retrograde'. In this context, retrograde refers to planetary movement that, to use Guffey's word, *deviates* from normal movement.[50] In my eighth and final chapter, I will discuss how queer theory and spaceflight can further inform one another, by exploring potential liberating aspects of 'deviance' in both queer culture and in the extreme environments of space travel.

[50] Guffey, pp. 12-3.

Chapter Eight: Queering Space, Queering the Future

I will begin by returning to a text I discussed in Chapter Five – the NASA memo from 1971 authored by Kanas and Fedderson. In addition to the section on sexual release which I have already analysed, the document contains another important example of the impact of sexual culture on space research. This section, which importantly follows that addressing 'the problem of direct sexual release', is titled, 'Separation Reactions of Married Women'.[1] I wish to draw attention to several key aspects of this section. First, this section is abruptly placed after the section on sexual release, with no articulated transition or link between them. The logical connection between discussions of wives notwithstanding, the shift lacks any clear explanation for the sudden change in focus away from the astronauts themselves. Indeed after this short section (three paragraphs in length), the topic immediately returns to astronaut psychology, under the heading 'Predicting Action from Personality'.[2] Third, the content of this section raises some questions about the authors' assumptions around sex and sexual culture. It is, however, that first point, rather than the content of the text itself, toward which I direct my critique.

In 'Separation Reactions of Married Women', Kanas and Fedderson report on an earlier study of submariners' wives, among whom an 'illness' is identified: 'The Submariners' Wives Syndrome'. This 'syndrome', identified in 61% of the submariners' wives in the study Kanas and Fedderson cite, is experienced by women whose husbands have returned from long-duration submarine missions, and is 'manifested by sexual withdrawal, marital conflicts, sleep disturbances, and uncontrollable weeping'.[3] These women, Kanas and Fedderson assert, 'were unable to develop mature associations with their husbands', which they imply results in Submariners' Wives Syndrome. To conclude the section, Kanas and Fedderson write, 'Men training for a long space flight will frequently be away from home for varying periods of time,

[1] Nick A. Kanas and William E. Fedderson, 'Behavioral, Psychiatric, and Sociological Problems of Long-Duration Space Missions', *NASA Technical Memorandum X-58067* (1971), p. 38.
[2] Kanas and Fedderson, p. 38.
[3] Kanas and Fedderson, p. 38.

and the actual flight itself will involve many months; therefore, the need to recognize the "Submariners' Wives Syndrome" is obvious'.[4]

As with the Kanas and Fedderson section that I discussed in Chapter Five, this short passage is dense with presumptions and oddities. In reporting on this research, Kanas and Fedderson conspicuously do not acknowledge any role that the submariners themselves might play in their wives' 'syndrome' – this despite the fact that their memorandum spends a great deal of time exploring all of the psychological problems routinely brought on or exacerbated by the conditions of long-term submarine deployments. This is another example of space research reproducing the narrative of 'woman as problem', that I discussed in Chapter One. However, this passage itself is not the subject of my analysis. I draw attention to this section only because it is so striking that it is included immediately after the section which I discussed in Chapter Five, where the spectre of homosexuality is raised. I contend that the very existence of the discussion of the Submariners' Wives Syndrome serves to reinforce the heteronormativity of space culture. Perhaps the 'obvious' need to focus on the possibility of an 'Astronauts' Wives Syndrome' is also to remind everyone, not least the astronauts themselves, of the heterosexual couple as the fundamental social unit.

In Chapter Six I briefly discussed an anecdote from Casper and Moore's study of NASA, in which two Apollo astronauts, after returning from their mission, jokingly announced that their mutual confinement had inspired a romantic relationship between them. As I argued in Chapter Six, that this joke was met with much amusement from the press speaks both to the acceptability of homosexuality as a punch line, and to the underlying anxiety that homosexual behaviour could occur under the conditions of single-gender space missions.[5] The joke only

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[4] Kanas and Fedderson, p. 38. It is perhaps clear from my analysis so far that I am sceptical of the conclusions drawn in this passage regarding the psychosexual health of submariners' wives. The study Kanas and Fedderson cite, by Richard A. Isay, addresses the institutional culture which Isay suggests contributes to submariners' wives processing emotional responses to their husbands' deployments in less-healthy ways. However, its relative lack of consideration for the behaviour of returning submariners, and whether this impacts upon their wives' interest in, among other things, having sex with them, raises additional questions for me, which I do not feel are satisfactorily addressed in either text. See Richard A. Isay, 'The Submariners' Wives Syndrome', *Psychiatric Quarterly*, 42 (1968) 647-652.

[5] See pp. 148-149.

works because it plays on the pre-existing idea that such a thing might happen in the alien environment of outer space, and making this idea into a joke functions as a disavowal of its potential danger.[6]

In this final chapter, I argue that there is critical potential in the possibility of queer futures in space. Further, this critical potential applies to my analysis in two key ways. For one, it provides possibilities for the field of space culture to be more inclusive of queer subjects. Additionally, as I will argue, considering futurity through both its queer potential and its relationship to space culture holds critical potential for expanding queer studies of time and the future. In Chapter Seven I examined how normative conceptions of time, combined with the temporal disorientation of space culture, contribute to a limiting effect on extra-terrestrial conceptions of futurity. However in this chapter I want to argue for a different perspective on the future, one that can be informed by queer possibility and can thus offer a more optimistic view of a spacefaring future for human culture. As I will explore in further detail, I am informed in this by José Esteban Muñoz's *Cruising Utopia*, which supports my contention that there is valuable critical potential in an optimistic view of queer possibilities in extra-terrestrial futures.

Toward this exploration, I begin with another example of both space art and extra-terrestrial communication, a text which I have briefly discussed previously, as it contributes to this thesis its epigraph. Trevor Paglen's *The Last Pictures* is a project which offers a particular view of an extra-terrestrial future which is both extremely far away from the present moment, and very cynical. In this chapter's first section I will discuss what I identify as the lack of critical potential in Paglen's work, as a route into exploring the critical potential in the queer space art of Frank Pietronigro, as I will discuss in the last section.

The Last Pictures

That space is a space of the future is something Paglen's *Last Pictures* explicitly foregrounds, as I discussed in the introduction. There is, however, little hope in this construction. The grand

[6] Much research in sociology has explored the link between homophobic humour and the construction of heterosexual masculinity. For one example which has assisted the formulation of my argument, see Mary Jane Kehily & Anoop Nayak, '"Lads and Laughter": Humour and the production of heterosexual hierarchies', *Gender and Education* 9 (1998), 69-88.

timescale involved in *The Last Pictures* project – in the billions of years – positions the artwork to outlast the human species. Paglen is explicitly pessimistic about this, and not only because of the length of time involved. One of the stated aims of the project, he writes, is to tell a story of 'how the humans committed suicide'.[7] Yet in pursuit of answering this question, as project research assistant Kate Detwiler writes in one of the book's early chapters, the team initially planned to use no images depicting human beings. This plan was scrapped due to ambiguity about what in fact constituted a depiction of a human figure.[8]

Detwiler's discussion of this centres mainly on those figures which raise obvious questions about what does constitute a human figure, such as an extracted human brain and a drawing of the comic book character Captain America.[9] Aside from this two-page explanatory note from Detwiler, on the whole the project provides minimal explanatory notes on the images it did eventually choose. Further, despite Detwiler's chapter, the question of how to address humanity is not given much detailed attention elsewhere, aside from the unexplained note that at one point during the project Paglen considered etching the cover of the image disc with 'an image of a tall, goat-headed man towering over a startled child'.[10] Thus the images of humans that do remain in the final work are difficult to explain in a coherent way in my analysis.

Paglen's work ultimately contains no direct discussion of sexuality or sexual culture. Even so, that is not a shield from heteronormative influences, as one example I will shortly discuss reveals. Paglen's collection bears some resemblance in form and function to the *Family of Man* exhibition which Donna Haraway critiqued, as I discussed in Chapter Five, although the two projects were constructed toward very different ends. Paglen even includes one of the images from *The Family of Man* in *The Last Pictures* – that of Yvonne Chevallier, photographed during trial for the murder of her husband. Paglen quotes photo theorist Ariella Azoulay who

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[7] Trevor Paglen, *The Last Pictures* (Berkeley: University of California Press, 2012), p. 13.
[8] Katie Detwiler, '"Belonging": Human/Archive/World', in Trevor Paglen, *The Last Pictures* (Berkeley: University of California Press, 2012), pp. 21-22.
[9] Detwiler, p. 22.
[10] Paglen, p. 18.

argues that Steichen's inclusion of this photo in *The Family of Man* is a surprising and affecting choice which speaks to Steichen's support for women's liberation.[11] Similarly to Steichen's work, Paglen's *Last Pictures* are underwritten with a progressive ideology, but also like *The Family of Man*, this allows heteronormativity to remain unchecked in the work. In the eventual choice to represent the human, the choices that were made, while not on a scale with other interstellar communication projects as I explored in Chapter Two, are still heteronormative in design. For this reason, I have some criticisms of Paglen's project which are very similar to feminist criticisms of the Pioneer Plaque, which I discussed in Chapter Two.

Heteronormativity in *The Last Pictures*

The unchecked heteronormativity of *The Last Pictures* is most clear in one pair of images set on facing pages of the book: in one, a male figure expertly surfs an enormous, perfectly formed wave; opposite him, a topless woman is shown standing in knee-high water as the choppy sea breaks against her back. In the text explaining the images, their visual connection is not acknowledged, though an implicit narrative thread is constructed between them. The surfer is participating in a big-wave competition, Paglen explains, and this raises issues of global warming because, as another big-wave surfer is quoted as saying, 'Global warming can create bigger storms, and has, and is going to…and that's great for me.'[12] The woman in the opposite photo is identified as Cristina Llanos, a Spanish artist whose graphic designer partner, Aitor Mendez, took the photograph of her while they were on holiday in a beach town which Mendez refers to as 'virgin land'.[13] Perhaps Paglen's message is the impossibility of 'virgin land' in contemporary society, that the sea itself is unavoidably influenced by environmental damage. Still, that the illustration of this concept involves a fully-clothed man and a barely-clothed woman is notable – to me, if not to Paglen. The heterosexual relationship which

[11] Paglen, p. 164. I contend that the way this is positioned functions as an attempt to absolve Paglen, if unintentionally, of the responsibility of addressing gender issues in his own work. The quote from Azoulay positions women's oppression in the past, and Steichen as a 'courageous' figure of his time. Though Paglen makes no claim to being courageous himself by including it, I am unconvinced that Paglen is expressing much of a critical focus at all by including either the image or the commentary, though it does seem to imply critical engagement on some level.

[12] Paglen, p. 153.

[13] Paglen, p. 152.

frames the photo of Llanos, along with her juxtaposition with another male figure, strikes me as a repetition of familiar tropes. If the human figures ultimately chosen for inclusion in *The Last Pictures* are intended to break with the tradition established by the Pioneer Plaque, I argue that they have not succeeded, due to the repetition of heterosexist and sexist tropes. [14]

While Paglen's project does not display the same overt anxiety as I argue is present in Kanas and Fedderson, along with other texts covered in the previous chapters of Part Two, there is a degree of heteronormativity to the work which belies the conversations Detwiler reports about nuanced consideration of representations of human cultural biases. I argue that this unquestioned undercurrent of heteronormativity is closely related to the overarching pessimism of *The Last Pictures'* argument. As I argued in Chapter Seven, the heteronormative view of the future described by Edelman's framework of 'reproductive futurism' is constrained by its focus on the figure of the child. I have argued that this has an important restrictive effect on who and what is granted symbolic access to outer space. However, I want to further argue that the constraining effect of heteronormative ideas of the future also has a negative effect on those ideas themselves.

Pessimism and Critical Failure

I argue that *The Last Pictures* is an example of the constraining effect of heteronormative futurity. Paglen's work is one with minimal hope. Without dismissing the importance of the concerns he raises – environmental destruction and war, particularly – I argue that the pessimism in Paglen's work diminishes its effectiveness as an engagement with ideas of the future. Paglen may well be right about the human race's trajectory toward self-destruction, but *The Last Pictures* offers little in the way of critical response to this prospect. The futility of communicating with extra-terrestrials is a strong theme in the writing within the publication of *The Last Pictures,* and the futility of communicating with even other humans – particularly about the human race's trajectory toward suicide – in Paglen's work does not offer much in

[14] One possible exception is a photo included in the project, with no explanation from Paglen, which features two Nepalese policemen holding hands (Paglen, p. 165). However, I contend that this functions at most as an example of cultural dimensions of homosociality, not as a critique of heteronormativity in this or any cultural context.

the way of future cultural possibility. At the same time, by failing to engage critically with many of the cultural issues raised by the images Paglen includes, *The Last Pictures* fails to provide even a critical response to the present.

In Part Two so far I have discussed how the threat of the queer exists and provokes disciplinary response in space culture, and how heteronormativity places a restrictive influence on the relationship between space and the future. Paglen's *Last Pictures* are an example of the effects of both of these aspects – while neither his pessimism nor his image selection are explicitly sourced from heteronormativity or a backlash against queer potentiality, the project nonetheless is a clear representation of these issues. Paglen's future offers little recourse and little hope, and this is a broader limitation of heteronormative thinking about a future in space. In this I am informed by José Esteban Muñoz's *Cruising Utopia*, in which he argues that queer futurity can productively be conceptualised as both a position of hope and a position of critical possibility – two points on which *The Last Pictures* crucially fails, as do the other examples of extra-terrestrial futurity I have discussed.

Muñoz on the Critical Value of Utopia

In responding to Paglen's *Last Pictures* I am particularly informed by Muñoz's framework of utopia as a site of productive critical potential. Muñoz writes, 'utopia offers us a critique of the present, of what is, by casting a picture of what *can and perhaps will be*'; at the same time, Muñoz also argues that utopia allows us to 'imagine a space outside of heteronormativity'.[15] Part of what limits the critical potential of *The Last Pictures* is simply that Paglen's cynical future does not provide critical tools which can be productively applied to the present, because it offers no solutions to the future it envisions. At the same time, the unreflective reproduction of heteronormative and sexist tropes in *The Last Pictures* also hinders its critical potential. This aligns Paglen's work with some other examples from space culture which I have discussed in this thesis, in that Paglen's future in space does not provide space for women or for queer subjects. Further to this, I contend that these same limitations also prevent Paglen's

[15] José Esteban Muñoz, *Cruising Utopia: The Then and There of Queer Futurity* (New York: New York University Press, 2009), p. 35.

critiques of violence, oppression, and environmental destruction from fulfilling their potential. Paglen's future does not critique the present as effectively as it could, because the future it offers does not diverge from the present's normative terms.

In contrast – importantly so, I argue – Muñoz claims in *Cruising Utopia* that 'the future is in the present'.[16] Muñoz explores the relationship between present and future through examples that enact 'important critiques of the present by insisting on the present's dialectical relation to the future'; looking to the future, Muñoz argues, 'cuts through fragmenting darkness and allow[s] us to see the politically enabling whole'.[17] This, I contend, is exactly what *The Last Pictures* fails to do. Fragmenting aspects of social power relations, like the construction of heteronormativity and objectification of women, prevent political enablement.

Past, Present, Utopia

In addition to this important claim of the future's relationship to the present, Muñoz also articulates how the future is inextricably entangled with the past, in language which recalls Bell and Parker's claims about the temporal disorientation which characterises space culture. *Cruising Utopia* vitally argues for, 'a theory of queer futurity that is attentive to the past for purposes of critiquing a present'.[18] Rather than the reactionary way in which the past can inform the present in space culture, as I discussed in Chapter Seven, Muñoz offers a different way to think through temporal disorientation. Rather than the retrograde effect of traditional normativity, Muñoz argues for understanding the relationship between past, present, and future as non-binary and thus critically powerful. He writes:

> Queerness is a structuring and educated mode of desiring that allows us to see and feel beyond the quagmire of the present. The here and now is a prison house. We must strive, in the face of the here and now's totalizing rendering of reality, to think and feel a then and there.[19]

[16] Muñoz, p. 49.
[17] Muñoz, p. 64.
[18] Muñoz, p. 18.
[19] Muñoz, p. 1.

Further, Muñoz argues that utopia provides a more productive way of conceptualising queerness itself. He writes, 'we gain a greater conceptual and theoretical leverage if we see queerness as something that is not yet here'.[20] This has critical power because viewing queerness as yet to be realised offers reasons for and pathways toward critiquing the present. This further relates to the past, and how these three temporal modes can be used to productive effect, as Muñoz claims:

> Queerness as utopian formation is a formation based on an economy of desire and desiring. This desire is always directed at that thing that is not yet here, objects and monuments that burn with anticipation and promise. […] And thus past pleasures stave off the affective perils of the present while they enable a desire that is queer futurity's core.[21]

A key component of Muñoz's argument in *Cruising Utopia* is the idea that straight time is based in the present. This may seem to contrast with Edelman's argument, important to my last chapter, that the reproductive futurism renders the normative future a site of heterosexuality. However, as I argued in the introduction, Edelman's critique of heteronormative futurity does not contrast with Muñoz's queer utopianism. Muñoz instead positions queer utopia as a response to the heteronormativity of reproductive futurism. He writes:

> Indeed, to live inside straight time and ask for, desire, and imagine another time and place is to represent and perform a desire that is both utopian and queer. To participate in such an endeavour is not to imagine an isolated future for the individual but instead to participate in a hermeneutic that wishes to describe a collective futurity, a notion of futurity that functions as a historical materialist critique. [22]

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[20] Muñoz, p. 22.
[21] Muñoz, p. 26.
[22] Muñoz, p. 26.

I argue that Muñoz's queer utopianism aligns in this way with Edelman's concerns about reproductive futurism. I have argued in Chapter Seven that reproductive futurism is particularly bad for women, and for queer subjects, in the present. Muñoz's analysis expands upon this in that it further suggests that the future that straight time offers is not a future for a collective. The phenomenon Edelman terms reproductive futurism offers an individualistic avenue toward the future which focusses on the heterosexual family unit in a sense that lacks provision for a wider community, both in conceptions of the future and in what Muñoz terms the here and now. In this way, I argue that queer futurity, and particularly Muñoz's queer utopianism, provides a more critically effective way of thinking through a future in outer space.

In saying this, I am not suggesting that Muñoz's queer utopia must or even should be realised in outer space. What I do contend is that Muñoz's view of futurity both aligns with and provides new possibilities for conceptualising the future in/and the extra-terrestrial. Most of the texts I have analysed in Part Two represent what I argue are disciplinary reactions to the spectre of queer possibility in space, however there are also arguments that space may hold unique potential for future queer projects. One notable source of the idea that space may hold beneficial queer potential is the queer space artist Frank Pietronigro, whose work raises many questions – and offers unexpected answers – on the subjects of space culture and sexuality.

Frank Pietronigro

Similarly to the art of Aleksandra Mir, which I discussed in Chapter Two, Frank Pietronigro's work offers possibilities and promise for engagements with space beyond the normative paradigm. Where Mir's work demands reflection on the gendered construction of extra-terrestrial space, Pietronigro's suggests that extra-terrestrial space can be, and may already be, queer. Much of Pietronigro's work explicitly engages with space culture, and some of his projects have even been produced in a microgravity environment.

With access to microgravity simulation flights, Pietronigro has developed multiple art projects which both exist in and directly engage with the material conditions of outer space.

One of Pietronigro's projects, his 'drift paintings', involves using a traditional artistic technique – painting a canvas – to new, extra-terrestrial effect. By utilising the effects of microgravity in his work, the practice of painting a canvas becomes a bodily practice, as Pietronigro's body moves in unpredictable ways in response to the motion of the aircraft and the effects of experiencing microgravity. Paint, its movement similarly influenced by the lack of gravity, covers not only the canvas but also the plastic sheeting erected to separate the art from the plane's cabin, and Pietronigro's clothing and shoes.[23] Pietronigro argues that because microgravity causes the paint to interact with everything inside the partition (as well as the partition itself), his body leaves a 'queer imprint' on the canvas. In this way the most formal output of the 'drift paintings' procedure, the canvas titled *Document 34*, is a record of a queer bodily experience in microgravity. As Pietronigro says, 'I am queer no matter what I am doing and in honor of that fact, showing up with my essence in each instance, creates a naturally occurring queer imprint reflected in the work, my life and its diversity.'[24]

Through this idea of inserting queerness into extra-terrestrial spaces, Pietronigro's work argues for an expansion of the cultural possibilities imaginable in outer space. In another of his works, *Flags in Space*, he engages more overtly with queer culture through the queer artistic practice of flag dancing. Flag dancing is associated with gay or queer performance and the LGBT community; as Pietronigro says in his statement on the project, flag or fan dancing 'is usually experienced late at night in gay dance clubs around the world'.[25] This association is part

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[23] The latter is the subject of another art piece, *Diamond Dust Worker Boots*. This piece references Andy Warhol's *Diamond Dust Shoes,* and also Pietronigro's own class background, something he and I discussed in an interview I conducted with him for the journal *Assuming Gender*. See Kat Deerfield, 'Queer in Zero G: An Interview with Frank Pietronigro', *Assuming Gender* 4:1 (2014), 72-80, p. 77.

[24] Pietronigro's assertion that he is 'queer no matter what' he does raises the spectre of the tensions between queer as a theoretical approach and the use of queer as an identity label. It is pertinent that Pietronigro uses both of these concepts in his work – his own queer identity as well as queerness as a form of cultural and artistic practice. In this way, he frames queerness as an essential part of his personality, but in his art, as I discuss further, he frames queerness as a *doing* rather than the *being* of essentialist constructions of sexual identity. Although, as he discusses here, his identity is an important part of his artistic and theoretical approach, it is ultimately his art, not his identity, which I focus on in my analysis. See Deerfield, p. 78.

[25] From the artist's project statement. See Frank Pietronigro, 'Flags in Space', Pietronigro.com (2006) <http://pietronigro.com/wp-content/uploads/2013/06/Flags-In-Space-by-Frank-Pietronigro-2006.pdf> [accessed 28 November 2013] (p. 2).

of Pietronigro's justification for including flag dancing in some of his microgravity simulation art projects. He writes:

> Theoretically, I knew it was significant and symbolic for me to dance within zero gravity by bringing authentic queer cultural production into those interdisciplinary sites. During my first flight I used blue silk flags. During my second flight I asked Gilbert Baker, the creator of the Rainbow flag, to sew for me two flags: one rainbow flag and one American flag.[26]

This concept of 'authentic queer cultural production' is key to Pietronigro's interest in the intersections between queer culture and space culture. Pietronigro uses flags made by the creator of the original rainbow flag, now one of the world's most recognisable images of gay culture, and puts these flags into a practice already defined as queer: in so doing, Pietronigro is making those intersections visible and inescapable. Pietronigro goes even further than this to argue that queer culture and space culture are intrinsically related. Space can be a queer space, and indeed, it arguably already is.

Queer Space, Queer Perspective

Pietronigro's explicit claims about the relationship between queer culture and space culture stand in stark contrast to the heteronormativity I have identified in space culture. I argue that the accord Pietronigro identifies between space culture and queer culture is nonetheless a reality, and that this is at the root of the 'spectre of queer sex' I have examined in other texts. Further, this relates to issues of extra-terrestrial spatiality. Pietronigro addresses this in discussing the relationship between vision and queerness. Queer perspective, he argues, has great value for space culture:

> Queers see the world differently and our unique way of looking at the world offers a differentiated viewpoint on space exploration that can help reveal many hidden benefits yet to be discovered for all space travelers regardless of their sexual orientation. There is inherent value in

[26] In Deerfield, p. 76.

> understanding space travel, specifically in weightless environments, from the vantage point of queer spectators, as queer perspectives have and will continue to contribute, as a counterpoint way of seeing for the larger numbers of all people living in the ever-changing kinetic environment of microgravity space. I posit that queers are optimally suited for space flight because of our unique ability to deal with the perception of the environment and space around ourselves. I learned as a young man to stay in tune with what was going on in my environment both because of my artistic curiosity and the necessity of fending off homophobes. Such perceptual skills and others like them, yet to be scientifically identified, may be gleaned from queer experiences in space to the benefit of all space explorers.[27]

In this passage, Pietronigro refers to a phenomenon that Kirby identifies in 'Re: Mapping Subjectivity', to which I return now after temporarily abandoning this spatial approach from Chapters Three and Four.[28] In Kirby's analysis, the Cartesian subject's interest in maintaining a strict boundary between body (internal) and space (external) may be born from that subject's privileged perspective. As Kirby explains, consciously becoming aware of one's body, such as in the example of Jameson experiencing feeling lost in postmodern city spaces, is something that is rarely experienced by women, because society requires that women be more aware of their embodiment than men are.[29] Kirby further writes of the idea that a woman could not become lost in the way that Jameson does, because women's perception of risk in their environment

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[27] Frank Pietronigro, 'The Potential Contributions of Queer Culture on the Future of Space Exploration' Paper presented at LESS REMOTE: The Future of Space Exploration – An Arts and Humanities Symposium, September 30 – October 1, 2008, organized by Flis Holland and The Arts Catalyst in association with Leonardo and OLATS. Co-sponsored by IAA Commission VI; to run parallel to the 59th International Astronautical Congress (IAC), SECC, Glasgow, Scotland.

[28] In the spirit of Kirby's own framework from this essay, I would say that the Cartesian subject has been lost in the intervening chapters – in a way, I hope, which allows it to be penetrated by other aspects of my argument, such as the influence of temporality. See Kathleen M. Kirby, 'Re:Mapping Subjectivity: Cartographic Vision and the Limits of Politics', in *Bodyspace*, ed. by Nancy Duncan (London: Routledge, 1996) pp. 45-55 (pp. 52-53).

[29] Kirby, 'Re: Mapping', pp. 52-53.

requires a degree of vigilance which precludes this kind of loss of body to external space.[30] Pietronigro explicitly references the existence of this same phenomenon in his own experience – that of a man, but not the 'master subject' figure that Haraway identifies in 'Situated Knowledges' and that Rose explores further in *Feminism and Geography*.[31] He further contends that the realities of extra-terrestrial experience – its novelty, its extremity – demand a perspective and a spatial awareness for which queer subjects are uniquely suited. Space may not be normatively constructed as a space for queers, but its own spatial constitution seems to demand queer engagement.

In addition to the spectre of queer sex as I have addressed in Chapters Five and Six, Pietronigro's experiences suggest that there are aspects of spaceflight experience themselves that threaten normativity. While I argued in Chapter Four that microgravity can usefully inform broader discussions of gendered spatiality, I similarly argue that Pietronigro provides evidence that it can also inform discussions of sexualised space in a unique way. Further to this however, through the work of Muñoz and in direct contrast to Trevor Paglen's art, I argue that Pietronigro's work speaks to how space can serve as an important site for examining the relationship between queerness and futurity.

Queer Space and Queer Futures

In the same way that Muñoz argues that the queer is a horizon rather than a 'here and now', space culture is tremendously future-focussed, as I have argued. Just as I argued that Paglen's work lacks critical efficacy because of its cynicism and its unconscious heteronormativity, based on Muñoz's ideas of queerness and the future I contend that Pietronigro's artistic practice is critically productive because of Pietronigro's overt engagement with queer culture. Pietronigro's work offers not just a space, but a future for queer subjects in a way that space culture generally does not.

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[30] Kirby, 'Re: Mapping', p. 53.

[31] See my analysis of Haraway's 'master subject' and Rose's application of this figure to geography in Chapter Three, especially p. 74-75. Donna Haraway, 'Situated Knowledges: The Science Question in Feminism and the Privilege of Partial Perspective', in *Simians, Cyborgs and Women* (London: Free Association Books, 1991), pp. 183-202; Gillian Rose, *Feminism and Geography* (Cambridge: Polity Press, 1993).

In addition, Pietronigro's work is explicitly hopeful in its engagement with queerness. By opening up extra-terrestrial space to queer subjects, and by opening up queerness for the benefit of space culture, Pietronigro's art works toward a utopian future in space. This is similar to Muñoz's assertion that '[q]ueerness's ecstatic and horizontal temporality is a path and a movement to a greater openness to the world.'[32] Pietronigro's work expands upon this by directing openness not only toward the world, but to that which lies beyond. In this way, Pietgronigro's art is an example of how space culture can itself productively contribute to queer theoretical approaches to both space and time.

More than this however, I argue that the juxtaposition of Pietronigro's work with Paglen's demonstrates that queer theoretical approaches are especially useful to cultural studies of space. The lack of critical effectiveness in *The Last Pictures* is not unrelated to its heteronormativity, as I have argued. Queer futurity provides a more critically effective account of not only the future, but also the present. Pietronigro's work, like Muñoz's theory, looks toward the future with hope. In this way, a queer perspective on space culture not only contributes to a more inclusive environment for queer subjects, it also promises a more robust critical framework for engaging with futurity in space. I argue that this is even more productive, and even more important, because of space's deep, though troubled, association with the future. As human beings continue to venture further into the cosmos, I contend that we need queer critique. Whether or not there is a future for humanity in space, there is certainly space in humanity's future, but if we are to think through this future in a critically effective, progressive manner, we can do so by 'seeing queerly', and striving toward a horizon of possibility.

[32] Muñoz, p. 25.

Conclusion

While this thesis has demonstrated that traditional discourses of gender, sexuality, space, and time greatly impact upon space culture, it has also proposed that the extra-terrestrial presents unique challenges to the human body and to human understandings of space and time. I have argued that aspects of the extra-terrestrial can usefully inform larger conversations about bodies, spaces, and the future. Ultimately, this is the overarching goal of this thesis: to argue that space is not just a productive source of texts for analysis, but that it is an important site of theoretical production as well. Chapters Four and Eight most directly addressed this by arguing for the value of incorporating lessons taken from space culture into broader studies of spatiality and temporality, respectively. At the heart of this thesis is my contention that an investigation of gender, sexuality, spatiality and temporality in the extra-terrestrial can productively inform the study of these aspects of culture more broadly.

The first four chapters which constituted Part One were primarily focussed on my investigation of gender issues in multiple arenas within space culture. In Chapter One I analysed case studies of individual examples of women in space to illuminate the discursive field that surrounds the construction of gender in space culture. I used a theoretical framework drawn primarily from the work of Constance Penley and Monica Casper and Lisa Jean Moore to analyse these texts from a feminist perspective. From the basis of this argument, in Chapter Two I used examples from space art and interstellar communication to illustrate the broad range of gendered ideologies in space culture. These examples raise questions of gendered space, questions to which I devoted Chapters Three and Four, which comprised an investigation of the intersections between spatial theory and space culture in terms of gender and the body. In Chapter Three, I argued that traditional discourses of geography and mapping are apparent within the discourse of spaceflight, and as a result, the masculinist ideologies that structure those fields also appear in space culture. In Chapter Four I analysed examples of bodily-spatial discourses from space culture for both the ways they

reproduce traditional gendered narratives of the body, and the ways they provide potential new avenues for feminist interrogation of these same narratives.

In Part Two, I turned my focus to sexuality. Chapter Five was devoted to analysing the sexual culture of spaceflight, identifying heteronormativity in texts from space research and policy, and evaluating the concept of 'family' which appears in these texts. In Chapter Six I turned my attention specifically to discussions of actual sex acts in spaceflight, investigating how the concerns raised about privacy, logistics, and hygiene point to heteronormative assumptions about sexual behaviour, and underlying discomfort about the prospect of queer sexual possibilities in outer space. In Chapter Seven I began to directly address the temporality of spaceflight through the aesthetic construct of retrofuturism and its relationship to space culture's own discursive connections to the future. In Chapter Eight I continued to analyse space temporality alongside queer temporality to argue for the critical potential in a hopeful view of futurity, both for space culture and for queer theory.

It is my hope that this project can spark further conversations about incorporating topics from space culture into broader cultural studies, to productive ends for both. In the course of my research, I have found several avenues of potential future work in this area that I have not covered in the body of this thesis. Additionally, as a doctoral thesis this text is necessarily limited in scale and in scope, and as a result there are many related topics which I regretfully give little attention. This section comprises a non-exhaustive account of some limitations of which I am aware in my work on this project, as well as new avenues of research suggested by these limitations.

Race and Class

I discussed in my Introduction the constraints which have limited my perspective on race and national identity. There is a great deal of further research to be done to expand analyses of gender and sexuality to a broader cultural context, beyond the English-speaking 'West' on which I mainly focus. Undoubtedly, intersections of nationality, race, and ethnicity impact on gendered and sexualised aspects of space culture, and this will provide fruitful directions for

future study. Similarly, socioeconomic class has clear impact in the accessibility of spaceflight, however I do not discuss this in detail in this thesis. For future investigation of the impact of class on space culture, the burgeoning commercial space industry will undoubtedly be of great importance; as of early 2016, the price for a seat on a future Virgin Galactic flight is $250,000 (approximately £160,000), to be paid up-front.[1] That this excludes access to space to a very narrow demographic perhaps goes without saying. As I discussed in Chapter One, Constance Penley importantly argues that there is theoretical importance in the ways that those excluded from space (in her analysis, women) still find symbolic access through various means. In a similar way, I would argue that space is still culturally relevant even to those of us unlikely to ever afford a seat on Virgin Galactic. At the same time, a class-centred analysis of spaceflight more broadly, including both space tourism and governmental space missions, would greatly contribute to understandings of space's role in society. Although I briefly mention the influence of class in Frank Pietronigro's space art in Chapter Eight, this is a topic that I mostly leave to future analysis, despite my contention that such analysis is vitally necessary.

Dis/ability

The concept of the unremarkable or ordinary is central to many astronauts' public personas, as scholars including Penley identify.[2] At the same time, the medical clearance requirements for astronauts far exceed what would be considered good health and fitness for an average person.[3] In addition, I would argue that the technology needed to sustain human life in outer space could be perceived as assistive technology. While astronauts are required to be exceptionally physically fit and healthy, the extra-terrestrial environment simultaneously renders even these most able of bodies totally incapable of life without extensive

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[1] Virgin Galactic, 'Fly With Us' <http://www.virgingalactic.com/human-spaceflight/fly-with-us/> [accessed 11 January 2016].

[2] See Constance Penley, *NASA/TREK: Popular Science and Sex in America* (London: Verso, 1997), especially pp. 29, 75-76; Mary Roach, *Packing for Mars: The Curious Science of Life in Space* (Oxford: Oneworld, 2010); Dario Llinares, 'Idealized heroes of "retrotopia": history, identity and the postmodern in *Apollo 13*' in *Space Travel and Culture*, ed. by David Bell and Martin Parker (Oxford: Blackwell, 2009), pp. 164-177.

[3] This tension is illustrated, as I discussed in Chapter Four (pp. 96-97 in particular), in Helen Sharman's account of her experience of astronaut training. See Helen Sharman, *Seize the Moment* (London: Victor Gollancz, 1993), p. 87.

technological intervention. Viewing the space suit and other aspects of astronaut life support through this lens suggests that space culture could hold potential for destabilising dominant narratives of ability and disability. This line of enquiry could expand upon the argument I made in my fourth chapter regarding using spaceflight to destabilise traditional discourses of gendered spatiality. Incorporating disability studies into future studies of spaceflight could productively contribute to broader understandings of the cultural meanings of not only astronaut bodies, but the construction of able-bodiedness in itself.

Animals in Space

Though the subject of this thesis is human spaceflight, my focus on the human body is a limitation in my analysis. This results in substantial omissions because many non-human beings have travelled to space, for numerous reasons and to numerous ends (for both the animals and for the space programmes they served). The impact on and cultural meanings of test animals used in early space programmes is discussed by Donna Haraway in a 2006 lecture.[4] In addition to the potential for animal studies research within this area, I believe there is value in incorporating animal research in space into discussions of gender and sexuality in future research. Using animal test subjects as human analogues for studies of reproduction, gestation, and birth is a repeated theme in space science.[5] Incorporating a fuller awareness of animal studies issues into a study of space biomedicine would be a productive avenue for future research into the influence of ideologies of gender and sexuality in the field.

Additionally, the cultural meanings ascribed to animals in space reveal much about human culture, as I argue in a paper I presented to the *Cosmopolitan Animals* conference in 2012.[6] As I argued there, all-too-human ideologies of gender and sexuality are often foregrounded in discussions of these animal test subjects. One example which raises

[4] Haraway, Donna, 'When Species Meet', *The Pavis Lecture* (Milton Keynes: Open University, 11 October 2006).

[5] On rat gestation, see April E. Ronca and Jeffrey R. Alberts, 'Physiology of a Microgravity Environment Selected Contribution: Effects of spaceflight during pregnancy on labor and birth at 1 G', *Journal of Applied Physiology* 89 (2000), 849-854; on the use of rat gestation studies in speculative research on human reproduction, see Janet Tou et al., 'Models to Study Gravitational Biology of Mammalian Reproduction', *Biology of Reproduction* 67(6) (2002), 1681-1687.

[6] Kat Deerfield, 'Animals in Space: Ham, Enos, and the Cat who Got Away', unpublished paper presented at *Cosmopolitan Animals*, University of London School of Advanced Studies, 26 October 2012.

interesting questions of gender – especially relating to masculinity and heroism – is reported by Mary Roach in her retelling of the public memorial service for Ham, the first chimp in space. When both Alan Shepard and John Glenn rejected invitations to speak at the service, the memorial organisers gave the honour to a local Girl Scout troop.[7] Roach relates this to the discomfort expressed by Mercury and Geminii-era astronauts about their apparent similarities to their non-human predecessors; as Roach claims, 'Ham's flight implied – in a widely publicized manner – that the astronaut, America's hero, was no more than a glorified chimp'.[8] The symbolism in turning to a local Girl Scout troop in lieu of internationally famous (and male) astronauts bears further study, as do the broader questions this raises about the binaries of gender and the human/animal.

Heaven, Earth, and Language

The title of this thesis alludes to an interesting set of linguistic and conceptual overlaps which exist in both contemporary and historical understandings of outer space and the spiritual realm.

Fraser MacDonald has also identified this as an area for further research: 'While it would be unwise to glibly conflate the terms 'space' and 'heaven',' he writes, 'there is clearly some interesting work that could be done here, remembering that heaven is no less a geographical imaginary than the Orient or the Occident'.[9] Though MacDonald is here proposing further spatial study rather than linguistic, and though he is right that conflation of these terms would not be a productive analytical approach, there is much to be said about the way these words are already conflated in popular discourse. 'The heavens' can mean outer space as much as it can mean the spiritual realm.[10]

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[7] See Mary Roach, *Packing for Mars: The Curious Science of Life in Space* (Oxford: Oneworld, 2010), pp. 130-131.
[8] Roach, p. 122.
[9] Fraser MacDonald, 'Anti-Astropolitik – outer space and the orbit of geography', *Progress in Human Geography* 31 (2007), 592-615 (p. 596).
[10] Oxford English Dictionary [online], 'Heaven', <http://www.oed.com/view/Entry/85205> [accessed 11 November 2015].

This is not the only term which contains this same contradiction. Another example is 'mundane', the most familiar contemporary meaning of which is ordinary or prosaic; intriguingly it can also mean either 'earthly' or 'cosmic'.[11] I would suggest that oxymoronic terms like this develop in part because our ideas of the world and the universe are deeply connected to our beliefs about what we can consider knowable. As our understanding of the earth and outer space has developed, some of these words have developed conflicting meanings, because our understanding of that which is not Earth, or that which is beyond Earth, is characterized by slippage between the scientific and the spiritual.

'Mundane' is derived from the Latin *mundus*, or world. In the modern day (including in this thesis) we often speak of the world as a contrast from outer space, but *mundus* is defined by the contrast between the earthly and the divine. Thus the underlying contrast throughout the many contemporary meanings of 'mundane' is against the spiritual, or perhaps the unknowable.[12] Even as our understanding of space or the cosmos continues to develop, 'mundane' can mean both of the earth, and of the knowable universe. Commercial space tourism promises to make outer space ever more mundane, in the sense of unremarkable; meanwhile, this single word encapsulates a great deal of the complexity of our cultural relationship with space. Further linguistic and etymological scholarship on the lexicon of space will be a vital addition to studies of space culture.

Mars

I alluded in Chapter Five to the interest, both historical and contemporary, in human exploration of Mars. This theme is perhaps nowhere more apparent at the time I write this than in the Mars One project, a competitive programme to send a group of ordinary humans on a one-way mission to Mars within the next few years.[13] Since its announcement in 2012, a number of questions have been raised about the feasibility, both scientific and financial, of this project, which aims to fund itself in part from the revenue of a *Big Brother*-style reality

[11] Oxford English Dictionary [online], 'Mundane', <http://www.oed.com/view/Entry/123748> [accessed 11 November 2015].
[12] OED, 'Mundane'.
[13] Mars One, <http://www.mars-one.com/> [accessed 23 January 2016].

television show about the Mars colonists.[14] Regardless of its feasibility, the media coverage around the programme incorporates many of the masculinist and heteronormative tropes I have identified in other space culture texts in this thesis. In 2015 the Daily Mail ran two articles about British Mars One semi-finalists. One was about Ryan McDonald, an Oxford Masters student, and was headlined, 'It's difficult to chat up girls when you're going to space'.[15] The other, focussing on Birmingham PhD student Maggie Lieu, ran with the headline, 'I want to have the first BABY on Mars'.[16] The commentary of these two finalists does not centre on the aspects that became the headlines – that they became the headlines nonetheless speaks to the influence of heteronormativity in the field.

At the same time, Hannah Earnshaw, another British Mars One finalist – one who was not given an in-depth profile in the *Mail* – wrote an article for *The Conversation* in which she alludes to her own bisexuality:

> Hoping that I am suitable, but ultimately wanting the very best and most capable people to go, I have had to hold two possible futures in my mind. In one, I complete my PhD, get a place of my own, pursue a career in research or maybe in politics. I get really good at playing piano, I find time to travel to Norway, Italy, Canada, and Japan, and maybe find a husband or wife. In the other, I leave behind the possibilities of Earth for the possibilities of Mars. Alongside my crew I pioneer planetary scientific research and, as the founding member of a new civilisation, I plant the seeds of a diverse and

[14] See Anna Holligan, 'Can the Dutch do reality TV in space?' *BBC News,* 20 June 2012 <http://www.bbc.co.uk/news/world-europe-18506033> [accessed 10 December 2015]; Sydney Do et al., 'An Independent Assesment of the Technical Feasibility of the Mars One Mission Plan', *Proceedings of the 65th International Astronautical Congress* (2014), 1-35; Elmo Keep, 'Mars One Finalist Explains Exactly How it's Ripping off Supporters', *Medium*, 16 March 2015 <https://medium.com/matter/mars-one-insider-quits-dangerously-flawed-project-2dfef95217d3#.6yk4pe9a4> [accessed 10 December 2015].

[15] Steph Cockroft, 'It's difficult to chat up girls when you're going to space', *Daily Mail* 23 February 2015 < http://www.dailymail.co.uk/news/article-2964862/It-s-difficult-chat-girls-going-space-Mission-Mars-student-admits-one-way-journey-red-planet-ruining-love-life.html> [accessed 13 August 2015].

[16] Sarah Griffiths, 'I want to have the first BABY on Mars', *Daily Mail* 18 February 2015 < http://www.dailymail.co.uk/sciencetech/article-2958312/I-want-BABY-Mars-says-British-candidate-one-way-space-mission-TV-company-reveals-plans-Big-Brother-style-beamed-red-planet.html> [accessed 13 August 2015].

> generous society. I communicate our life to followers on Earth, help establish new policy through which humans explore and settle the stars ethically and responsibly… and maybe find a husband or wife.[17]

Earnshaw's self-revelation raises the question of whether the commercial space industry, with its promises of expanded access to space, could lead to more inclusive narratives of identity within space culture. I have incorporated some texts from the space tourism industry in this thesis, and I have argued that they have reproduced traditional narratives of gender and sexuality. Perhaps, however, there are alternatives already being formulated. Whether Earnshaw or any other Mars One contestants ever make it to Mars, the conversations they are having will surely influence space culture more broadly. I am very interested to see how gender and sexuality influence these new conversations, and whether their effect is progressive or not, they will undoubtedly provide important sites for further study.

Final Thoughts

In 'The Promises of Monsters', Donna Haraway identifies space as a site of two important cultural constructions that I identified in the Introduction: that of a place beyond both nature and culture, and that of a place of the future.[18] I have argued in this thesis, especially in Chapter Three, that these symbolic meanings of space create fertile ground for assumptions, such as those of Frank White in *The Overview Effect*, that social progress and outer space go hand-in-hand. In this context, I recognise that there is a certain risk in expressing optimism about the future of human spaceflight, as I do above. As I have argued, I situate my argument not alongside blithe assumptions of social progress in spacefaring futures, but rather in the vein of José Esteban Muñoz's queer utopianism. With attention to the regressive, retrograde, or reactionary possibilities of assuming a progressive future, I still wish to argue for the critical value of optimism. In this also lies what I perceive as the value of this thesis and of the further

[17] Hannah Earnshaw, '"I could sow the seeds of a new civilisation": Mars One hopeful's vision of a stellar future', *The Conversation*, 18 February 2015 < https://theconversation.com/i-could-sow-the-seeds-of-a-new-civilisation-mars-one-hopefuls-vision-of-a-stellar-future-37777> [accessed 11 January 2016].
[18] Donna Haraway, 'The Promises of Monsters: A Regenerative Politics for Inappropriate/d Others', in *The Haraway Reader* (London: Routledge, 2004), pp. 63-124, p. 92.

questions it raises. Space culture often asks us to look to the future, albeit often in a way that is problematically entangled with artefacts of the past. It is my hope that we can continue to exploit this drive to futurity to critically productive ends in analysis of the cultural construction of this spacefaring future, these spacefaring spaces, and the bodies that inhabit them.

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