SPACE TOURISM

The Elusive Dream

Edited by Erik Cohen
and Sam Spector

TOURISM SOCIAL
SCIENCE SERIES

VOLUME 25

Tourism Social Science Series
Volume 25

Space Tourism

Tourism Social Science Series

Series Editor: **Jafar Jafari**

University of Wisconsin-Stout, USA
Email: jafari@uwstout.edu

The books in *Tourism Social Science Series* (TSSSeries) are intended to systematically and cumulatively contribute to the formation, embodiment and advancement of knowledge in the field of tourism.

The TSSSeries' multidisciplinary framework and treatment of tourism includes application of theoretical, methodological, and substantive contributions from such fields as anthropology, business administration, ecology, economics, geography, history, hospitality, leisure, planning, political science, psychology, recreation, religion, sociology, transportation, etc., but it significantly favors state-of-the-art presentations, works featuring new directions, and especially the cross-fertilization of perspectives beyond each of these singular fields. While the development and production of this book series is fashioned after the successful model of *Annals of Tourism Research*, the TSSSeries further aspires to assure each theme a comprehensiveness possible only in book-length academic treatment. Each volume in the series is intended to deal with a particular aspect of this increasingly important subject, thus to play a definitive role in the enlarging and strengthening of the foundation of knowledge in the field of tourism, and consequently to expand the frontiers of knowledge into the new research and scholarship horizons ahead.

Published TSSSeries titles:

Volume 24: Authenticity & Tourism: Materialities, Perceptions, Experiences*, Jillian M. Rickly and Elizabeth S. Vidon*

Volume 23: Social Conflict and Harmony: Tourism in China's Multi-ethnic Communities, *Liping Cai*

Volume 22: Tourism Research Paradigms: Critical and Emergent Knowledges, *Ana María Munar and Tazim Jamal*

Volume 21: Tourism Education: Global Issues and Trends, *Pauline J. Sheldon and Cathy H. C. Hsu*

Volume 20: Tourism Research Frontiers: Beyond the Boundaries of Knowledge, *Donna Chambers and Tijana Rakić*

Volume 19: Geographies of Tourism: European Research Perspectives, *Julie Wilson and Salvador Anton Clavé*

Volume 18: Tourism Social Media: Transformations in Identity, Community and Culture, *Ana María Munar, Szilvia Gyimóthy and Liping Cai*

Volume 17: Culture and Society in Tourism Contexts, *A-M. Nogués-Pedregal*

Volume 16: The Discovery of Tourism Economics, *Larry Dwyer*

Volume 15: The Study of Tourism: Foundations from Psychology, *Philip Pearce*

Volume 14: Modern Mass Tourism, *Julio R. Aramberri*

Volume 13: The Discovery of Tourism, *Stephen L. J. Smith*

Volume 12: The Sociology of Tourism: European Origins and Developments, *Graham M.S. Dann and Giuli Liebman Parrinello*

Tourism Social Science Series
Volume 25

SPACE TOURISM

The Elusive Dream

ERIK COHEN
Hebrew University of Jerusalem, Israel

SAM SPECTOR
University of Canterbury, New Zealand

emerald
PUBLISHING

United Kingdom – North America – Japan – India – Malaysia – China

Emerald Publishing Limited
Howard House, Wagon Lane, Bingley BD16 1WA, UK

First edition 2019

Reprints and permissions service
Contact: permissions@emeraldinsight.com

British Library Cataloguing in Publication Data
A catalogue record for this book is available from the British Library

ISBN: 978-1-78973-496-6 (Print)
ISBN: 978-1-78973-495-9 (Online)
ISBN: 978-1-78973-497-3 (Epub)

ISSN: 1571-5043 (Series)

ISOQAR
REGISTERED

ISOQAR certified Management System, awarded to Emerald for adherence to Environmental standard ISO 14001:2004.

Certificate Number 1985
ISO 14001

INVESTOR IN PEOPLE

Contents

INTRODUCTION
The Dawn of a New Era?

Erik Cohen
Hebrew University of Jerusalem, Israel

Sam Spector
University of Canterbury, New Zealand

Humans have become increasingly aware of the potential to realize the age-old aspiration of flying into space and reaching out toward the planets and stars; yet, space travel remains an elusive dream. Expanding into outer space is seen by many as an appealing, or even inevitable, endeavor for humanity, a magnified vision of what was once considered to be America's "manifest destiny" (Mitchell & Staretz, 2010; Sage, 2008). Some experts argue that becoming a spacefaring species is the only way to ensure humankind's long-term survival. Heavenly bodies offer unprecedented opportunities for adventure and exploration in addition to nearly inexhaustible resources. Traveling beyond the biosphere may fundamentally alter how we view ourselves, our place in the Universe, and our relationship to the Earth. It has even been suggested that a collaborative effort to settle space could help humans recognize their interconnectedness and interdependence, thereby allowing us to finally achieve peace and pursue a collectively advantageous future (Collins & Autino, 2010; White, 1998).

However, as research and development lead to the discovery of novel ways of realizing the dream of space travel, it is increasingly evident that human expansion into space creates potentially momentous new

Space Tourism: The Elusive Dream
Tourism Social Science Series, Volume 25, 1–11

ISSN: 1571-5043/doi:10.1108/S1571-504320190000025001

challenges here on the Earth. Intensified space exploration and exploitation could lead to monumental environmental consequences, precipitating the destruction of both terrestrial and celestial environs. Unequal access to space, with its abundance of resources, may become a determining factor in the relative wealth or impoverishment of countries, private corporations, social classes, and individuals (Dickens & Ormrod, 2007; Ormrod & Dickens 2017). Dominance of space has become a critical factor in strategic contests among countries in addition to a means of surveillance by states over their citizens. Near-Earth space, in particular, has gained growing significance in the realms of political and military power, leading to concerns about a looming arms race in space (Koplow, 2017). The strategic importance of space is reflected in President Trump's directive to the Department of Defense in June 2018 to establish a sixth branch of the US military – the Space Force. Competition over the domination of space and access to its resources might extend conflicts heretofore limited to the Earth to cosmic proportion.

Space travel development is intimately interwoven with far-sighted visions of space exploration and exploitation and the eventual human expansion to and settlement of other celestial bodies. While such visions are rich in imagery, the constraints are staggering. Optimistic expectations regarding the impending availability of safe and affordable space travel remain, as yet, unfulfilled. With fewer than ten tourists having left the biosphere, space tourism is the epitome of a niche specialty. In the course of the second-half of the twentieth century, the governments of the major world powers were virtually the sole initiators and supporters of activities in outer space. Yet, with the turn of the millennium, the initiative moved progressively into the hands of privately owned companies. The transition to privatization revitalized the field and started a quest for technological innovations, cost reductions, and safety improvements. Some visionaries, space scientists, and academics see space activities, particularly space tourism, as on the verge of a dramatic and unparalleled expansion within the first-half of this century, and the leaders of the space industry see space travel as the next "logical extension" of aviation (Ryabinkin, 2004, p. 108).

This book examines the state and future of space tourism by pitting the grandiose dreams of human expansion into the cosmos against some formidable economic, environmental, and social challenges. Underlying these topics are a broad spectrum of fundamental questions regarding humanity's place and future in the cosmos.

FUNDAMENTAL QUESTIONS

One of the most prominent, and existentially significant, questions which has fascinated humans since antiquity (Rood & Trefil, 1981) and is driving much of contemporary cosmological research is whether we are alone in the universe (Geppert, 2012). This is seen in the observation of the science fiction writer Arthur C. Clarke (1917–2008) that identified the human:

> "desire to know, whatever the consequences may be, whether or not man [sic] is alone in an empty universe" as the one key motive underlying all human efforts to overcome gravity and reach out beyond humankind's natural habitat on planet Earth. (cited in Geppert, 2012, p. 3)

It has even been suggested that an encounter with the Otherness of aliens or extraterrestrials is a precondition for the formation of a human cosmopolitan identity (Novoa, 2016). While efforts of the Search for Extraterrestrial Intelligence project to open contact with alien beings by radio-telescopic devices have not yet born fruit and have a low probability of ever doing so, it is widely believed that human cosmic exploration might eventually establish whether other intelligent beings exist in the Universe and, if so, what they are like (Tarter, 2001).

Another fundamental question, which emerged with the progressive deterioration of the Earthly environment, on the one hand, and prospective future advances in space exploration, on the other, is whether humanity should expand into the cosmos. This touches upon one of the most crucial issues of our collective future – whether to remain the Earthlings or settle the Galaxy and develop into a spacefaring civilization, as envisioned by enthusiasts such as Davies (2010), Hawking (2012), and Zubrin (1999) and, more recently, by such technological wizards as Elon Musk (Buchanan, 2017; Davenport, 2018). However, human expansion into space would be a gigantic and extended project, cutting deeply into the Earth's resources, therefore diverting them from alternative uses. An extension of human life beyond the Earth may be a fulfillment of the "survival imperative" or it may threaten the viability of life on Earth. Creating a cosmic civilization to escape an increasingly less livable Earth might paradoxically further worsen its livability. There is thus deep uncertainty regarding whether a sustainable, peaceful human future is to be found by looking to the stars or by reigning in our species' impact and focusing our efforts on the terrestrial environment and its inhabitants.

Human expansion into space would also affect conceptions of humanity's future on the Earth. Deleuze and Guattari (1987) discuss the possibility that capitalism will eventually exhaust itself as it is fundamentally constrained in its ability to develop functionally distinct products. The popular "limits to growth" hypothesis identifies a fixed cap on the resources available to humans (Meadows, Meadows, Randers, & Behrens, 1972). Yet, theses that are based on the assumption that the Earth is our sole habitat – and sole supplier of resources – will become questionable if constraints are overcome and access to celestial resources and habitats becomes technologically and economically viable (Spector, Higham, & Doering, 2017). We must therefore question: What are the implications of extending capitalist methods of production and consumption into the cosmos? Some see the limits that we confront on the Earth as potentially negated by access to outer space, whereas others assert that expansion into space will greatly exacerbate, rather than overcome, those problems.

Political (Steer, 2017), ethical (Fogg, 2000; Galliott, 2016; Marsh, 2006), and legal (Ferreira-Snyman, 2014; Freeland, 2005; Hobe, 2007; Ryabinkin, 2004; von der Dunk, 2011; 2013) challenges and dilemmas accompany our conversion to a spacefaring species. How do we govern human behavior in space and conceive, specify, and justify our rights to invade pristine and untouched environs? What are the consequences of these interventions for other celestial bodies and even, potentially, for intelligent alien beings? And how will those cosmic activities affect life on the Earth? As space is primarily unchartered territory, humanity also faces the dilemma of whether to keep it open for the enjoyment of individuals' personal freedoms or to control their conduct to avoid detrimental developments. But who has the authority to institute laws that will regulate freedoms in space, and how can the rule of law be maintained beyond the Earth? There is a need to anticipate and address these questions by formulating an ethics of space travel and exploration.

Since it is intertwined with the scientific and technological advancement of space exploration, the development of space tourism is affected by, and affects, efforts to deal with and resolve these important questions. This book takes a broad view of the historical background, significance, and implications of space tourism development. Specifically, it addresses four major issues which, while sometimes treated separately, have not been brought together and confronted in a single volume. First, it uncovers the historical, mythological, artistic, and virtual imaginaries of the cosmos which paved the way to the contemporary visions and increasingly realistic projects for space travel and tourism and stand to influence their future trajectory. Second, it confronts these visions with the actual contemporary achievements and setbacks in the ongoing efforts to create a viable space travel and tourism industry. Third, it considers the potential environmental, economic, social, and legal implications of the successful establishment of such an industry. Finally, it investigates the broader significance of space travel and tourism as forerunners of a possible human expansion into space and creation of a spacefaring civilization.

THE BIRTH PANGS OF A NEW MODE OF TOURISM

Outer space has fascinated humans since ancient times. These fascinations were abetted in the early modern era with the realization of the vastness of space and the Earth's place in it as a small planet circling a medium-sized star in an unremarkable corner of one of the Universe's billions of galaxies. As new technologies made human space travel appear increasingly realistic by the beginning of the second-half of the twentieth century, it became a prominent theme in popular culture. Space science is now adapted for mass consumption and communicated via magazine, newspaper articles, television, radio programs, and popular-press books. Works of fantasy, such as science fiction, films, games, and virtual reality simulations, began offering visions of space tourists' trips into the depths of the cosmos and their encounters with aliens and stellar civilizations, while the possibility of life on other celestial bodies became a major preoccupation of astronomers and other space scientists.

As the space race between the United States and the Soviet Union escalated after World War II, military interests drove progress in cutting-edge space technologies, making the dream of human spaceflight increasingly achievable. The first orbital flight in 1961 by Russian Yuri Gagarin and the American Apollo 11 landing on the Moon in 1969 are the defining milestones in the arrival of the Space Age. Many believed that these events signaled that humanity would soon embark on an unimpeded and exponential conquest of outer space. Early successes, especially the Apollo series of lunar missions, encouraged optimism, particularly in the United States, that rapid development of inter-planetary and even interstellar travel would soon become possible. Visions of humanity's future in space were closely associated with the expectation of a swift rise of space tourism. In the 1960s, the prominent hotelier Barron Hilton was already planning a lunar hotel (Cohen, 2017, p. 33). In 1985, the company Society Expeditions announced "that it will sell trips into space on a rocket to be built by a commercial launch company" (Billings, 2006, p. 162). More than two decades ago, the National Aeronautics and Space Administration declared, "For the most part, the machinery to accommodate the needs of an evolving space tourism industry is in place" (NASA, 1994, n.p.). However, these optimistic expectations proved, for the most part, to be premature. Hilton's space hotel remained a fantasy, and Society Expeditions' rocket was never built (Billings, 2006, p. 162). Space tourism remained an elusive dream.

The disintegration of the Soviet Union suspended the space race. In the United States, technical problems and disasters, such as the explosion of the Challenger (1986) and Columbia (2003) space shuttles, held back government-led space travel development. At the time of this writing, only 24 humans have traveled beyond the International Space Station (ISS), and no crewed missions have escaped the Earth's orbit since the conclusion of the Apollo program with the Apollo 17 Moon landing in 1972 (Atkinson, 2013; NASA, n.d.; Williamson, 2001). A highly limited and elitist forerunner of space tourism was initiated in an unexpected manner in post-communist Russia. Following the fall of the Soviet regime, Russia's space industry found itself short of financing and decided to sell places on its missions to the ISS to well-heeled private individuals (Wall, 2011). Fewer than ten individuals, all multimillionaires, undertook these trips; but concerns were raised about tourists endangering the missions (Wall, 2011). With the enlargement of the ISS crew, Russia's offer to carry private individuals to the station was discontinued in 2009 in order to retain seats for professional astronauts. No tourists have departed into space since then, though Russia intends to again offer touristic flights to the ISS before the end of the present decade (Fingas, 2015).

In the United States, space exploration and space tourism parted ways, with the initiative of creating a space tourism sector moving into private hands. At the turn of the millennium, a new cadre of wealthy entrepreneurs, billionaires with not only significant disposable capital but also a proclivity for engaging in avant-garde technological projects, founded companies which took the lead in the development of the spacecraft, apparatus, and skills necessary for touristic space travel. These include the likes of Richard Branson's Virgin Galactic, Elon Musk's SpaceX, and Jeff Bezos' Blue Origin. Their immediate target was to create spacecraft to serve suborbital and orbital excursions into near-Earth space, but they also engaged in planning trips to the Moon and Mars.

Those who follow space tourism will be familiar with the numerous expectations and predictions that later proved overly optimistic. Complex technological difficulties and major mishaps have forced prolonged delays in the realization even of relatively modest (compared to grand visions of tourists on Mars) suborbital flights. Virgin Galactic's first SpaceShipTwo, programed for commercial suborbital flights, crashed in 2014 during a test flight (Chang & Chern, 2016). A second model is still undergoing tests, but it is uncertain when it will be put into service (Foust, 2017). In 2015, one of SpaceX's Falcon 9 launch vehicles carrying supplies to the ISS exploded after take-off, causing a disturbance in the company's launch program (Moon, 2015). Another company, XCOR Aerospace, developed a rocket-powered spaceplane, the Lynx Mark I, which was intended to take a pilot and one passenger to an altitude of 100 kilometers. The company planned its virgin flight for 2016 but had to postpone and eventually cancel it owing to financial difficulties. When suborbital flights will be available (much less widely used) is yet uncertain.

The leaders of the American space tourism sector remain seemingly undeterred by these difficulties and delays, continuing to offer ambitious visions of the future of space travel. Elon Musk announced in 2015 that the private sector would land humans on Mars in as few as ten years (Chang, 2016; Mitroff, 2015). Musk, who seeks to initiate "a self-sufficient colony of people on Mars to ensure that the human race could survive an earth-wrecking cataclysm" (cited in The Economist, 2015, n.p.), envisioned that the first hundred passengers will reach Mars by 2024, an initial step toward creating a sustainable settlement of one million people on the Red Planet (Chang, 2016). In contrast to this ambitious program, NASA has plans for a crewed mission to orbit Mars in the 2030s, landing astronauts on the planet only in the 2040s (Chang, 2016). There is a very real possibility that the first human mission to Mars will be achieved not by NASA, the most renowned and accomplished government space agency in history, but rather by private companies that have engaged in space-related activities for less than two decades.

The state of human space tourism, as seen to date, is thus marked by a sharp contrast between, on the one hand, an optimistic outlook and growing aspirations and, on the other, the as yet very limited achievements. Space tourism as an ongoing practice does not presently exist. In the immediate future, space tourism available to the public appears likely to remain exclusive, expensive, and intermittent (if it will be available at all). Suborbital spaceflight, if it becomes viable, would afford a brief but extraordinary experience of weightlessness, a vista of the curvature of the Earth from space, and a view of non-twinkling stars (as stars only appear to twinkle due to the Earth's atmosphere). If orbital space trips, such as to the ISS, become more widely available, tourists will have the extraordinary experience of the so-called overview effect, resulting from seeing the whole Earth floating in the vastness of space (White, 2014; Yaden et al., 2016). Among astronauts, this experience has elicited a deep personal sense of transcendence and transformation (White, 2014; Yaden et al., 2016). The overview effect is likely to become one of the key motivators and experiences of orbital travel.

The destiny of space tourism to further destinations, such as the Moon, Mars, and other celestial bodies, is uncertain. At least initially, such trips would be available only to a small coterie of super-rich individuals. Private trips around the Moon have indeed been offered by the company Space Adventures at the astronomic price of US $150 million per person (IFLS Store, 2016), but, at the time of this writing, the project's viability is unclear. Given current capabilities, Mars seems to be the only planet in our solar system suitable for human visits and constitutes the furthest achievable destination for space tourism in the next few decades. The expansion of humanity further into the Galaxy will need technologies and organizational forms of a different order – ones that in the year 2018 exist only in the realms of speculation and fantasy.

The United States remains the leader of space exploration and space travel development, but competitors are rising around the world, especially in Asia. Japan initially prepared to launch the Selene-2 mission to the Moon in 2018, but, as is becoming the norm in this arena, the project has been delayed (Hashimoto et al., 2014). Japan is also planning a mission to Mars. India's space program reaches back to the 1960s (Suresh, 2014). In 2008, India sent its first planetary orbiter, Chandrayaan-1, to the Moon to explore its surface and environment and – alone among the Asian nations – a Martian space probe (the Mangalyaan), which has been orbiting the Red Planet since 2014 (Chauhan, 2016). China is believed to be NASA's biggest rival in space exploration. The Chinese have accomplished the first-ever landing on the dark side of the Moon in January 2019, and plan to send a probe to Mars in 2020 (Normile, 2016). They have demonstrated an interest in human space travel, with plans to land *taikonauts* (Chinese astronauts) on the Moon in the 2030s and sometime thereafter on Mars (Bloomberg News, 2016; Qiu & Stone, 2013). But their primary interest seems to be in the exploitation of resources on other celestial bodies rather than in the development of space tourism. In contrast to Asia, South American countries are still "at an early stage of […] space technology development" (Sarli et al., 2015, n.p.), and even Brazil, one of the world's ten biggest economies, has up to now failed "to emerge as a significant space actor" (Moltz, 2015, p. 13).

THE DISTINCTIVE TRAITS OF SPACE TOURISM

A recent trend in tourism studies is to conceive of tourism in terms of the mobilities approach – as a "fuzzy cluster of 'discretionary mobilities" (Cohen & Cohen, 2015, p. 15), without a clear distinction between travel and tourism. This perspective certainly fits space tourism. Another predominant trend is the dedifferentiation of tourism from everyday life (Franklin & Craig, 2001). However, far from being part of everyday life, space tourism stands in sharp contrast to it. Its attractiveness to no small extent resides in leaving the Earth and gaining an outsider's perspective, viewing, and even eventually accessing, celestial bodies on which everyday life, as we know it, is not possible. Space tourism offers an encounter with the Otherness of the cosmos. Whether that encounter will over time be normalized, as proponents of the emergence of a "cosmic society" seem to believe, is one of the great questions of our future.

Space travel and tourism can be analytically approached as a mode of mobility (Johnson & Martin, 2016), but one which is in many respects fundamentally different from even the most extreme forms of tourism on the Earth. It involves not only the obvious differences of incomparably greater distances and speeds of movement but also technological and organizational complexities (many of which have not yet been resolved) that are unmatched by any other existing form of travel. Longer-distance space tourism might constitute an experience desired by tourists, but this comes with a possible impediment due to the boredom of staying confined in a spacecraft for a lengthy period of time. Despite the efforts of developers, space travel still involves some unpredictable risks, and these might increase the exhilaration of the experience for some prospective tourists and also repel others.

Space tourism is an unusual and dangerous undertaking, attracting adventurers. But in contrast to some other kinds of adventure, the space tourist is a passive tourist embedded in a complex operational network. Owing to the highly technical nature of operating a spacecraft, passengers are precluded from taking any substantive part in the conduct of the voyage, which is left in the hands of professionals. Self-dependence, initiative, and robustness (the distinctive qualities of adventurers that explored and charted the Earth) are of limited relevance for the space tourists (Cohen, 2017). While contemporary tourism studies increasingly emphasize the multisensory characteristic of experiences, space tourism, as presently envisaged, will be mainly restricted to a single one of the traditional five senses: the ocular.

Space tourists will be mostly unable to interact with their stellar surroundings, to touch, smell, or taste them, or to listen to cosmic sounds – the Moon's lack of atmosphere renders it devoid of sound; the thin Martian atmosphere allows sound waves to travel, but over much smaller distances than on the Earth (NASA, 2013; Sharp, 2017). However, space travel might affect some of the newly conceived "internal senses," especially the vestibular (sense of balance), resulting in the desired experience of weightlessness (Agapito, Mendes, & Valle, 2013; Cohen, 2017). While space tourism has a certain novelty value at present, it is questionable whether its long-term, intrinsic appeal is substantial enough to outweigh the tedium of extremely long transit times and the lack of sensory richness.

At present, space tourism is an expensive affair, ranging from $200,000 for a brief suborbital trip to $150 million for a tour around the Moon. But even if prices were to decline over time, space tourism will remain affordable only to a relatively small segment of wealthy individuals, despite surveys indicating that space tourism exercises a considerable enthusiasm in the general public. In view of the discrepancy between a wide popular interest and a limited, exorbitantly expensive supply, Damjanov and Crouch recently argued that while "space travel remains an exclusive domain reserved for the very few" there is an "ever-evolving array of web and mobile applications which are providing everyone and anyone with access to them the opportunity to take a virtual tour of various places beyond the planet [Earth]" (2018, p. 1).

In contrast to actual space tourism, these virtual means are readily and cheaply available. These scholars conclude that:

> unlike actual space tourism, which is a kind of "privileged" mobility […] available only to a select few and restricted to Earth's immediate environs, its virtual forms democratise and widen the area of space travel […] far beyond the globe. (Damjanov & Crouch, 2018, p. 1)

Space travel and tourism, an integral part of the enormously complex and expensive project of human expansion into space, might thus be experienced by the majority of people only in the form of a cheap and entertaining virtualized surrogate. But it is doubtful that they will share the excitement and profound experiences of anxiety and awe of those who actually venture into outer space. Space tourists will have a story to tell. Virtual reality viewers will not.

OVERVIEW OF THIS VOLUME

This book approaches space tourism from a broad, multidisciplinary perspective. Part I, "Histories," opens with Roger Launius outlining the historical background underlying human aspirations to expand into space (Chapter 1), and Carl Cater proceeds with a focused historical review of space tourism developments (Chapter 2). Part II, "Imaginaries," begins with Erik Cohen's examination of three myths on exo-life as possible motivators for space tourism: extraterrestrials, cosmic civilizations, and aliens (Chapter 3); Maud Ceuterick and Mark Johnson examine imaginaries of space tourism presented in films and games (Chapter 4); and Katarina Damjanov and David Crouch discuss the relationship between virtual reality and space travel (Chapter 5).

Part III, "Advances," starts with Jennifer Laing and Warwick Frost's exploration of the motivations for space tourism (Chapter 6); Derek Webber reviews advances in the development of the technologies and other perquisites needed for commercial space tourism (Chapter 7); and Frans von der Dunk examines the rather inadequate regulatory frameworks that presently pertain to space tourism (Chapter 8). Part IV, "Implications," begins with Peter Dickens' critical examination of astronauts' work regimes and their relations with mission controllers (Chapter 9); James Ormrod and Peter Dickens analyze the broader sociological implications of space tourism development, including the search for capital "fixes" in outer space (Chapter 10); and in the final chapter, Sam Spector and James Higham discuss the possible implications of a space tourism industry for conceptualizations of sustainability and the Anthropocene (Chapter 11). In the Conclusion section, the editors highlight the major topics that cut across the chapters and offer some thoughts regarding the consequences of humanity's efforts to expand into space.

PART I
HISTORIES

This page intentionally left blank

Chapter 1

HUMAN ASPIRATIONS TO EXPAND INTO SPACE
A Historical Review

Roger D. Launius
Launius Historical Services, USA

Abstract: In the 1950s, a combination of technological and scientific advancement, political competition, and changes in popular opinion about spaceflight generated public policy in favor of an aggressive space program. This and that of 1960s moved forward with a Moon landing and the necessary budgets. Space exploration reached equilibrium in the 1970s, sustained through to the present. The twenty-first-century progresses signals that support for human space exploration is waning and may even begin declining in the coming years. This chapter reviews this history and analyzes five rationales suggested in support of continued human spaceflight: discovery and understanding, national defense, economic competitiveness, human destiny, and geopolitics. **Keywords**: human spaceflight; history of spaceflight; justifications for spaceflight; Space Race

INTRODUCTION

Curiosity about the universe and other worlds has been one of the few constants in the history of humankind. Prior to the twentieth century,

Space Tourism: The Elusive Dream
Tourism Social Science Series, Volume 25, 15–50

ISSN: 1571-5043/doi:10.1108/S1571-504320190000025002

however, there was little opportunity to explore the universe except in fiction and through astronomical observations. These early explorations led to the compilation of a body of knowledge that inspired and, in some respects, informed the efforts of scientists and engineers who began to think about applying rocket technology to the challenge of spaceflight in the early part of the twentieth century. These individuals were essentially the first spaceflight pioneers, translating centuries of dreams into a reality that matched in some measure the expectations of the public that watched and the governments that supported their efforts. However, in the latter half of the twentieth century, humans had the opportunity to expand into space.

The US space program emerged in large part because of the pressures of national security during the Cold War with the Soviet Union (Burrows, 1998; Launius, 1998; McCurdy, 1997). From the latter 1940s, the Department of Defense had pursued research in rocketry and upper atmospheric sciences as a means of assuring American leadership in technology. The civilian side of the space effort began in 1952 when the International Council of Scientific Unions established a committee to arrange an International Geophysical Year for the period, July 1, 1957, to December 31, 1958. On July 29, 1955, the US scientific community persuaded President Dwight D. Eisenhower to approve a plan to orbit a scientific satellite as part of the International Geophysical Year effort. With the launch of Sputniks I and II by the Soviet Union in the fall of 1957 and the American orbiting of Explorer 1 in January 1958, the space race commenced and did not abate until the end of the Cold War – although there were lulls in the competition (Bulkeley, 1991; Dickson, 2001; Divine, 1993). The most visible part of this competition was the human spaceflight program – with the Moon landings by Apollo astronauts as de rigueur – but the effort also entailed robotic missions to several planets of the solar system, military and commercial satellite activities, and other scientific and technological labors (Chaikin, 1994; Logsdon, 2010; McDougall, 1985; Murray & Bly Cox, 1989; a good introduction to the history of planetary exploration is Schorn, 1998). In the post-Cold War era, the space exploration agenda underwent significant restructuring and led to such cooperative ventures as the International Space Station (ISS) and the development of launchers, science missions, and applications satellites through international consortia (Launius, 2003; on the Space Shuttle see Heppenheimer, 2002, 2004; Jenkins, 2017). This overview will examine the historical background of space exploration, focusing on the history of the National Aeronautics and Space Administration (NASA) and the evolution of its activities in the last 50 years.

SPACEFLIGHT BEFORE AND AFTER THE SPACE AGE

Not until the twentieth century did technology develop to the extent that actual travel into the observable universe could take place, although many people had posited that it was theoretically possible and longed for the time when humanity could venture beyond the Earth. When Galileo first broadcast his findings of the solar system in 1610, he sparked a flood of speculation about the lunar flight. Johann Kepler (1571–1630), himself a pathbreaking astronomer, posthumously published a novel, *Somnium (Dream)*, in 1634 that recounted a dream of a supernatural voyage to the Moon in which the visitors encountered serpentine creatures. He also included much scientific information in the book, speculating on the difficulties of overcoming the Earth's gravitational field, the nature of the elliptical paths of planets, the problems of maintaining life in the vacuum of space, and the geographical features of the Moon (Dick, 1982, pp. 77–84; Rosen, 1967, pp. 17–22).

Other writings sparked by the invention of the telescope and the success of *Somnium* also described fictional trips into space. Cyrano de Bergerac (1610–1655), for example, wrote *Voyage dans la Lune* (The Voyage to the Moon, 1649), describing several attempts by the hero to travel to the Moon. First, he tied a string of bottles filled with dew around himself, so that when the heat of the Sun evaporated the dew he would be drawn upward, but the hero only made it as far as Canada on that attempt. Next, he tried to launch a vehicle from the top of a mountain by means of a spring-loaded catapult, "but because I had not taken my measures aright, I fell with a slosh on the Valley below." Returning to his vehicle, Cyrano's hero found some soldiers mischievously tying firecrackers to it. As they lit the fuse, he jumped into the craft and tier upon tier of explosives ignited like rockets and launched him to the Moon. Thus, Cyrano's hero became the first flyer in fiction to reach the Moon by means of rocket thrust, a premonition of Newton's third law of gravity about every action having an equal and opposite reaction. Once on the Moon, the character in this novel had several adventures, and later in the book, he journeyed also to the Sun (Emme, 1965, pp. 37–38).

Other writers picked up the science fiction format and used it to discuss the possibilities of space tour in the years that followed. For example, Edward Everett Hale, a New England writer and a social critic, published in 1869 a short story in the *Atlantic Monthly* entitled "The Brick Moon." The first known proposal for an orbital satellite around the Earth, Hale described how a satellite in polar orbit could be used as a navigational aid to ocean-going vessels (Hale, 1869).

Perhaps, the most important development in the literary consideration of space tourism came following the publication of work by Italian astronomer Giovanni Schiaparelli in 1877 concerning the possibility of canals on Mars. He, and especially others, concluded that the features that he saw on Mars and called canals were the work of intelligent life. This was a startling observation because it meant that science had now validated the speculations of some fiction writers, lending credibility to their claims. Moreover, other scientists sought to explore these ideas, and in the United States, Percival Lowell built what became the Lowell Observatory near Flagstaff, Arizona, to study the planets. In 1906, he published *Mars and its Canals*, which argued that Mars had once been a watery planet and that the topographical features known as canals had been built by intelligent beings. Over the course of the next forty years, a steady stream of other works was based upon Lowell's theories about the red planet (Ezel & Neuman Ezel, 1984, pp. 61–114).

While many of these fiction writings were not scientifically valid, that became less true as time passed and more modern science fiction writers such as Jules Verne and H. G. Wells appeared. Both were aware of the scientific underpinnings of space flight, and their speculations reflected reasonably well what was known at the time about its problems and the nature of other worlds. Both Wells and Verne incorporated into their novels a much more sophisticated understanding of the realities of space than had been seen before. Their space vehicles became enclosed capsules powered by electricity, and they possessed some aerodynamic soundness. Most of Wells' and Verne's concepts stood up under some, although not all, scientific scrutiny. For example, the scientific principles informing Verne's *De la Terre a la Lune* (From the Earth to the Moon, 1865) were very accurate for the period. It described the problems of building a vehicle and launch mechanism to visit the Moon. At the end of the book, Verne's characters were shot into space by a 900-foot-long cannon. Verne picked up the story in a second novel, *Autour de la Lune* (*Around the Moon*), describing a lunar orbital flight, but he did not allow his characters to land. Wells published *War of the Worlds* in 1897 and *The First Men in the Moon* immediately thereafter. Both used sound scientific principles to describe space tourism and encounters with aliens.

War of the Worlds, furthermore, played upon a theme in space exploration that had been present for many centuries and would continue to appear throughout the twentieth century: humanity's fascination and terror about contact with alien species. Excitement about the prospect that humanity is not alone in the universe, that contact is possible, and that both cultures might be made richer through interaction has been a persistent theme for advocates of the exploration of space. Some science fiction positively expressed this image of contact with aliens – for example, three novels by C. S. Lewis, *Out of the Silent Planet* (1938), *Perelandra* (1943), and *That Hideous Strength* (1945). At the same time, there has long been a fear that an alien civilization might attack the Earth and either enslave or destroy humanity. In *War of the Worlds* the Earth was attacked by invaders from Mars, and eventually only defeated by terrestrial bacteria harmless to humans but deadly to an alien without generations of built-up immunity. These stories, both positive and negative examples of contact, provided some of the inspiration for many scientists and engineers who developed modern rocketry (Michaud, 2007).

In the post-World War II era, a wide range of science fiction writers broke the boundaries of the genre and contributed significantly to public perceptions of space tourism. Perhaps, the three most significant authors in this category were Robert A. Heinlein, Isaac Asimov, and Arthur C. Clarke, all of whom took pains to make their science fiction novels and short stories both believable as reality and exciting as works of literature. They found a ready audience in the environment of the Cold War, as growing numbers of Americans could both envision and understand the advance of technology and technocracy, the merger of bureaucratic and technical expertise in government. Asimov, for one, featured robots in his writings, something more and more Americans could understand as machines of all types took over an ever-increasing part of the workload. Both Asimov and Heinlein played out their stories within the context of complex galactic politics not unlike those perceived by Americans in the world situation (Moskowitz, 2007).

Asimov and Clarke also bridged the gap between science fiction and science fact in some very fundamental ways. They each wrote both fiction and popular scientific studies relative to space flight, physics, and astronomy. They also identified some interesting potential uses for space technology. For example, in February 1945, Clarke described the use of the German V-2 as a launcher for ionospheric research, even as the war was going on. He specifically suggested that by putting a second stage on a V-2 the rocket could generate enough velocity to launch a small satellite into orbit. "Both of these developments demand nothing in the way of technical resources," he wrote, adding that they "should come within the next five or ten years." He later described the possibility of placing three satellites in geosynchronous orbit 120 degrees apart to "give television and microwave coverage to the entire planet" (Clarke, 1945a). Later, the same year, Clarke elaborated on the communications and implications of satellites and set in motion the ideas that eventually led to the global communications system first put in place during the 1960s (Clarke, 1945b).

Another important way in which the US public became aware that flight into space was a possibility was the rise of films depicting space tourism that were firmly rooted in scientific reality. One of the keys in this process was the work of film producer–director George Pal, a master of special effects, who made several space-oriented movies in the 1950s (Heinlein, 1950, p. 6). Especially memorable were two films, *The Day the Earth Stood Still* (1950), directed by Robert Wise, in which the benevolent alien Klaatu warns the Earth to shape up and control its aggressiveness by disarming, and *Forbidden Planet* (1956), about the extinct Krell super intelligent society and the Monster from the Id (Stuart, 1956). These films excited the public with ideas of space flight, exploration, and contact with alien civilizations. It is often easy to forget that these sophisticated visions of space tour occurred *before* Sputnik.

Progenitors of the Space Age

Envisioning rocketry as a means of realizing the aspirations of spaceflight, three great pioneering figures pursued the effort. Collectively, they were the progenitors of the modern space age. The earliest was the Russian theoretician Konstantin Eduardovich Tsiolkovskiy. An obscure schoolteacher in a remote part of Tsarist Russia in 1898, he submitted for publication to the Russian journal, *Nauchnoye Obozreniye* (Science Review), a work based upon years of calculations that laid out many of the principles of modern space flight. His article was not published until 1903, but it opened the door to future writings on the subject. In it, Tsiolkovsky described in depth the use of rockets for launching orbital spaceships. He continued to theorize about spaceflight until his death, describing in detail both methods of flight and the technical requirements of space stations. Significantly, he never had the resources – nor perhaps the inclination – to experiment with rockets himself. His theoretical work, however, influenced later rocketeers both in his native land and abroad, and served as the foundation of the Soviet space program.

A second rocketry pioneer was Hermann Oberth (1894–1989), by birth a Transylvanian but by nationality a German. Oberth began studying the nature of space flight at the time of World War I and published his classic study, *Die Rakete zu den Planetenräumen* (*Rockets into Planetary Space*) in 1923. It was a thorough discussion of almost every phase of rocket travel. He posited that a rocket could travel in the void of space and that it could move faster than the velocity of its own exhaust gases. He noted that with the proper velocity a rocket could launch a payload into orbit around the Earth, and to accomplish this goal, he reviewed several propellant mixtures to increase the speed. He also designed a rocket that he believed had the capability to reach the upper atmosphere by using a combination of alcohol and hydrogen as fuel. Oberth followed this up with a long series of publications on rocketry and the prospects of space tourism. He became the father of German rocketry. Among his protégés was Wernher von Braun (1912–1977), the senior member of the rocket team that built NASA's Saturn launch vehicle for the trip to the Moon in the 1960s.

Finally, the American Robert H. Goddard (1882–1945) pioneered the use of rockets for spaceflight (a standard but outdated biography of Goddard is Lehman, 1963). Motivated by reading science fiction as a boy, Goddard became excited by the possibility of exploring space. In 1901 he wrote a short chapter "The Navigation of Space" arguing that movement could take place by firing several cannons, "arranged like a 'nest' of beakers." He tried unsuccessfully to publish this article in *Popular Science News*. At his high school oration in 1904, he summarized his future life's work, "It is difficult to say what is impossible, for the dream of yesterday is the hope of today and the reality of tomorrow". In 1907, he wrote another chapter on the possibility of using radioactive materials to propel a rocket through interplanetary space. He sent this article to several magazines, and all rejected it. Still not dissuaded, as a young physics graduate student he worked on rocket propulsion and received two patents in 1914. One was the first for a rocket using solid and liquid fuel and the other for a multi-stage rocket.

After a stint with the military in World War I, where he worked on solid rocket technology for use in combat, Goddard became a Professor of Physics at Clark College (later University) in Worcester, Massachusetts. There he turned his attention to liquid rocket propulsion, theorizing that liquid oxygen and liquid hydrogen were the best fuels, but learning that oxygen and gasoline were less volatile and therefore more practical. To support his investigations, Goddard applied to the Smithsonian Institution for assistance in 1916 and received a US $5000 grant from its Hodgkins Fund. His research was ultimately published by the Smithsonian as the classic study, *A Method of Reaching Extreme Altitudes* in 1919. Goddard argued in it from a firm theoretical base that rockets could be used to explore the upper atmosphere. Moreover, he suggested that with a velocity of 6.95 miles/second, without air resistance, an object could escape the Earth's gravity and head into infinity, or to other celestial bodies. This became known as the Earth's "escape velocity."

It also became a great joke for those who believed spaceflight either impossible or impractical. Some ridiculed Goddard's ideas in the popular press, much to the consternation of the already shy Goddard. Soon after the appearance of his publication, he commented that he had been "interviewed a number of times, and on each occasion have been as uncommunicative as possible." (Goddard, 1970e, pp. 109–110). The *New York Times* was especially harsh in its criticisms, referring to him as a dreamer whose ideas had no scientific validity. It also compared his theories to those advanced by novelist Jules Verne, indicating that such musing is "pardonable enough in him as a romancer, but its like is not so easily explained when made by a savant who isn't writing a novel of adventure" (*New York Times*, 1920). The *Times* questioned both Goddard's credentials as a scientist and the Smithsonian's rationale for funding his research and publishing his results.

The negative press Goddard received prompted him to be even more secretive and reclusive. He sought a remote setting to conduct his experiments. His ability to shroud his research in mystery was greatly enhanced by Charles A. Lindbergh, fresh from his trans-Atlantic solo flight, who helped Goddard obtain a series of grants from the Guggenheim Fund fostering aeronautical activities. This enabled him to purchase a large tract of desolate land near Roswell, New Mexico, and to set up an independent laboratory to conduct rocket experiments far away from anyone else. Between 1930 and 1941, Goddard carried out more ambitious tests of rocket components in the relative isolation of New Mexico, much of which he summarized in a 1936 study, *Liquid-Propellant Rocket Development*. The culmination of this effort was a successful launch of a rocket to an altitude of 9,000 feet in 1941.

Parallel Developments

Concomitant with Goddard's research into liquid-fuel rockets, and perhaps more immediately significant because the results were more widely disseminated, were activities in several other quarters. Among the most important of these ventures were those undertaken by the various rocket societies. The largest and most significant was the German organization, the *Verein fuer Raumschiffahrt* (Society for Spaceship Travel, or VfR). Although spaceflight aficionados and technicians had organized at other times and in other places, the VfR under the able leadership of Berlin engineer Max Valier emerged soon after its founding on July 5, 1927, as the leading space tourism group. It was specifically organized to raise money to test Oberth's rocketry ideas. It was successful in building a base of support in Germany, publishing a magazine and scholarly studies, and constructing and launching small rockets. One of its strengths from the beginning, however, was the VfR's ability to publicize both its activities and the dream of spaceflight (Winter, 1983).

The VfR made good on some of those dreams on February 21, 1931, when it launched the LOX-methane liquid-fuel rocket HW-1 near Dessau to an altitude of approximately 2,000 feet. The organization's public relations arm went into high gear after this mission and emphasized the launch's importance as the first successful European liquid-fuel rocket flight. Wernher von Braun, then a neophyte learning the principles of rocketry from Oberth and Valier, was both enthralled with this flight and impressed with the publicity it engendered. Later, he became the quintessential and movingly eloquent advocate for the dream of spaceflight and a leading architect of its technical development. He began developing both skills while working with the VfR.

There were other national rocketry societies that sprang up during this same period, each contributing to the base of technical knowledge and the popular conception of spaceflight. The American Interplanetary Society was one of the more powerful of these institutions. Organized in 1930, within two years the American Interplanetary Society had begun a program of rocket experimentation. On November 12, 1932, it tested its first static test of a LOX-gasoline rocket. It launched a rocket on May 14, 1932, attaining an altitude of only 250 feet, but its second and last launch on September 9, 1934, went over 1,300 feet into the atmosphere. Because of the great cost and risk to the people involved, after this launch the group concentrated throughout the rest of the 1930s on static firings of engines and published results of its research, the cumulation of which proved significant for later experimentation in rocketry. Almost concomitant with its withdrawal from rocket experimentation, and out of a desire to improve the image of the organization, the AIS changed its name to the American Rocket Society (Emme, 1961, p. 31; Winter, 1983, pp. 73–85).

That name change may also have been prompted in part by the organization of the British Interplanetary Society on October 13, 1933, at Liverpool, England. More oriented toward theoretical studies than rocket experimentation, in the 1930s the society became a haven for writers and other intellectuals interested in the idea of spaceflight. By September 1939, at the beginning of World War II, the British Interplanetary Society numbered about 100 members, including several Germans. Its periodical, the *Journal of the British Interplanetary Society*, began its publication in January 1934, and it quickly became a persistent and powerful voice on behalf of space exploration. It did not undertake field work with rockets (although several members did conduct some crude experiments with potential solid propellants), but in 1938–1939 its members designed a lunar landing vehicle which influenced the Lunar Module used in Project Apollo during the 1960s (Winter, 1983).

While both the individual and societal precursors of spaceflight struggled along as best they could, beginning in 1936 the Guggenheim Aeronautical Laboratory, California Institute of Technology (GALCIT), in Pasadena, California, began to pursue its own rocket research program (Koppes, 1982). Frank J. Malina, a young Caltech PhD student at the time, persuaded GALCIT to adopt a research agenda for the design of a high-altitude sounding rocket and enthusiastically began experimentation. Using some of the ideas from the research of Eugen Sanger in Austria, and Goddard in New Mexico, Malina and a design team – composed of, among others, H. S. Tsien, a Chinese national who was later deported and became the architect of the ICBM (intercontinental ballistic missile) and space launcher programs for the People's Republic of China – began the work. Malina and his colleagues started the static testing of rocket engines in the canyons above the Rose Bowl, with mixed results. It was not until November 28, 1936, for example, that the motor ran at all, and then only for 15 seconds. A series of tests thereafter brought incremental improvements; a year later Malina and an associate had learned enough to distill the results into the first scholarly chapter on rocketry to come out of GALCIT. The test results showed that with proper fuels and motor efficiency a rocket could be constructed with the capability to ascend as high as 1,000 miles.

Because of this research GALCIT's rocketry team obtained funding from outside sources, among them General H. H. (Hap) Arnold, soon to become the Army Air Corps Chief of Staff; he visited GALCIT in the spring of 1938 and was enthusiastic about the work on rockets he saw Malina and co-workers doing. That fall he arranged for additional funding from the National Academy of Sciences to proceed with the project, with the specific goal of research on the possibilities of rocket-assisted takeoff for aircraft. The committee that approved this funding did so with some consternation that it might be money poorly spent. Finally, Jerome Hunsaker, the head of the Guggenheim Aeronautics Department of the Massachusetts Institute of Technology, told the committee that he would be glad to have Theodore von Karman, the director of GALCIT, "take the Buck Rogers job" (von Karman & Edson, 1967, p. 243). GALCIT accepted the task, and beginning in 1939 Malina and his rocket team began working on what became the JATO project. Although Malina always expressed misgivings about working on weaponry and, after World War II, accepted employment with the United Nations so he could help prevent such occurrences from taking place again, the difficult political climate in 1939 prompted him to support the development of US military capability as a deterrent to fascism. As a result, Malina and GALCIT engaged throughout the war years in rocketry research for military purposes (von Karman & Edson, 1967, p. 244).

The V-2 Rocket and Modern War

Although the work of Goddard, Oberth, and others was path-breaking, World War II truly altered the course of rocket development. Prior to that conflict technological progress in rocketry had been erratic. The war forced nations to focus their attention on the activity and to fund research and development. Such research and development was oriented, however, toward the advancement of rocket-borne weapons rather than of rockets for space exploration and other peaceful purposes. This would remain the case even after the war, as competing nations perceived and supported advances in space technology because of their military potential and the national prestige associated with them. The security role of the Department of Defense and the function of NASA as a civilian space agency have been inextricably related ever since.

During World War II, virtually every belligerent was involved in developing some type of rocket technology. Germany's rocket program proved the most significant transformative force for spaceflight. This was probably the case largely because in 1932 the German army hired the charismatic and politically astute Wernher von Braun, then only 20 years old, to work in its military rocket program. While he has been the first VfR member to go to work for the German military, he was far from the last.

Von Braun's motivations for this move, with the hindsight of Hitler's rise to power in Germany and the devastation and terror of World War II, have been questioned and criticized. For some he was a visionary who foresaw the potential of human spaceflight, but for others he was little more than an arms merchant who developed brutal weapons of mass destruction. In reality, he seems to have been something of both. Political humorist Tom Lehrer wrote a song about von Braun's pragmatic approach to serving whoever would let him build rockets regardless of their purpose. "Don't say that he's hypocritical, say rather that he's apolitical," Lehrer wrote. "'Once the rockets are up, who cares where they come down? That's not my department', says Wernher von Braun." Lehrer's biting satire captured well the ambivalence of von Braun's attitude on moral questions associated with the use of rocket technology.

Under von Braun's technical direction, with political oversight provided by General Walter Dornberger, Germany developed the V-2 rocket, the first true ballistic missile. The brainchild of Wernher von Braun's rocket team operating at a secret laboratory at Peenemunde on the Baltic coast, this rocket was the immediate antecedent of many of those used in world space programs thereafter. A liquid propellant missile rising 46 feet in height and weighing 27,000 pounds at launch, the V-2, called the A-4 by the Germans involved in the project, flew at speeds in excess of 3,500 miles per hour and delivered a 2,200-pound warhead 500 miles away. First flown in October 1942, it was employed against targets in Europe beginning in September 1944, and by the end of the war 1,155 had been fired against England and another 1,675 had been launched against Antwerp and other continental targets. The guidance system for these missiles was imperfect and many did not reach their targets, but they struck without warning and there was no defense against them. As a result, the V-2s had a terror factor far beyond their capabilities (Neufeld, 1993).

Germany's astounding success in developing a ballistic missile while the other combatants had not done so was no accident, and it was in no small measure the result of personalities involved in the research. Before 1941 the United States had led the world in rocket technology, chiefly because of Goddard's work. But he failed to gain the support of the United States either other scientists or the government. However, the energetic Oberth courted his scientific colleagues and those in the German government. For instance, as early as 1929 Oberth had helped kindle the fires of rocketry's promise in Walter Dornberger, later the military commander of the German rocket program. No similar level of salesmanship took place in any other nation. Popular and top-level support was therefore lacking, and

Germany was able to capitalize on this with the V-2 development during the war.

Rationales for Spaceflight

From the very earliest era, the following five major themes – and only these five – have been of use in justifying a large-scale spaceflight agenda: scientific discovery and understanding, national security and military applications, economic competitiveness and commercial applications, human destiny/survival of the species, and national prestige/geopolitics. Specific aspects of these five rationales have fluctuated over time but remain the only reasons for the endeavor that have any saliency whatsoever (Launius, 2006).

The first and most common rationale for spaceflight is that an integral part of human nature is a desire for discovery and understanding. At one level, there exists the ideal of the pursuit of abstract scientific knowledge – learning more about the universe to expand the human mind – and pure science and exploration of the unknown will remain an important aspect of spaceflight well into the foreseeable future. This goal clearly motivated the scientific probes sent to all the planets of the Solar System. It propels a wide range of efforts to explore Mars, Jupiter, and Saturn in the twenty-first century (for an excellent discussion of all space probes launched to the early twenty-first century, see Siddiqi, 2002).

From the beginning, science has been a critical goal in spaceflight. The National Aeronautics and Space Act of 1958 that created NASA stated that its mandate included "the expansion of human knowledge of phenomena in the atmosphere and space." This idea has continually drawn verbal and fiscal support, but it has proven less important than the pursuit of knowledge that enables some practical social or economic payoff.

Even the Apollo missions to the Moon, certainly inaugurated as a Cold War effort to best the Soviet Union and demonstrate the power of the United States, succeeded in enhancing scientific understanding. The scientific experiments placed on the Moon and the lunar soil samples returned through Project Apollo have provided grist for scientists' investigations into the Solar System ever since. In that case, and many others, a linkage between the spirit and need of scientific inquiry and the spirit and need for exploration served as strong synergetic forces for human spaceflight (Spudis, 1996; Wilhelms, 1993). The performance of scientific experiments on the Space Shuttle and the science program envisioned for the ISS demonstrated the same linkages at the beginning of the twenty-first century.

The second rationale of national defense and military space activity has also proven useful for spaceflight advocates. From the beginning, national leaders sought to use space to ensure US security from nuclear holocaust. For instance, in 1952 a popular conception of the US-occupied space station showed it as a platform from which to observe the Soviet Union and the rest of the globe in the interest of national security. The US military also argued for a human capability to fly in space for rapid deployment of troops to hot spots anywhere around the Earth. The human spaceflight enterprise gained energy from Cold War rivalries in the 1950s and 1960s as international prestige, translated into American support from non-aligned nations, found an important place in the space policy agenda. Human spaceflight also had a strong military nature during the 1980s when astronauts from the military services deployed reconnaissance satellites into the Earth orbit from the Space Shuttle. A human military presence in space promises to remain a compelling aspect of spaceflight in the twenty-first century (Launius, 2003, pp. 26–35 & pp. 114–121).

The third rationale of economic competitiveness and commercial applications also represents a useful role that the public accepts for spaceflight. Space technologies, especially the complex human spaceflight component, demand a skilled and well-trained workforce whose talents are disseminated to the larger technological and economic base of the nation. The Apollo program, for example, served explicitly as an economic engine fueling the southern US' economic growth. In recent years, the economic rationale has become stronger and even more explicit as space applications, especially communications satellites, became increasingly central for maintaining US global economic competitiveness. Ronald Reagan's presidential administration especially emphasized enlarging the role of the private sector, and its priorities have remained in place thereafter. One of the key initiatives in this effort for human spaceflight is tourism (see Chapters 2 and 7); visionaries envisaged hotels in the Earth orbit and lunar vacation packages. While this has yet to find realization, it remains a tantalizing possibility for the twenty-first century.

The fourth imperative for spaceflight has revolved around human destiny. With the Earth so well known, advocates argue, exploration and settlement of the Moon and Mars is the next logical step in human exploration. Humans must question and explore and discover or die, advocates for this position insist. There is also a terrifying aspect of this rationale: humanity will not survive if it does not become multi-planetary (see Chapter 11). Carl Sagan wrote eloquently about the last perfect day on the Earth, before the Sun would fundamentally change and end our ability to survive on this planet. While this will happen billions of years in the future, any number of catastrophes could end life on the Earth beforehand. The most serious threat is from an asteroid or meteor impact. Throughout history, asteroids and comets have struck the Earth, and a great galactic asteroid probably killed the dinosaurs when an object only six to nine miles wide left a crater 186 miles wide in Mexico's Yucatan Peninsula.

Finally, national prestige and concern for geopolitical relations has dominated so many of the spaceflight decisions that it sometimes seems trite to suggest that it has been an impressive rationale over the years. Yet, there is more to it than that, for while all recognize that prestige sparked and sustained the space race of the 1960s we too often fail to recognize that it continues to motivate support for NASA's programs. The United States went to the Moon for prestige purposes, but it also built the Space Shuttle and embarked on the space station for prestige purposes as well. Are these sufficient rationales to sustain human spaceflight indefinitely? While Americans want the endeavor's fruits, too many are unwilling to invest in it. The rationales, as real as they might be, are not compelling enough to sustain an expansive program indefinitely and the effort has stumbled for more than thirty years after its initial acceptance.

The Space Policy Debate in the 1950s

The Role of Adventure and Discovery. There seems to be little doubt that adventure and discovery, the promise of exploration and colonization, were the motivating forces behind the small cadre of early space program advocates in the United States prior to the 1950s. Most advocates of aggressive space exploration efforts invoked an extension of the popular notion of the American frontier with its then-attendant positive images of territorial discovery, scientific discovery, exploration, colonization, and use. This notion takes a further step beyond Frederick Jackson Turner's "Frontier Thesis" that guided inquiry into much of American history for a generation. It also continues to inform many popular images of the American West. Turner (1920) outlined the major features of the subject in *The Frontier in American History* which included the seminal 1893 essay, "The Significance of the Frontier in American History." Indeed, the image of the American frontier has been an especially evocative and somewhat romantic, as well as popular, argument to support the aggressive exploration of space. It plays to the popular conception of "westering" and the settlement of the American continent by Europeans from the East that was a powerful metaphor of national identity until the 1970s.

The space promoters of the 1950s and 1960s intuited that this set of symbols provided a vigorous explanation and justification of their efforts. The metaphor was probably appropriate for what they wanted to accomplish. It conjured up an image of self-reliant Americans moving westward in sweeping waves of discovery, exploration, conquest, and settlement of an untamed wilderness. In the process of movement, the Europeans who settled in North America became in their own eyes a unique people from all the others of the Earth imbued with virtue and justness. The frontier ideal has always carried with it the ideals of optimism, democracy, and right relationships. It has been almost utopian in its expression, and it should come as no surprise that those people seeking to create perfect societies in the seventeenth, eighteenth, and nineteenth centuries – the Puritans, the Mormons, the Shakers, the Moravians, the Fourians, the Icarians, the followers of Horace Greeley – often went to the frontier to carry out their ends.

It also summoned in the popular mind a wide range of vivid and memorable tales of heroism, each a morally justified step of progress toward the modern democratic state. While the frontier ideal reduced the complexity of events to a relatively static morality play, avoided matters that challenged or contradicted the myth, viewed Americans moving westward as inherently good and their opponents as evil, and ignored the cultural context of westward migration, it served a critical unifying purpose for the nation. Those who were persuaded by this metaphor, and the most white Americans in 1960 did not challenge it, embraced the vision of space exploration.

While the frontier imagery was overtly mythic, myths are important to the maintenance of any society, for they are stories that symbolize an overarching ideology and moral consciousness. As James Oliver Robertson observes, "Myths are the patterns of behavior, or belief, and/or perception – which people have in common. Myths are not deliberately, or necessarily consciously, fictitious" (1980, p. xv). Myth, therefore, is not so much a fable or falsehood, as it is a story, a kind of poetry, about events and situations that have great significance for the people involved. Myths are, in fact, essential truths for the members of a cultural group who hold them, enact them, or perceive them. They are sometimes expressed in narratives, but in literate societies like the United States they are also apt to be embedded in ideologies. Robertson's book is one of many studies that focus on American myths – such as the myth of the chosen people, the myth of a God-given destiny, and the myth of a New World innocence or inherent virtue.

The Role of Popular Conceptions of Space Travel. If the frontier metaphor of space exploration conjured up romantic images of an American nation progressing to something for the greater good, the space advocates of the Eisenhower era also sought to convince the public that space exploration was an immediate possibility. It was seen in science fiction books and film, but more importantly, it was fostered by serious and respected scientists, engineers, and politicians. Deliberate efforts on the part of space boosters during the late 1940s and early 1950s helped to reshape the popular culture of space and to influence governmental policy. These advocates worked hard to overcome the level of disbelief that had been generated by two decades of "Buck Rogers"-type fantasies and to convince the American public that space tourism might actually, for the first time in human history, be possible.

The decade following World War II brought a sea change in perceptions, as most Americans went from skepticism about the probabilities of spaceflight to an acceptance of it as a near-term reality. This can be seen in the public opinion polls of the era. For instance, in December 1949, Gallup pollsters found that only 15% of Americans believed humans would reach the Moon within 50 years, while a whopping 70% believed that it would not happen within that time. By 1957, 41% believed firmly that it would not take longer than 25 years for humanity to reach the Moon, while only 25% believed that it would. An important shift in perceptions had taken place during that era, and it was largely the result of a public relations campaign based on the real possibility of spaceflight coupled with the well-known advances in rocket technology (Gallup, 1972, pp. 875, 1152.).

There were many ways in which the US public became aware that flight into space was a possibility, ranging from science fiction literature and film (see Chapter 4) that were more closely tied to reality than ever before to speculations by science fiction writers about possibilities already real to serious discussions of the subject in respected popular magazines. Among the most important serious efforts was that of the handsome German émigré, Wernher von Braun, working for the Army at Huntsville, Alabama. Von Braun, in addition to being a superbly effective technological entrepreneur, managed to seize the attention of the powerful print and electronic communication media that the science fiction writers and filmmakers had been using in the early 1950s and no one was a more effective promoter of space exploration to the public (see Wernher von Braun's exceptionally sophisticated spaceflight-promoting book, 1953).

In 1952 von Braun burst on the public stage with a series of articles in *Collier's* magazine about the possibilities of spaceflight. The first issue of *Collier's* devoted to space appeared on March 22, 1952. An editorial suggested that space flight was possible, not just science fiction, and that it was inevitable that humanity would venture outward. Von Braun advocated the orbiting of humans, development of a reusable spacecraft for travel to and from the Earth orbit, building a permanently inhabited space station, and finally human exploration of the Moon and Mars by spacecraft departing from the space station. The series concluded with a special issue of the magazine devoted to Mars, in which von Braun and others described how to get there and predicted what might be found based on recent scientific data (Collier's, 1952, p. 23).

Following closely on the heels of the *Collier's* series, Walt Disney contacted von Braun and asked his assistance in the production of three shows for Disney's weekly television series. The first of these, *Man in Space*, premiered on Disney's show on March 9, 1955, with an estimated audience of 42 million. The second show, *Man and the Moon*, also aired in 1955 and sported the powerful image of a wheel-like space station as a launching point for a mission to the Moon. The final show, *Mars and Beyond*, premiered on December 4, 1957, after the launching of Sputnik I. Von Braun appeared in all three films to explain his concepts for human spaceflight, while Disney's characteristic animation illustrated the basic principles and ideas with wit and humor. Both the *Collier's* and Disney series helped to shape the public's perception of space exploration as something that was no longer fantasy.

The coming together of public perceptions of spaceflight as a near-term reality with the technological developments then being seen at White Sands and elsewhere created an environment much more conducive to the establishment of an aggressive space program. The convincing of the American public that spaceflight was *possible* was one of the most critical components of the space policy debate of the 1950s. Without it, the aggressive exploration programs of the 1960s would never have been approved. To be approved in the public policy arena, the public must have both an appropriate vision of the phenomenon with which the society seeks to grapple and confidence in the attainability of the goal. Indeed, space enthusiasts were so successful in promoting their image of human spaceflight as being just over the horizon, that when other developments forced public policymakers to consider the space program seriously, alternative visions of space exploration remained ill-formed, and even advocates of different futures emphasizing robotic probes and applications satellites were obliged to discuss space exploration using the symbols of the human space tour vision that had been so well established in the minds of Americans by the promoters.

A dichotomy of visions has been one of the central components of the US space program. Those who advocated a scientifically oriented program using non-piloted probes and applications satellites for weather, communications, and a host of other useful activities were never able to capture the imagination of the American public the way the human spaceflight advocates did. For a modern critique of this dichotomy see Roland (1989). That the human imperative is still consequential is demonstrated in Bainbridge's (1991) sociological study.

The Role of Foreign Policy and National Security Issues. While space exploration advocates, both buffs and scientists, were generating an image of spaceflight as a genuine possibility and no longer fantasy and proposing how to accomplish a far-reaching program of lunar and planetary exploration, another critical element entered the picture, the role of spaceflight in national defense and international relations. Space partisans early began hitching their exploration vision to the political requirements of the Cold War to the belief that the nation that occupied the "high ground" of space would dominate the territories underneath it. In the first of the *Collier's* articles in 1952, the exploration of space was framed in the context of the Cold War rivalry with the Soviet Union and concluded that:

> Collier's believes that the time has come for Washington to give priority of attention to the matter of space superiority. The rearmament gap between the East and West has been steadily closing. And nothing, in our opinion, should be left undone that might guarantee the peace of the world. It's as simple as that.

The magazine's editors argued:

> that the US must immediately embark on a long-range development program to secure for the West "space superiority." If we do not, somebody else will. That somebody else very probably would be the Soviet Union. (*Collier's*, 1952, p. 23)

Couple this sense of terror with the reality of the Soviet Union successfully testing an atomic bomb on August 29, 1949, in Semipalatinsk, Siberia, and the nightmare had become reality. This shock was still reverberating when the Soviets tested their first hydrogen bomb in the early 1950s. After an arms race that had a definite nuclear component and a series of hot and cold crises in the Eisenhower era, with the launching of Sputnik in 1957, the threat of holocaust for most Americans was now not just a possibility but a probability. One of Lyndon Johnson's aides, George E. Reedy, summarized the feelings of many Americans at that time:

> the simple fact is that we can no longer consider the Russians to be behind us in technology. It took them four years to catch up to our atomic bomb and nine months to catch up to our hydrogen bomb. Now we are trying to catch up to their satellite. (Launius, n.d., n.p.)

The linkage between the idea of progress manifested through the frontier, the selling of spaceflight as a reality in American popular culture, and the Cold War rivalries between the United States and the Soviet Union made possible the adoption of an aggressive space program by the early 1960s. The NASA effort through Project Apollo, with its emphasis upon human spaceflight and extraterrestrial exploration, emerged from these three major ingredients, with Cold War concerns the dominant driver behind monetary appropriations for space efforts.

The Space Race

The Cold War rivalry with the Soviet Union was the key that opened the door to aggressive space exploration to achieve technological superiority in the eyes of the world. From the perspective of the twenty-first century it is difficult to appreciate the near-hysterical concern of how nuclear attack preoccupied Americans in the 1950s. Far from being the "Happy Days" of the television sitcom, the United States was a dysfunctional nation preoccupied with death by nuclear war. Schools required children to practice civil defense techniques and shield themselves from nuclear blasts, in some cases as simply as crawling under their desks. Communities practiced civil defense drills and families built personal bomb shelters in their backyards. In the popular culture, nuclear attack was inexorably linked to the space above the United States, from which the attack would come.

After an arms race with its nuclear component and a series of hot and cold crises in the Eisenhower era, with the launching of Sputniks I and II in 1957 the threat of holocaust felt by most Americans and Soviets was now not just a possibility, but a seeming probability. For the first-time enemies could reach the United States with a radical new technology. In the contest over the ideologies and allegiances of the world's non-aligned nations, space exploration became contested ground (Launius, Logsdon, & Smith, 2000). Even while US officials congratulated the Soviet Union for this accomplishment, many Americans thought that the Soviet Union had staged a tremendous coup for the communist system at US expense. It was a shock, introducing the illusion of a technological gap and providing the impetus for the 1958 act creating NASA. Sputnik led directly to several critical efforts aimed at "catching up" to the Soviet Union's space achievements. These included the following: full-scale review of both the civil and military programs of the United States (scientific satellite efforts and ballistic missile development); establishment of a Presidential Science Advisor in the White House who had responsibility for the activities of the Federal government in science and technology; creation of the Advanced Research Projects Agency in the Department of Defense, and the consolidation of several space activities under centralized management; establishment of the NASA to manage civil space operations; and passage of the National Defense Education Act to provide Federal funding for education in the scientific and technical disciplines (Launius, 1996a, 1996b).

More immediately, the United States launched its first Earth satellite on January 31, 1958, when *Explorer 1* documented the existence of radiation zones encircling the Earth. Shaped by the Earth's magnetic field, what came to be called the Van Allen Radiation Belt influences the electrical charges in the atmosphere and the solar radiation that reaches the Earth. It also began a series of scientific missions to the Moon and planets in the latter 1950s and early 1960s. Because of this perception, Congress passed, and President Dwight D. Eisenhower signed, the National Aeronautics and Space Act of 1958. This legislation established NASA with a broad mandate to explore and use space for "peaceful purposes for the benefit of all mankind" (National Aeronautics Space Act). The core of NASA came from the earlier National Advisory Committee for Aeronautics with its 8,000 employees, an annual budget of $100 million, and its research laboratories. It quickly incorporated other organizations into the new agency, notably the space science group of the Naval Research Laboratory in Maryland, the Jet Propulsion Laboratory managed by the California Institute of Technology for the Army, and the Army Ballistic Missile Agency in Huntsville, Alabama (Launius, 1994, pp. 29–41).

The Soviet Union, while not creating a separate organization dedicated to space exploration, infused money into its various rocket design bureaus and scientific research institutions. The chief beneficiaries of Soviet spaceflight enthusiasm were the design bureau of Sergei P. Korolev (the chief designer of the first Soviet rockets used for the Sputnik program) and the Soviet Academy of Sciences, which devised experiments and built the instruments that were launched into orbit. With huge investments in spaceflight technology urged by Soviet premier Nikita Khrushchev, the Soviet Union accomplished one public relations coup after another against the United States during the late 1950s and early 1960s (Siddiqi, 2000).

In an irony of the first magnitude, Eisenhower believed that the creation of NASA and the placing of so much power in its hands by the Kennedy administration during the Apollo program of the 1960s was a mistake. He remarked in a 1962 article:

> Why the great hurry to get to the moon and the planets? We have already demonstrated that in everything except the power of our booster rockets we are leading the world in scientific space exploration. From here on, I think we should proceed in an orderly, scientific way, building one accomplishment on another. (Eisenhower, 1962, p. 24)

He later cautioned that the Moon race "has diverted a disproportionate share of our brain-power and research facilities from equally significant problems, including education and automation" (Eisenhower, 1964, p. 19). He believed that Americans had overreacted to the perceived threat.

During the first 25 years of the Space Age, the United States emphasized a civilian space exploration program consisting of several major components: Human spaceflight initiatives – Mercury's single astronaut program (flights during 1961–1963) to ascertain if a human could survive in space; Project Gemini (flights during 1965–1966) with two astronauts to practice for space operations; and Project Apollo (flights during 1968–1972) to explore the Moon. Similarly, there were robotic missions to the Moon (Ranger, Surveyor, and Lunar Orbiter), Venus (*Pioneer Venus*), Mars (*Mariner 4, Viking 1* and *Viking 2*), and the outer planets (*Pioneer 10* and *Pioneer 11*, *Voyager 1* and *Voyager 2*); orbiting space observatories (*Orbiting Solar Observatory*, *Hubble Space Telescope*) to view the galaxy from space without the clutter of the Earth's atmosphere; and remote-sensing Earth satellites for information gathering (Landsat satellites for environmental monitoring). In addition, applications satellites such as communications (*Echo 1*, *TIROS*, and *Telstar*) and weather monitoring instruments; an orbital workshop for astronauts, *Skylab*. a reusable spacecraft for traveling to and from the Earth orbit, the Space

Shuttle and also the building of a space station in the Earth orbit were set up.

The capstone of this effort was, of course, the human expedition to the Moon, Project Apollo. A unique confluence of political necessity, personal commitment and activism, scientific and technological ability, economic prosperity, and public mood made possible the May 25, 1961 announcement by President John F. Kennedy to carry out a lunar landing program before the end of the decade as a means of demonstrating the US' technological virtuosity.

Project Apollo, backed by sufficient funding, was the tangible result of an early national commitment in response to a perceived threat to the United States by the Soviet Union. NASA leaders recognized that while the size of the task was enormous, it was still technologically and financially within their grasp, but they had to move forward quickly. Accordingly, the space agency's annual budget increased from $500 million in 1960 to a high point of $5.2 billion in 1965. A comparable percentage of the $1.9 trillion Federal budget in 2006 would have equaled more than $77 billion for NASA, whereas the agency's actual budget then stood at $16.6 billion. NASA's budget began to decline beginning in 1966 and continued a downward trend until 1975. NASA's fiscal year 1971 budget took a battering; forcing the cancellation of Apollo missions 18 through 20. Except for a few years during the Apollo era, the NASA budget has hovered at slightly less than 1% of all money expended by the US treasury. Stability has been the norm as the annual NASA budgets has incrementally gone up or down in relation to that 1% benchmark, see Figure 1 (these observations are based on calculations using both the budget data from the annual NASA Space Report to the President for 2004 (Appendix E), which contains this information for each year since 1959, and on NASA's (2006) budget request for 2007).

While there may be reason to accept that Apollo was transcendentally important at some sublime level, assuming a generally rosy public acceptance of it is at best a simplistic and ultimately unsatisfactory conclusion. Indeed, the public's support for space funding has remained remarkably stable at approximately 80% in favor of the status quo since 1965, with only one significant dip in support in the early 1970s. However, responses to funding questions on public opinion polls are extremely sensitive to question wording and must be used cautiously. Polls in the 1960s consistently ranked spaceflight near the top of those programs to be cut in the federal budget. Most Americans seemingly preferred doing something about air and water pollution, job training for unskilled workers, national

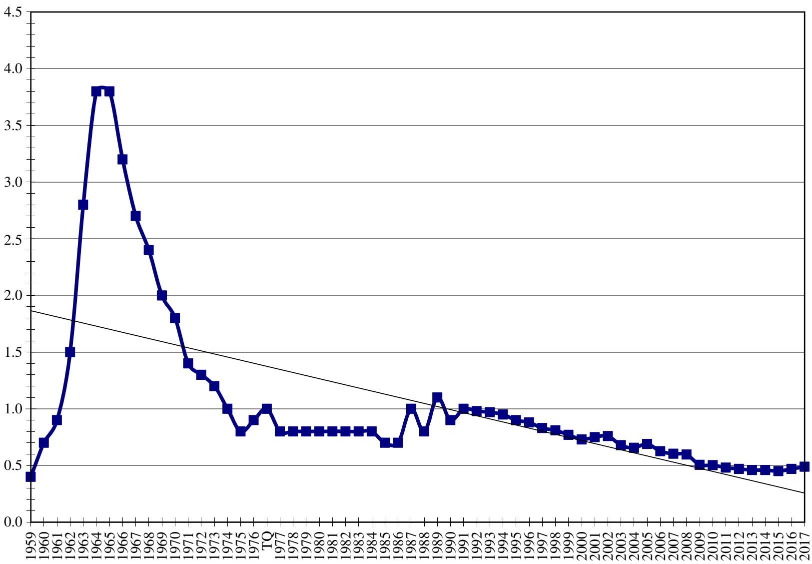

Figure 1. NASA's Budget as Percentage of Federal Budget

beautification, and poverty before spending federal funds on human spaceflight. The following year *Newsweek* stated:

> The US space program is in decline. The Vietnam war and the desperate conditions of the nation's poor and its cities – which make space flight seem, in comparison, like an embarrassing national self-indulgence – have combined to drag down a program where the sky was no longer the limit.

Nor did lunar exploration in and of itself create a groundswell of popular support from the general public. The American public during the 1960s largely showed hesitancy to "race" the Soviets to the Moon (Figure 2). "Would you favor or oppose US government spending to send astronauts to the moon?" these polls asked, and in virtually all cases a majority opposed doing so, even during the height of Apollo. At only one point, October 1965, did more than half of the public favor continuing human lunar exploration. In the post-Apollo era, the American public has continued to question the validity of undertaking human expeditions to the Moon (this analysis is based on a set of Gallup, Harris, NBC/Associated

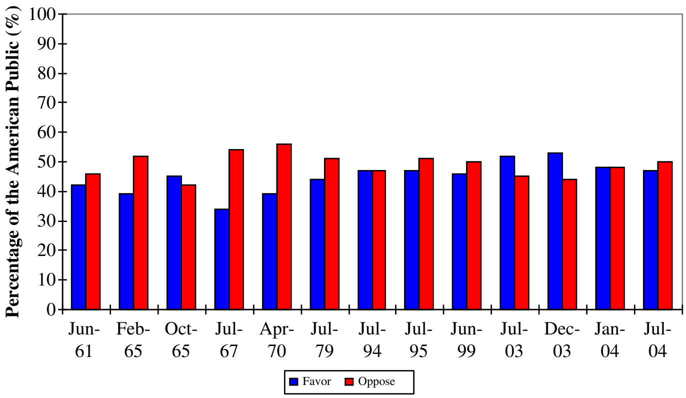

Figure 2. Should the Government Fund Human Trips to the Moon?

Press, CBS/*New York Times*, and ABC/*USA Today* polls conducted throughout the 1960s; copies are available in the NASA Historical Reference Collection).

Some concluded from these opinion polls that even though the American public might have been generally unsupportive of human lunar exploration that Project Apollo – wrapped as it was in the bosom of American virtue, advocated by the most publicly wholesome of astronaut heroes, and hawked by everyone from journalists to Madison Avenue marketers – enjoyed consistent popularity. There is some evidence to suggest this, but it is, on the main, untrue. From the 1960s to near the present, using the polling data that exists, there is little evidence to support an expansive lunar exploration and colonization program. One must conclude from hard evidence that the United States undertook and carried out Apollo not because the public clamored for it during the 1960s, but because it was seen as serving key national purposes. Furthermore, the polling data suggest that should the United States mount another human mission to the Moon in the future it will also be because the mission serves a larger political, economic, or national defense agenda (Launius, 2003).

These statistics do not demonstrate unqualified support for NASA's effort to reach the Moon in the 1960s. They suggest, instead, that the political crisis that brought public support to the initial lunar landing decision was fleeting and within a short period the coalition that announced it had to retrench (Launius, 2003). It also suggests that the public was never enthusiastic about human lunar exploration, and especially about the costs associated with it. What enthusiasm it may have enjoyed waned over time, until by the end of the Apollo program in December 1972 one has the image of the program as something akin to a limping marathoner straining with every muscle to reach the finish line before collapsing.

The first Apollo mission of public significance was the flight of Apollo 8. On December 21, 1968, it took off atop a Saturn V booster from the Kennedy Space Center. Three astronauts were aboard – Frank Borman, James A. Lovell, Jr., and William A. Anders – for a historic mission to orbit the Moon. After Apollo 8 made one-and-a-half Earth orbits, its third stage began a burn to put the spacecraft on a lunar trajectory. It orbited the Moon on December 24–25. The crew undertook a Christmas Eve broadcast, sending images of the Earth from lunar orbit while reading the first part of the Bible – "God created the heavens and the Earth, and the Earth was without form and void" – before sending Christmas greetings to humanity. The next day they fired the boosters for a return flight and "splashed down" in the Pacific Ocean on December 27. That flight was such an enormously significant accomplishment because it came at a time when American society was in crisis over Vietnam, race relations, urban problems, and a host of other difficulties. For only a few moments, the nation united as one to focus on this epochal event. Two more Apollo missions occurred before the climax of the program, confirming that the time had come for a lunar landing.

That landing came during the flight of Apollo 11, which lifted off on July 16, 1969, and, after confirmation that the hardware was working well, began the three-day trip to the Moon. Then, at 4:18 p.m. EST on July 20, 1969, the Lunar Module – with astronauts Neil Armstrong and Buzz Aldrin aboard – landed on the lunar surface while Michael Collins orbited overhead in the Apollo command module. After checkout, Armstrong set foot on the surface, telling millions who saw and heard him on the Earth that it was "one small step for [a] man – one giant leap for mankind." Aldrin soon followed him out and the two plodded around the landing site in the 1/6 lunar gravity, planted an American flag but omitted claiming the land for the United States as had been routinely done during European exploration of the Americas, collected soil and rock samples, and set up scientific experiments. The next day they launched back to the Apollo capsule orbiting overhead and began the return trip to the Earth, splashing down in the Pacific on July 24. In addition to the many histories of Apollo that give center place to Apollo 11, there have been several memoirs by the astronauts on this mission (Aldrin, 1973; Armstrong, Collins, & Aldrin, 1970; Collins, 1974).

Five more landing missions followed at approximately six-month intervals through December 1972, each of them increasing the time spent on the Moon. The scientific experiments placed on the Moon and the lunar soil samples returned have provided grist for scientists' investigations ever since. The scientific return was significant, with the latter Apollo missions using a lunar rover to enhance substantially the ability to undertake scientific investigation. None of them, however, equaled the excitement of Apollo 11.

Project Apollo in general should be viewed as a watershed in the nation's history. It was an endeavor that demonstrated both the technological and economic virtuosity of the United States and established national pre-eminence over rival nations – the primary goal of the program when first envisioned by the Kennedy administration in 1961. At the same time the Apollo program, while an enormous achievement, left a divided legacy for NASA and the aerospace community. The perceived "golden age" of Apollo created for the agency an expectation that the direction of any major space goal from the president would always bring NASA a broad consensus of support and provide it with the resources and license to dispense them as it saw fit. Something most NASA officials did not understand at the time of the Moon landing in 1969, however, was that Apollo had not been conducted under normal political circumstances and that the exceptional circumstances surrounding Apollo would not be repeated.

Sustained Space Exploration?

After Apollo – and the interlude of Skylab – the space program went into a holding pattern as nearly a decade passed. During that time, it moved from its earlier heroic age to one that was more characterized as a "routinization" of activities, perspectives, and processes.

The Space Shuttle was intended to make spaceflight routine, safe, and relatively inexpensive. Although NASA considered a variety of configurations, some of them quite exotic, it settled on a stage-and-one-half partially reusable vehicle with an approved development price tag of $5.15 billion. On January 5, 1972, the President Nixon announced the decision to build a Space Shuttle. He did so for both political reasons and for national prestige purposes. Politically, it would help a lagging aerospace industry in key states he wanted to carry in the next election, especially California, Texas, and Florida. Supporters – especially Caspar W. Weinberger, who later became Reagan's defense secretary – argued that building the shuttle would reaffirm America's superpower status and help restore confidence, at home and abroad, in America's technological genius and will to succeed. This was purely an issue of national prestige.

The prestige factor belies a critical component. United States leaders supported the shuttle not on its merits but on the image projected. In so doing, the Space Shuttle that emerged in the early 1970s was essentially a creature of compromise that consisted of three primary elements: a delta-winged orbiter spacecraft with a large crew compartment, a cargo bay 15 by 60 feet in size, and three main engines; two solid rocket boosters; and an external fuel tank housing the liquid hydrogen and oxidizer burned in the main engines. The orbiter and the two solid rocket boosters were reusable. The shuttle was designed to transport approximately 45,000 tons of cargo into low-Earth orbit, 115–250 statute miles above the Earth. It could also accommodate a flight crew of up to ten persons (although a crew of seven would be more common) for a basic space mission of seven days. During a return to the Earth, the orbiter was designed so that it had a cross-range maneuvering capability of 1,265 statute miles to meet requirements for liftoff and landing at the same location after only one orbit.

After a decade of development, on April 12, 1981, *Columbia* took off for the first orbital test mission. It was successful and after only the fourth flight in 1982, the President Ronald Reagan declared the system "operational." It would henceforth carry all US government payloads; military, scientific, and even commercial satellites could all be deployed from its payload bay (Jenkins, 2000).

The shuttle soon proved disappointing. By January 1986 there had been only 24 shuttle flights, although in the 1970s NASA had projected more flights than that for every year. Critical analyses agreed that the shuttle had proven to be neither cheap nor reliable, both primary selling points, and that NASA should never have used those arguments in building a political consensus for the program. In some respects, therefore, many agreed that the effort had been both a triumph and a tragedy. It had been an engagingly ambitious program that had developed an exceptionally sophisticated vehicle, one that no other nation on the Earth could have built at the time. As such it had been an enormously successful program. At the same time, the shuttle was essentially a continuation of space spectaculars, *à la* Apollo, and its much-touted capabilities had not been realized. It made far fewer flights and conducted far fewer scientific experiments than NASA had publicly predicted (Launius, 2006).

All these criticisms reached crescendo proportions following the loss of *Challenger* during launch on January 28, 1986. Although it was not the entire reason, the pressure to get the shuttle schedule more in line with earlier projections throughout 1985 prompted NASA workers to accept operational procedures that fostered shortcuts and increased the opportunity for disaster. The accident, traumatic even under the best of situations, was made that much worse because *Challenger's* crew members represented a cross-section of the American population in terms of race, gender, geography, background, and religion. The explosion became one of the most significant events of the 1980s, as billions around the world saw the accident on television and empathized with any one or more of the crew members killed (Vaughan, 1996).

With the *Challenger* accident, the shuttle program went into a two-year hiatus while NASA worked to redesign the system. The Space Shuttle finally returned to flight without further incident on September 29, 1988. Up to February 2003, NASA had launched a total of 114 shuttle missions, with two tragic accidents. *Challenger* was lost during launch and *Columbia* during reentry on February 1, 2003. Each undertook scientific and technological experiments ranging from the deployment of important space probes like the *Magellan* Venus radar mapper in 1989 and the Hubble Space Telescope in 1990, through the flights of "Spacelab," to a dramatic three-person EVA in 1992 to retrieve a satellite and bring it back to the Earth for repair, to the exciting missions visiting the Russian space station *Mir*, and to the orbital construction of an ISS. Through all these activities, a good deal of realism about what the shuttle could and could not do began to emerge.

In 1984, as part of its interest in reinvigorating the space program, the Reagan administration called for the development of a permanently-occupied space station. At first projected to cost $8 billion, in part because of tough Washington politics, within five years, the projected costs had more than tripled and the station had become too expensive. NASA pared away at the station budget, and in the end, the project was satisfactory to almost no one. In 1993, the international situation allowed NASA to negotiate a landmark decision to include Russia in the building of an ISS. By 1998, the first elements had been launched and in 2000 the first crew went aboard. At the beginning of the twenty-first century, the effort involved 16 nations, but the ISS was a shadow of what had been intended, caught in the backwash of another loss of a shuttle and the inability to complete construction and resupply. Consistently, the ISS has proven a difficult issue as policymakers wrestled with competing political agendas without consensus.

The *Columbia* accident of 2003, which resulted in the deaths of seven astronauts, grounded the Space Shuttle fleet and thereby placed on hold construction of the ISS. Access to the station, thereafter, came only through using the Russian Soyuz capsule, a reliable but limited vehicle whose technology extended back to the 1960s. Because of this limitation, the ISS crew was cut to two members in May 2003, a skeleton workforce designed to keep the station operational as further deliberations took place, while the shuttle program underwent organizational reform and technical modifications and a policy debate over the long-term viability of human spaceflight took place.

On January 14, 2004, the President George W. Bush announced a vision of space exploration that called for humans to reach for the Moon and Mars during the next 30 years. As stated at the time, the fundamental goal of this vision was to advance US scientific, security, and economic interests through a robust space exploration program. In support of this goal, the United States planned to implement a sustained and affordable human and robotic program to explore the solar system and beyond; extend human presence across the solar system, starting with a human return to the Moon by the year 2020, in preparation for human exploration of Mars and other destinations; develop the innovative technologies, knowledge, and infrastructures both to explore and to support decisions about the destinations for human exploration; and promote international and commercial participation in exploration to further US scientific, security, and economic interests.

In so doing, the president called for completion of the ISS and retirement of the Space Shuttle fleet by 2010. Resources expended there would go toward creating the enabling technologies necessary to return to the Moon and eventually to Mars. He also proposed a small increase in the NASA budget to help make this a reality. By 2006, however, it had become highly uncertain that the initiative could be realized. It appeared increasing that this proposal would follow the path of the aborted Space Exploration Initiative announced with great fanfare in 1989 but derailed in the early 1990s.

The Lure of the Red Planet in the Twenty-first Century

Despite the failures of the past to send humans to Mars, it remained an important dream of many within the space community as the twenty-first century progressed. The robotic missions there, beginning with the Mars Pathfinder of 1997, bringing evidence of ancient geological activity on Mars as well as of the planet's watery past, renewed calls for Mars exploration. Working on the notion that all life on the Earth was first formed in liquid water and that any similar life elsewhere would probably have similar chemical requirements, NASA's scientists surmised that to find evidence of life on Mars, past or present, they would need to follow the water, and they believed it had either been there in the past or was possibly still present underground.

The next NASA probe to reach the Red Planet was the *Mars Global Surveyor*, which entered a Martian orbit in 1998 and began to map the planet's surface in greater detail. Using Mars Global Surveyor' images, astronomers identified more than 150 geographic features from across the planet's surface that were probably created by fast flowing water. These results led scientist Michael Malin to suggest that there might still be some water on Mars still hidden beneath the Martian soil, deep within the planet's substrata.

Further images from Mars Global Surveyor and NASA's subsequent probe, Mars Reconnaissance Orbiter, showed further evidence of dry riverbeds, flood plains, gullies on Martian cliffs and crater walls, and sedimentary deposits that suggested the presence of water flowing on the surface at some point in the history of Mars, which may even have supported simple microbial life at some earlier point in its history when it was wetter, and possibly warmer.

But perhaps the most intriguing possibility is that simple life forms might still be living on Mars today, lying beneath Mars' polar caps or in subterranean hot springs warmed by vents from the Martian core. Discoveries from Mars Pathfinder and other spacecraft at the Red Planet suggested as much. These might be Martian equivalents of single-celled microbes that dwell in the Earth's bedrock. Scientists are quick to add, however, that these are unproven theories that currently lack any evidential support. The only way for scientists to find out for sure will be to continue the strategy of "follow the water." If evidence of life on Mars exists, finding it is just a matter of time and continued exploration.

These findings, coupled with several significant feature films about Mars in the twenty-first century (Table 1), has energized public sentiment in favor of a human mission. Some of these films are entertaining, a few are scientifically embarrassing, and many more are entirely forgettable; but two actually hold up remarkably well under scientific scrutiny. Among the entertaining romps are such titles as *Red Planet* (2000), *Ghosts of Mars* (2001), and *Stranded* (2001) and the ridiculous, big budget, special effects-laden actioner *John Carter* (2012).

In addition to the 2015 Ridley Scott film *The Martian*, the other most significant Mars-related film in recent years was *Mission to Mars* (2000),

Table 1. Major Feature Films Relating to Mars, 2000–2018

Title	Year	Synopsis
Mission to Mars	2000	NASA supported film about first human mission to Mars and a sole survivor's rescue
Red Planet	2000	Terraforming Mars proves more difficult than thought, and a mission sent to fix it crash-lands on the planet
Ghosts of Mars	2001	Essentially a horror story, a Mars police team fights zombies
Stranded (Spanish: *Náufragos*)	2001	A human mission crash-lands on Mars
John Carter	2012	Based on the Edgar Rice Burroughs 1912 novel, *A Princess of Mars*, former American Civil War soldier, John Carter, is transported to Mars and engages in intrigue and adventure
The Martian	2015	A single astronaut survives a human mission to Mars, and has to survive until rescued
The Space Between Us	2017	Mostly taking place on the Earth, this film tells the story of a boy born in a Mars colony who visits the Earth

directed by Brian De Palma. The film's script was adapted from an original screenplay written by Jim Thomas, John Thomas, and Graham Yost all writers with a pedigree in space-related feature films and documentaries. Starring Gary Sinise, Tim Robbins, Don Cheadle, Connie Nielsen, Jerry O'Connell, and Kim Delaney as a team of astronauts, the film tells the story of a disastrous mission to Mars in which Don Cheadle's character is the sole survivor. A second mission sets out to rescue him and eventually returns to the Earth after an encounter with the "Face on Mars," which reveals that life was first seeded from Mars.

Aside from references to the famed Face on Mars from the *Viking 2*, *Mission to Mars* is scientifically significant for two reasons. First, as only a small number of filmmakers before them, the producers of the film secured support from NASA for both filming in its facilities and the portrayal of its Mars mission planning concepts in the film. Second, its premise of Mars seeding the Earth with protoplasm was the first broad presentation in a modern Hollywood film of the scientific theory of panspermia, which holds that microscopic life forms embedded in rock from a planet that supports such life can survive the effects of space and deposit that life on any world it lands on. This method of distributing life throughout the universe gained currency at NASA after the excitement provoked by the Martian meteorite ALH 84001 in 1996. The film cites this theory as the explanation for the origins of life on the Earth, as revealed to the astronauts by a Martian hologram.

Few films about Mars exploration have struck the balance between entertainment and scientific accuracy as well as director Ridley Scott's 2015 film *The Martian*. Based on the book of the same name by Andy Weir and starring Matt Damon its plot is relatively simple. In 2035 an expedition to Mars is forced to leave early after a dust storm threatens to overturn their ascent vehicle. Everyone escapes except astronaut Mark Watney (Matt Damon), who is presumed dead. However, Watney survives and, despite sustaining an injury, goes on to thrive through the use of his engineering and scientific skills to repair equipment, grow potatoes (using his own excrement), make oxygen, and signal the Earth. Of course, in the end he is eventually rescued by his crewmates.

On writing *The Martian* Andy Weir heavily researched NASA's planning for survival during a Mars mission and depicted, in both the novel and the film, scientifically legitimate episodes and explanations for various problems a stranded astronaut might face. The film also benefited from the assistance from NASA experts, who provided technical expertise, imagery, and on-call responses to questions. Like the 1968 film *2001: A Space Odyssey* before it, *The Martian* depicted space exploration in a realistic, scientifically plausible fashion. It was also a major critical and box-office success and served as a rally call for future human missions to Mars.

Sending humans to Mars presents a significant challenge, but it remains a potentially very rewarding accomplishment. All that is required is a political decision by a spacefaring nation, or coalition of nations, to expend the resources necessary to accomplish the task. Most plans formulated to this point have been too large, complex, and expensive to be feasible. However, some studies have recommended a leaner operation and may be possible within a budget of approximately $250 billion, which is roughly what the ISS has cost to build and maintain. Such a plan would be well worth pursuing and could take place by the 2030s.

For example, a proposal to "live off the land" using resources on the red planet might dramatically simplify exploration plans. The first humans to Mars may well extract fuel and consumables from the Martian environment. Such a mission would require a two-year-plus timetable to fly to Mars, work on the surface, and then return to the Earth. It would also require a vehicle for getting to Mars, a lander with a scientific laboratory and habitat module, a power plant for generating electricity on the surface, rovers, human transports on the surface, food, and, most critically, an ascent vehicle for leaving Mars and a manufacturing plant capable of producing its propellant.

Fuel could be manufactured on Mars from the local atmosphere, which consists mainly of carbon dioxide (CO_2). This gas would be pumped into a reaction chamber in the manufacturing plant where it would be mixed with liquid hydrogen (H_2) and heated. The resulting process, discovered in the nineteenth century by French chemist Paul Sabatier (1854–1941), produces methane (CH_4) and water (H_20). The methane would be pumped through a cryogenic cooler, which reduces it to a liquid state, which could be stored for use as rocket fuel. The resulting water could be pumped into an electrolysis unit where electrodes separate it into hydrogen and oxygen for use in the facility.

Upon arrival, humans would need to deploy an inflatable greenhouse to grow food in. Using automated rovers the crew could begin explorations of the surrounding terrain. They would collect rock samples for analysis in a small laboratory setup in their habitat module. They could also drill into the Martian substrata in search of water and any subterranean life that may exist. They could also search for fossils and seek to confirm the existence of any further natural resources that have already been detected by satellites orbiting Mars. Once their time on the planet came to an end, the crew would undertake a 110-day trip back to the Earth.

The technical problems of such a mission are considerable. The crew would be exposed to two types of radiation: cosmic radiation invading the Solar System from the galaxy beyond and solar flares of radiation that runs the whole electromagnetic spectrum and is emitted by the sun. A fast transit time is the best protection against galactic radiation, as is the local atmosphere on Mars. Solar flares, in contrast, can be lethal, especially in the unprotected vacuum of space. Engineers may opt to shield the crew from such flares with water, using a donut-shaped water tank into which the crew could retreat until the solar storm subsides. It may also be necessary to maintain some artificial gravity on the spacecraft carrying the crew to Mars to help minimize biomedical problems associated with prolonged exposure to low-gravity environments. This could be accomplished with rotating areas of the vessel.

All scientific and technical challenges can be overcome with sufficient funding. The major obstacle for a human Mars mission remains cost. Engineers will need to develop low-cost, high-reliability technologies. If humans go to Mars in the 2030s, it will be because those on the Earth are willing to expend enough funding to overpower the inevitable obstacles. But the President Donald J. Trump announced on December 11, 2017 that he intended to revector NASA toward a return to Moon and the establishment of a Moon base, prior to a human mission to Mars. This may push a Mars landing a decade or more into the future, or it might energize other nations to take leadership for an international human landing effort on Mars. Regardless, in a Pew Research Center poll released in June 2018, human missions to Mars and the Moon ranked at the bottom of what the public believed NASA should be focused on in its future missions (see http://www.wmfe.org/poll-public-support-for-nasa-moon-mars-missions-low/87662).

There are some private individuals, most particularly billionaire Elon Musk, who champion a human mission to Mars, but there is little reason to believe this will come to anything, for three fundamental reasons. First, reaching Mars is a difficult undertaking for robotic probes but especially for human missions. Second, there is no compelling rationale at present for undertaking the mission other than prestige and bragging rights, which is not a sustainable reason. Third, the costs of such an endeavor may well be in the one-trillion-dollar range, and no private sector activity will pursue this end without an enormous capability for return on investment. As yet, the profit motive does not energize companies to pursue this objective.

As this chapter notes, there are five principal reasons for flying in space. National security is first, followed by a scientific enterprise. The third is capitalism – can you make a buck undertaking these space activities? The fourth is geopolitics, the creation of prestige aboard and pride at home. The last reason is human destiny, or "because it's there." Astronauts love to talk about how it is human nature to explore, to climb the highest mountain, and at some level, that is probably true. Elon Musk points to both adventure and self-preservation as his motivating factors. He unveiled a Mars plan in the fall of 2016 at the International Astronautical Federation, with the objective of minimizing risk, carrying forward human consciousness, and building a sense of adventure. Yet, these are not sustainable rationales for Mars exploration because of the costs involved. Indeed, in the two years since Musk gave this speech not a single technological advance has been registered that would make a human Mars mission more probable.

CONCLUSION

The combination of technological and scientific advancement, political competition with the Soviet Union, and changes in popular opinion about spaceflight came together in a focused way in the 1950s to affect public policy in favor of an aggressive space program. This found tangible expression in efforts of the 1950s and 1960s to move forward with a Moon landing and the budgets necessary to support it. After that initial effort, space exploration reached equilibrium in the 1970s that it has been sustained through to the present. The American public is committed to a measured program that includes a modest level of human and robotic missions, Earth science activities, and technology development efforts. A longstanding fascination with discovery and investigation has nourished much of the interest by the peoples of the United States in spaceflight. As the twenty-first-century progresses, however, support for human space exploration is soft and perhaps it will collapse in the coming years. George W. Bush's plan to return the Moon between 2015 and 2020 proved stillborn, and it may well be that Donald Trumps' recent advocacy of human missions to Mars will also fail. Of course, with sufficient diligence and resources virtually anything humans can imagine in spaceflight may be achieved, including space tourism, but there is a reason to question whether sufficient diligence nor resources will be available for this initiative.

Chapter 2

HISTORY OF SPACE TOURISM

Carl Cater
Swansea University, UK

Abstract: This chapter examines the historical development of space tourism from early wondering at the heavens to more recent extraterrestrial astrotourism. It catalogs the development of the significant terrestrial space tourism market, including dark-sky tourism, launch tours, zero-G flights, and edutainment experiences, as part of a "steps to space" for costlier future developments in space tourism. Recent developments in the suborbital sector initiated by the XPRIZE and spearheaded by Virgin Galactic are the next stage in this product ladder. All these draw on a rich history of space exploration – imagined, virtual, and real – that frames how future developments in space tourism can be viewed. **Keywords**: Astrotourism; space tourism; history; motivations

INTRODUCTION

In April 2001 American billionaire Dennis Tito became the first space tourist to realize the dream of being able to take a holiday in space. Tito paid a reported US $20 million to the Russian space agency for a week-long visit to the International Space Station (ISS) and was the first person to part with his own money in order to experience what exists beyond the confines of the Earth, in doing so becoming the world's first "astrotourist"

Space Tourism: The Elusive Dream
Tourism Social Science Series, Volume 25, 51–66

ISSN: 1571-5043/doi:10.1108/S1571-504320190000025003

(Cater, 2010). To date, six others, Mark Shuttleworth, Greg Olsen, Anousheh Ansari, Richard Garriott, Charles Simonyi, and Guy Laliberté, have followed in Tito's steps, with Simonyi conducting a repeat trip in 2009. While providing some cash flow to the Russian space agency over this time, these trips are most significant in heralding the opening of a new touristic frontier. It is interesting to observe that space tourism agencies and advocacy organizations are keen to promote terms such as "private space explorers" and "personal space flight participants" for these individuals, and yet academics and the media recognize that these activities are inherently touristic.

However, while the realization of space tourism, in terms of being able to voluntarily leave the Earth, is relatively recent, its origins are much older. Indeed, as Tcharfas notes, the articulation of space tourism was to some extent pre-ordained, for:

> in many ways [Tito] took his place in space history after it had already been imagined and defined, first by centuries of speculation and visionary science and finally in the introduction of commercial space enterprises of the new millennium. (2015, p. 5)

The desire to connect with what lies beyond the Earth dates back to the early planetary science of Galileo, or perhaps even earlier. While scientific knowledge of the heavens was at its initial stage, one can argue that early Greek astronomy, more than 2,000 years ago, or even Aboriginal dreamtime stories about the stars, which may be up to 60,000 years old, imbue a sense of wonder that is the foundation for space tourism today. Indeed, one might venture to suggest that without early space-related tourism, the British colonization of Australia might never have occurred. One of Captain Cook's main purposes on his first voyage to the South Pacific was to observe the transit of Venus across the Sun from Tahiti on June 3, 1769 (Edwards, 2003), forever linking terrestrial exploration with that of the heavens. Thus, the path to space tourism should be seen as incremental over decades or even centuries, rather than an overnight revolution (Cater, 2010). Indeed, companies working in the space tourism market promote a "steps to space," which includes a range of terrestrial and airborne pursuits while the opportunities for genuine astrotourism develop.

Therefore, to understand contemporary developments and potential markets, we should briefly examine the history of space tourism, both real and imagined. Historical perspectives on tourism are frequently used as a lens for understanding contemporary and future developments. A degree of path dependency means that the paths we chose in the past can determine where we are going in the future. Of course, one of the major issues with space tourism is its associations with fantasy and imaginary (see Chapters 3−5), as well as a history of broken promises. Thus, the potential for space tourism has attracted a degree of interest for many years but has mostly been confined to conjecture. Indeed, much of this discussion has been cyclical, related to significant developments in technology or high-profile events such as the Moon landings. The academic enquiry has been similarly recurrent, with a number of chapters over the years reporting on events and future suggestions (Ashford, 1990). However, developments in recent years hint more strongly than ever at the potential for a viable tourism industry focused on this market. As a result, there has been a more sustained academic interest in space tourism as shown by this volume and work by many others (Crouch, 2001; Crouch, Devinney, Louviere, & Islam, 2009; Laing & Crouch, 2004, 2005; Smith, 2000, 2001).

This chapter suggests that contemporary developments in extraterrestrial tourism are actually just an extension of the basic human desire to explore, which often finds its expression in tourism. However, in order to have a frontier, there has to be a foundation, which for the purposes of this discussion is terrestrial space tourism. There is a significant sector of the tourism industry that is already focused on the development of space products. Despite this, this has received remarkably limited critical examination to date. Nevertheless, as previous work has shown (Cater, 2010), the fledgling space tourism market is quick to recognize that there is a travel career ladder present that can be harnessed for potential development.

TERRESTRIAL SPACE TOURISM

The Space Tourism Society, a US-based non-profit promotion organization, defines space tourism as consisting of four different areas: "in earth-orbit experiences; beyond earth orbit (such as lunar and Mars) experiences; earth-based simulations, tours and entertainment experiences; and cyber space tourism experiences" (2007, n.p.). Somewhat ironically, there seems to have been far more attention directed toward the potential for the former, rather than the actual state of the latter two. Although the former undeniably attract a great deal of public interest, the latter have been in existence for a number of years as an established tourism product (Crouch, 2001). Consequently, this chapter seeks to recognize that space tourism has been around for a significant period and that this foundation is essential for future innovations.

There are many Earth-based space tourism experiences that have been on offer for many years, ranging from the multitude of observatories and planetariums to more entertainment-oriented facilities. Examples of the former include the Parkes Dish in New South Wales, Australia (Spennemann & Kosmer, 2005), or Manu Kea observatory in Hawaii. Examples of the latter include the National Space Centre opened in 2001 in Leicester, the United Kingdom, which was developed with Millennium commission funding, and had hosted one million visitors by 2005 (National Space Centre, 2007). On Australia's Gold Coast, a destination famed for its sun, surf, and sand, tourists could escape to the "Spacewalker" attraction, just a block back from the beach. Opened in 2004, the edutainment-based facility soon became a popular tourist site.

The most popular terrestrial space tourism facility presently in existence is the visitor center at Kennedy Space Centre (KSC), Cape Canaveral, Florida (Figure 1). In addition to being a working space facility, it is a relatively mature tourism attraction, having been in existence since 1967 and hosting 1.5 million visitors a year (KSC, 2018). The center has been run by Delaware North since 1995, a major hospitality and visitor management company which operates a number of stadiums and parks worldwide. One

Figure 1. Space Tourism, Kennedy Space Center

of the major challenges that the center faces is how to position itself in a region that is a major mass tourism destination. Being less than an hour from Orlando, home to many major theme parks, KSC competes for attention with them, while simultaneously relying on the destination to provide many of its visitors. Notably, the tagline used by KSV to attract visitors its website is:

> Kennedy Space Center Visitor Complex is where rockets launch and inspiration begins at Florida's gateway to space. Located one small step from Orlando, arrive early for a full-day experience at the greatest space adventure on Earth. (2018, n.p.)

The operators also find challenge in straddling the line between education and entertainment, which is seen as a potential line of friction between NASA's wish for the center to have an educational mission and the operation of the facility as an entertainment attraction (Cater, 2010). As a busy spaceport, launches of rockets are definite drawcards, and a variety of extra products and promotions were organized around these events (e.g., the opportunity to meet an astronaut). KSC is also a Wildlife Refuge and home to more than 500 species of animals and birds, including alligators, bobcat, dolphins, otter, sea turtles, and pelicans. It shelters no less than 21 federal- and state-listed endangered and threatened species, such as manatees and bald eagles (US Fish & Wildlife Service, 2007). The opportunity to conduct ecotourism tours on the complex is a recent development building on this resource. KSC is also looking at capitalizing on its reputation as the destination for space tourism and developing a range of active products along the lines of zero-gravity and potentially suborbital flights.

Terrestrial space tourism is not limited to fixed facilities, as in addition to these space tourism sites there are a host of other space-related tourism pursuits ranging from eclipse tours, Unidentified Flying Object (UFO) pilgrimages, and even meteorite collecting in Antarctica (see also Chapter 5 for discussion of virtual reality and space tourism). In Central Australia outback tourists can enter a meteorite impact crater Tnorala/Gosse Bluff, which has spiritual significance for the local Aboriginal population (Figure 2). The town of Roswell, New Mexico, located near the infamous "Area 51" and supposed crash site of a UFO in 1947 (see also Chapter 3) has an International UFO Museum and Research Center devoted to the incident and to research on the subject. The annual Roswell International UFO Festival brings visitors from all over the world.

Figure 2. Tnorala/Gosse Bluff, a Meteorite Impact Crater (© Tiffany Low)

In recent years, there has also been significant development of dark-sky tourism. Developed to acknowledge the significant incursion of light pollution on night skies, particularly in urban areas, locations have been designated as places where a "natural" night sky is still visible. The International Dark-Sky Association was set up in 1988 and certifies parks and reserves under five categorizations:

> International Dark Sky Communities, "cities and towns that adopt quality outdoor lighting ordinances and undertake efforts to educate residents about the importance of dark skies"; International Dark Sky Parks, "publicly- or privately-owned spaces protected for natural conservation that implement good outdoor lighting and provide dark sky programs for visitors"; International Dark Sky Reserves, which "consist of a dark 'core' zone surrounded by a populated periphery where policy controls are enacted to protect the darkness of the core"; International Dark Sky Sanctuaries, which are "the most remote (and often darkest) places in the world whose conservation state is most fragile"; and Dark Sky Developments of Distinction, for areas that recognize the importance of dark skies but do not fit the other categories. (2018, n.p.)

Many of the more extreme terrestrial space tourism activities are coordinated by specialized tourism agents, such as the US-based Space Adventures, which has organized all of the commercial trips to the ISS to date. Although this is undeniably the premium end of their product portfolio, a significant part of their business came from both terrestrial space tourism and activities like trips in high-altitude military aircraft and zero-gravity parabolic flights in specially converted airplanes. In 2003, the UK representatives for Space Adventures were the Bristol, UK-based Wild Wings, originally established as a specialized tourism agent for bird-watching tours. Interestingly, since this agent is involved heavily with various other forms of special interest tourism, such as ecotourism and adventure tourism, space tourism can be theoretically positioned as a natural extension of these niches.

There has been significant debate surrounding the definition of space tourism, although this has not taken place within the literature, with the majority of definitions emerging from a number of space advocacy organizations based in the United States, such as the Space Frontier Foundation, the Space Tourism Society, and the private corporations that are now developing this frontier. Although it is important to acknowledge industry debates, academics need to remain critical about their origins, particularly given the forceful anti-regulation discourse used by some of these organizations believing that "free markets and free enterprise will become an unstoppable force in the irreversible settlement of this new frontier" (Space Frontier Foundation, 2009, n.p.). In line with Cater (2010), this chapter adopts the classification of space tourism for the broad industry sector and reserve astrotourism for that which truly escapes the confines of this world (Table 1). Such a semantic distinction helps to differ between historical and future directions in the field. This distinction is founded within accepted terminology used in aeronautics; in the 1950s, the *Fédération Aéronautique Internationale* designated the so-called Karman line as being the edge of space at an altitude of 100 kilometers (FAI, 2004). Although this designation has not been without some scientific and legal controversy, from the 1960s onward those that have traveled beyond this threshold have been deemed astronauts, and it is logical that the current recreationalists to outer space should be dubbed astrotourists.

Twentieth-century Space Exploration

Genuine human space exploration that took place in the postwar era was a watershed in demonstrating that human spaceflight was finally possible. The

Table 1. A Historical Typology of Space Tourism

	Location		Type	Examples and Dates
Space tourism	Astrotourism	Beyond Earth orbit	Lunar and Martian voyages	Not yet available (but see SpaceX/Mars One)
		In Earth orbit	Orbital flights (350km)	Trips to ISS (2001–)
			Suborbital flights (100km)	Virgin Galactic (2020?)
	Atmospheric space tourism		High-altitude jet flights (20km)	MIG flights (Incredible Adventures, Russia, 1994–)
			Parabolic weightless flights	Zero-G corporation (1993–)
	Terrestrial space tourism	Specific space tourism sites	Simulations	Space shuttle launch simulator (Kennedy Space Center, 2007–)
			Tours of space facilities	Kennedy Space Center (Florida, USA, 1967–)
			Edutainment	Spacewalker (Gold Coast, Australia 2004–) National Space Centre (Leicester, UK, 2001–)
		Non-site-specific space tourism	Space tourism-related tourism	Eclipse tours (1768–), Meteorite collecting, stargazing tours
			Cyber space tourism experiences	Virtual space tourism and gaming environments
			Popular culture	Space movies-related tourism (e.g., *Tunisia/Star Wars*, 1977–)

Source: Adapted from Cater (2010).

1960s is remembered as a golden decade, starting with Yuri Gagarin completing the first manned orbital spaceflight on April 12, 1961, and the first Moon landing by the crew of Apollo 11 on July 20, 1969. This period heralded an era of significant public interest in space and the possibility of space tourism. It is no coincidence that the youth of 1969 are now the multimillionaires that can realistically fulfill their dream of seeing the Earth from space (Spennemann, 2007), a topic further explored in the 2009 documentary *Orphans of Apollo*. As Cosgrove (2001) has shown, NASA's Moon program was enormously important in creating a new awareness of the Earth for its human inhabitants. Most notable was the impact that images of our planet had on the environmental movement, but these images are also ingrained into the consciousness of those who aspire to experience that view. Of course, this romantic notion of the Earth from space is not one that is employed neutrally or solely by the environmental movement. Images of the globe are frequently turned into a metaphor for the power, coverage, and scope of corporate reach, and it is the migration of private finance into orbit that may prove to have the most significant impact on astrotourism.

The 1970s saw a period of preparation for the advent of space tourism. For example, in the early years of the decade, Pan Am had almost 100,000 people sign up on a space flight waiting list (BBC, 2006). This popularity coincided with a boom in portrayals of what life in space might be like. Thus, the influence of popular culture and the media on our aspirations for extraterrestrial experiences cannot be separated from the reality. Tcharfas shows how:

> the image of the space-age interstellar traveler was already drawing on a long lineage of civilian explorers in speculative science fiction literature and film at the turn of the twentieth century. (2014, p. 4)

Science fiction clearly has a part in all of this, whether print or celluloid, as images of life beyond our planet from movies such as *2001: A Space Odyssey* to *Star Trek* have glamorized the role of space explorers in the public imagination (see also Chapter 4).

In keeping with 1960s popular culture, the space-faring passengers in *2001* travel in comfortable and luxurious Pan American Airways' spaceships and stay in space hotels run by the Hilton Corporation. These images are so ingrained in childhood (and needless to say adult) imaginations that their impact goes beyond their basic form, and the circuit of culture reinforces their place in our desires.

What is especially interesting is the way that serious architectural designs for the first space hotels (Newbery, 1997) bear remarkable similarities to those suggested in sci-fi films (e.g., *2001: A Space Odyssey*), which might be a future case of reality-imitating fiction. Nevertheless, as Laing and Crouch (2004) have suggested, there is also the potential for conflict here as the romance of extraterrestrial exploration presented in these films may be at odds with the "boredom" of reality (see Chapter 3).

One of the perennial problems of space exploration has been the waste that goes into each excursion. The ethos of the 1960s "Space Race" was to waste anything but time, so the solutions and the culture that has influenced space exploration to date created a profligacy that could only be maintained by the most powerful governments of the time. This partly changed in the 1980s with the introduction of the Space Shuttle, the first serious attempt to introduce a degree of reusability into space vehicles. As Woods has noted, NASA's Space Shuttle "promised technology that would precipitate a revolution akin to those thought to have been engendered by the ship, the train, and the aeroplane" (2009, n.p.). This new infrastructure would open the door for investors, entrepreneurs, and potentially the general public, deeming it "the next logical step in space" (Tcharfas, 2015, p. 8).

Indeed, the Space Shuttle reignited enthusiasm for space tourism. NASA was looking toward:

> flying a very large number of shuttle missions each year, as we then envisaged it would then be possible to begin the process of inviting people in to apply, non-professional astronauts to go through a little bit of training and we would put them into space. (BBC, 2006; n.p.)

In 1985 another private company, Society Expeditions, was taking reservations for an orbital flight in 1992 (BBC, 2006). Privatization of space exploration was further encouraged by President Reagan's reforms to NASA in 1984 and introduction of the Commercial Space Launch Act which "called on the private commercial sector to begin competing in the space market, developing an independent industry for rocket technologies, launch pads and space enterprises" (Tcharfas, 2015, p. 10). However, all these dreams ended on January 28, 1986, when the shuttle Challenger exploded shortly after the takeoff. A high-school teacher Christy McAuliffe was killed along with the other members of her crew. NASA immediately suspended commercial and collaborative ventures, and the opportunities for space tourism seemed further than ever.

However, in the 1990s, as the Soviet space program looked for transition from centralized state planning to a capitalist system, opportunities for partnerships with other governments and companies became possible. This was not limited to scientific endeavors, as in 1999 Pizza Hut arranged to paint a 30-foot logo on a Russian rocket. It is important to note that along with commodification of the space experience comes increased commodification of space itself. Although technically nobody can own space (see Chapter 8), there are many commercial ventures that are tantamount to doing so. Thus, the commodification cycle of big business becoming involved with such high-profile and iconic ventures, and the linked consumer aspirations, will be an important factor in the emerging astrotourism sector. Indeed, of related interest, are plans for space station visits which have been based around commercial sponsorship.

One of the "new" agencies that emerged was called Mircorp, which worked closely with Energia, the former Russian space organization. In 1999, MirCorp and Energia began to develop a commercial platform as a last resort to save the ageing Mir space station, and it was MirCorp that initially brokered Tito's trip with Energia in the year 2000. Ultimately, the mission was finalized through Space Adventures, aboard the ISS, but MirCorp "played an important role in initiating and defining the precedent for the journey" (Tcharfas, 2015, p. 11). In order to undertake a visit to the ISS, an individual must also undergo significant training, taking up to six months (Space Adventures, 2018). As well as being a major commitment, it is likely that this requirement also fuels the intellectual and physical needs of participants. Indeed, Richard Garriott "felt fulfilled even before he rocketed away, thanks to all the training he got with astronauts and other space professionals" (Associated Press, 2008; n.p.). There is also evidence that these individuals try to make their folly look like "more than just a holiday" (Mowforth & Munt, 1998, p. 146). For example, Mark Shuttleworth undertook basic science projects while visiting the International Space Station.

The XPRIZE

Looking to the future, one of the most significant hopes for more affordable astrotourism lies in the suborbital market. In 1996 a competition was set up by Peter Diamantis called the XPRIZE, a $10 million reward to the first private company to build a craft capable of carrying passengers to a height of 100 kilometers (the boundary of "space" identified above) and being able to repeat the trip within two weeks. The scheme was modeled on the $25,000 prize awarded to Charles Lindbergh and his airplane, the *Spirit of St Louis*, for the first nonstop crossing of the Atlantic in 1927. This endeavor formed the basis for the modern air transport sector: prior to his feat aviation was largely seen as a risky military attempt and only occasionally useful for transport of mail and goods, despite having been in existence for over 20 years:

> Lindbergh completely changed the mindset of the world with regard to aviation. Aviation went from something very much like space is today—something that's expensive and difficult—to something that was exciting, with great potential, that a 25-year old from New York could do. (Hall, 2001, p. 19)

Diamantis' goal was to encourage entrepreneurial developments in space tourism using this model. He was of the opinion that only small private companies would have the appetite for risk and desire to find a cost-effective solution to the problem of space access. In June 2004, a craft designed by Burt Rutan (a California-based aircraft designer) completed the challenge and won the prize. Looking suitably futuristic, the vessel, *SpaceShipOne*, relied on a mothership to carry it to a height of 50,000 feet where it was released and ignited a rubber-nitrous oxide propellant to boost it to the edge of space. At the top of the climb, the craft's wing feathered much like a shuttlecock, slowing the descent and glide to the Earth.

Following the successful launch, Richard Branson partnered with the company to produce a craft capable of performing the same feat for commercial passengers under his Virgin Galactic brand. This vehicle proposes to take tourists to at least 110 kilometers in altitude, enabling a view of the Earth's curvature and several minutes of weightlessness. By comparison, passenger jets cruise at an altitude of about 10 kilometers. Despite an industrial accident at the Rutan fueling test stand in 2007, which killed three (Reuters, 2007), the company commenced an extensive program of flight testing. In 2014, the first of these spaceplanes, VSS Enterprise, broke up during a test flight over the Mojave Desert, killing one pilot and seriously injuring another. The National Transportation Safety Board conducted an independent investigation into the accident. In July 2015, the board released a report which cited inadequate design safeguards, poor pilot training, lack of rigorous federal oversight and a potentially anxious co-pilot without recent flight experience as important factors in the crash. The board determined that the crash resulted from the pilot's premature deployment of the feathering mechanism (NTSB, 2015). A replacement ship, VSS unity, began powered flight testing on April 5, 2018. A number of other previous XPRIZE entrants are still developing similar ventures but are unlikely to have the initial exposure of the Virgin developments.

Over the past decade, Virgin has been taking bookings for the first commercial flights, at a "fare" of $200,000. Offering three levels of booking, 300 people have made reservations and the company has taken over $40 million in deposits, while an additional 85,000 persons have registered their interest. Virgin has also developed a purpose-built $200m spaceport on a 27-square mile site in New Mexico to serve as a base for these flights. It is not without consideration of the influences discussed above (e.g., Cosgrove, 2001) that the logo for the company and, indeed, grandiose plans for the aerial view of the site were designed around an image representing the human iris (Virgin Galactic, 2018). These developments have captured a similar level of media and promotional interest in orbital experiences. A number of other destinations globally have recognized the potential for suborbital space tourism. For example, there have been discussions about using former Royal Air Force bases in Scotland, a Spaceport in Sweden, and a space-centric entertainment sector in the Kingdom of Saudi Arabia. Of course, the short duration of the suborbital product might require some reworking of the tourism definition, as most traditional definitions specify an overnight stay. However, as the experience is likely to include training and ancillary activities, with the flight being just the highlight, one can envisage its touristic dimensions being made up of the whole package, not just the suborbital trip.

Future History

The opportunity for private individuals to travel to space in the Soyuz rocket ended in 2009 with changes to the crew pattern of the ISS. However, the most promising recent historical developments for space tourism have been achieved by private development of space launch technology. The company SpaceX, founded by entrepreneur Elon Musk in 2002, has been developing a significant private space takeoff capability since launching the first privately funded liquid-fueled rocket to reach orbit in 2008. Based on a series of rockets called Falcon, SpaceX has been able to launch payloads to the international space station, put satellites into orbit and even put one of Musk's Tesla electric cars into space. SpaceX has also developed significant reusability, recovering rockets for future use, which has significantly lowered costs. SpaceX costs are significantly cheaper than the existing government-led space agencies and have proved popular with a number of commercial clients. In 2017, SpaceX completed 18 successful rocket launches, and in 2018 had 30 launches on the manifest. In 2017, SpaceX was awarded a $2.6 billion contract to develop its Dragon capsule to carry astronauts to the ISS. When this is operational, there will be a private vehicle available to carry humans into orbit. Musk has made no secret of his ambitions to develop space exploration further, planning a private Moon mission and setting his sights on Mars.

It is highly likely that such developments may have impacts beyond that of simply new tourism activity (Ashford, 2007). If further development of vehicles takes place, long-distance global tourism today may seem long-winded, and the historical progression of a "shrinking world" will continue. Thrift (1990, p. 470), for example, discusses how the adoption of railways in Great Britain altered the time-space of the nation. In 1845 barely half of the island could be reached in a full day's travel from London, but by 1910 only the far north of Scotland was beyond this. Similarly, there was a big change when aircraft emerged as vehicles that could realistically transport people vast distances. Although today many people view most air travel as a chore on the way to the real holiday, it is clear that in the 1930s, flying was as much a part of the travel adventure as the destination:

> In a trip from Amsterdam to Jakarta the aircraft touched down over 24 times in 12 days: Passengers prepared as they would for a cruise: women were advised to pack jumpers and tweeds, a leather coat and a fur, a felt hat, gumboots for wet aerodromes, a black lace evening dress and a Shetland dressing gown. The trip combined adventure and […] luxury […] although some stops were primitive. (Feifer, 1985, p. 221)

The highlight of trips to Africa was the bird's-eye view of the game wandering the savannah that one could experience on the way (Feifer, 1985). Certainly, in the 1930s, in common with space tourism these days, air travel was both highly time-consuming and expensive, and confined to the elite, so contemporary developments in space tourism may be viewed as being parallel to the early days of commercial aviation.

Furthermore, there are the technological spin-offs, and their consequent uptake, which are associated with such endeavor. As Thrift (1990) points out, the railways also facilitated the uptake of the typewriter, the telephone, and early cinema. In the same way, cheaper access to space would likely spin off a range of other technologies, as did early NASA missions, such as new metal alloys, and early computers. As Laing and Crouch (2004) suggest, technological progress is undoubtedly important in the development of space tourism, but one should not succumb to "technological determinism" which would see "travel as merely derived demand" (Lash & Urry, 1994, p. 253). Of course, the developments in suborbital tourism are a long way off the thresholds of power required for private orbital tourism, but Lash and Urry (1994) highlight organizational innovations as key to the success of technological advances. As part of this, the "nature of future legal and regulatory requirements for the industry, which are not inimical to viable businesses and commercial investment, as well as public support and confidence in a fledgling space tourism industry" (Laing & Crouch, 2004, p. 79) will be vitally important. The regulatory context and such bills as the US Commercial Space Act of 2003, which opened up the opportunities for suborbital development, are thus central to future development (Library of Congress, 2003; see also Chapter 8).

It is also apparent that the history of space exploration should itself be protected. For example, Spennemann (2007) acknowledges the importance of considering heritage preservation on the Moon before it is too late to do so. This argument draws on a wider discussion about space heritage preservation and the impacts of space tourism among archeologists and professionals over the last decade or so (Barclay & Brooks, 2002; Rogers, 2004; Spennemann & Kosmer, 2005). It is thus important to acknowledge the contributions made to this subject by the wider archeological community and the need for the tourism industry to be aware of these concerns. However, the principal point is that bringing tourism into space will have the effect of creating a dual purpose for development, both tourism and research, which, despite some challenges, will rely on and spin off one another.

CONCLUSION

This chapter's primary purpose has been to demonstrate the extent of historical developments in the space tourism market, most notably the development of extraterrestrial astrotourism. It joins a growing body of academic literature that recognizes that this phenomenon is no longer "out of this world" and is worthy of future study. It is undeniable that space tourism is maturing, both physically and in the legislative and organizational realm, evidenced by the chapters in this book. The present one advances beyond earlier embryonic descriptions to a better conceptualization of future space tourists as well as the industry itself. The implications for tourism are manifest, not only for the emergence of truly new destinations, but also for the considerable knock-on technologies that may be developed as a result. There are a number of ethical concerns that will also have to be answered in the coming years, particularly the appropriateness of such conspicuous consumption in a world of pressing problems (see Chapter 11). However, there are also those that argue that only by developing space can one hope to solve global problems such as those related to population pressure (Bernasconi & Bernasconi, 2004).

This chapter also addresses a lacuna in terms of research on terrestrial space tourism, which is flourishing as a result of some of the motivations shared by space tourists at all levels. Indeed, the space tourism sector, from mass-market terrestrial operations, including Kennedy Space Center, niche tours such as launch visits or eclipse tours, and specialized high-end operators like Virgin Galactic or SpaceX, recognize that they all exist because of a human desire to know what it is really like out there. Thus, the "Steps to Space" program initiated by Space Adventures is emblematic of a realization that this desire can be fulfilled on a variety of levels. Marketing literature clearly recognizes the importance of creating a relationship with the customer, and this stepwise approach is a useful tool. Although sharing similarities with Pearce's (1982) *Travel Career Ladder*, it is recognized that there may emerge individual economic and psychological barriers to space tourism. In addition, as previously mentioned, we must be aware of the uneven nature of this development, in favoring elites rather than the masses. Furthermore, it is likely that contemporary climate change concerns will force a careful examination of practices in this sector. As usual, operators are one step ahead, and the Virgin Galactic initiative promises to use the program to push forward developments in biofuels. Nevertheless, space tourism should not be seen as completely "out there" and treat it more as the natural progression of tourist practice that historically seeks new frontiers.

PART II
IMAGINARIES

This page intentionally left blank

Chapter 3

EXTRATERRESTRIAL LIFE, STELLAR CIVILIZATIONS, AND ALIENS

Erik Cohen
Hebrew University of Jerusalem, Israel

Abstract: Three myths of life on other celestial bodies are examined as potential motivators for space tourism. The historical myth of extraterrestrial planetary life was debunked by modern astronomy. The twentieth-century myth-like belief in the existence of stellar civilizations or extraterrestrial intelligence has engendered an extensive search for transmitted signals from such civilizations, but none have yet been detected. The post-modern myth of aliens visiting the Earth by unidentified flying objects, engendered new religious movements; however, it is silent about the aliens' stellar origins, while the new religions do not encourage adherents to visit the aliens' abodes. In the final analysis, none of the three myths offers an incentive for space travel and tourism. **Keywords**: cosmic myths; disenchantment; SETI; UFO religions; space tourism motivation

> [The alien] is a trope of ontological alterity, a way of our culture to come to terms with the radical otherness of the universe.
>
> – Gomel (2014, p. 6)

Space Tourism: The Elusive Dream
Tourism Social Science Series, Volume 25, 69–92

ISSN: 1571-5043/doi:10.1108/S1571-504320190000025004

INTRODUCTION

An existential question drives our contemplation and exploration of the cosmos: "Are we alone?" And if not, what are the other life-forms like? Can we establish contact with and access them in their abode? We do not presently know if there exists life elsewhere in the cosmos, nor, if it does, what it is like.

This question is closely associated with another one: What is our common human identity? The politolog Novoa asserts, "if cosmopolitanism is to be conceived as an identity, it lacks otherness." In his view, "cosmopolitanism, as a universal search for a common identity […] should be ventilated through Otherness," because "cosmopolitanism might only be possible […] when humankind is faced with life forms that are capable of providing true Otherness." Hence "the materialization [i.e. discovery] of extraterrestrial life matters, because it provides Otherness, allowing for the transcendence of cosmopolitanism." Novoa claims that "astrobiology is creating a great outer frontier of planet Earth […] astrobiology is the academic hunt for Otherness," which would provide the contrast against which humanity would be able to discover its identity as a whole. He concludes that "the astrobiological dream is the complete understanding of what we are so that we can discover what we are not, *out there*" (Novoa, 2016, n.p.), namely in the presence of the utter Otherness of the extraterrestrials.

The two complementary existential quests, to discover whether we are alone in the cosmos and to find an Other against which we could grasp our own identity, are powerful motives of the search for extraterrestrials. They also form the background against which human travel and tourism in space gain deeper meaning and raise the aspiration for authenticity (Cohen, 1988; MacCannell, 1973; Wang, 1999), an important motive for tourism on the Earth, unto a wider, cosmic level. For the individual traveler or tourist, an encounter with extraterrestrials would constitute a personal confirmation of the existence of other living beings, as well of their own human identity.

But we do not know if extraterrestrials exist and, if they do, what they are like and whether we will be able to contact them. Humans have speculated about the existence of life on other celestial bodies for a long time and have developed a rich imaginary of the abodes and characteristics of extraterrestrials. In this chapter, I shall therefore ask the question: How does the imagery of life on other celestial bodies affect their attractiveness for human space travel and space tourism? Specifically, I shall be concerned with three prominent myths to examine the historical permutations of the Western imaginary about extraterrestrials (or aliens): the myth of extraterrestrial life (in whatever form) on other worlds, and especially on the Moon and the planets in the solar system; the myth of advanced, intelligent stellar civilizations beyond the solar system; and the myth of aliens visiting the Earth from other celestial bodies. Against possible expectations, the examination of these myths will lead to the conclusion that neither of these myths, although for different reasons, has presently a significant potential to encourage space travel and space tourism.

EXTRATERRESTRIAL LIFE

It will be argued in this section that the (Western) cosmic imagery has in the modern period undergone a process of what Max Weber called *entzauberung* (disenchantment) (Jenkins, 2000; Weber, 2002[1904]). This process parallels in many ways the religious disenchantment of the world that constituted the principal theme of Weber's sociohistorical analysis: modern science, particularly astronomy, gradually debunked ancient myths of the existence of geomorphic (Earth-like) other worlds populated by anthropomorphic beings of all kinds.

The debate on the existence of extraterrestrial life on other celestial bodies has extended throughout Western history (Crowe, 2008; Dick, 1984). The issue has been discussed within the context of the theological, philosophical and scientific discourses, prevalent at various historical periods. The changing beliefs regarding different forms of extraterrestrial life have been extensively treated in the literature (Crowe, 1999, 2008; Dick, 1984, 1998, 2013). They will be discussed here only to support this section's principal argument, that our image of life on other celestial bodies, and specifically the Moon and the solar planets, has gradually been impoverished as scientific research presented a progressively bleaker picture of the conditions prevailing on them. This picture is offering the future space tourist much less attractive or hospitable stellar destinations than the picture that was offered to the past generations, at the very historical moment when technical progress made human travel to stellar bodies increasingly feasible.

Crowe notes that the "debate whether intelligent life exists elsewhere in the universe was already underway in Greek and Latin antiquity" (1997, p. 148). In ancient Greece, Democritus and the atomist philosophers, specifically Epicurus and Lucretius, believed in the existence of "innumerable words" (Crowe, 2008). The atomist Lucretius argued that there is no design to the cosmos; celestial bodies do not exist for the sake of their inhabitants;

they exist by chance (Beck, 1985, p. 4), an argument, which was resurrected by some mid-twentieth-century thinkers. The atomist philosophers, like Epicurus, claimed that "somewhere in space […] exist other universes comparable to our own—with an inhabited world, like the earth, at the center" (Crowe, 1997, p. 148), while the Pythagoreans believed specifically that "the moon is terraneous, inhabited as our earth is, and contains animals of a larger size and plants of a rarer beauty than our globe affords" (Crowe, 1999, p. 5).

However, the early Church Fathers, except for Origenes, rejected the idea of the existence of a plurality of worlds on the basis of theological principles (Crowe, 2008). The idea re-emerged at the dawn of the modern period with Nicholaus of Cusa (1401–1464), who advocated the existence of "a plurality of worlds," as well as of "life on the moon and sun" (Crowe, 1997, p. 149), and maintained that on "every [solar or stellar] region there are inhabitants" (Crowe, 1999, p. 3). Cusa, however, admitted that his speculations were groundless (Crowe, 1999).

The Copernican revolution was a crucial breaking point in humanity's view of the world and of its place in it. Geppert cites Freud on humankind's "cosmological mortification," as a result of the "humiliating decentering of the earth effected by Nicolaus Copernicus' heliocentric cosmology" (2012, p. 3). But the denial of centrality to the Earth, and hence humanity, in the cosmos made the existence of life elsewhere more plausible. The idea of life on other worlds consequently gained new popularity in the post-Copernican period. Dick notes that Copernicus' "heliocentric theory was critical for setting the stage for the discussion of other worlds;" it "provided the physical framework within which the existence of other earth-like worlds became possible" (2012, p. 1). The critical point is that Copernicus turned the Earth into a planet; this suggested that other planets might be earths and that they might be inhabited (Crowe, 2008).

Following the Copernican revolution, some thinkers proposed new theories regarding the existence of a plurality of worlds. However, rather than on observations, they based their claims on scholastic arguments, primarily on the principle of plenitude (Lovejoy, 1964), which postulates that:

> no genuine potentiality of being can remain unfulfilled, that the extent and the abundance of the creator must be as great as the possibility of existence and commensurate with the productive capacity of a "perfect" and inexhaustible Source, and that the world is better, the more things it contains. (Crowe, 2000; excerpts taken from chapter 3, n.p.)

It follows that "God must have placed human beings wherever conditions comparable to those on Earth existed" (excerpts from Crowe, 2000, chapter 3, n.p.). The Dominican friar and cosmologist Giordano Bruno (1548–1600) "populated the planets and stars" (Crowe, 1997, p. 159) in his cosmological theory; rather than from his observations, Bruno's ideas were based on his theological views regarding the infinite greatness of God (Michel, 1973); but astronomers at that time did not support Bruno's cosmological ideas about the plurality of worlds (Crowe, 1999, p. 11).

Following Galileo's (1564–1642) discoveries, interest in the possibility of extraterrestrial life surged again. Johannes Kepler (1571–1630), Galileo's contemporary, believed that Jupiter is inhabited and presented arguments for life on the moon (Crowe, 1999, pp. 10–11). The astronomer Christiaan Huygens (1629–1695) populated the planets with inhabitants similar to us (Crowe, 1999, p. 20). In the eighteenth century, Bernard le Bovier de Fontenelle (1657–1757) published a highly popular literary work, *Entretiens sur la pluralité des mondes* (Conversations on the plurality of worlds), in which he combined science and fiction, and asserted that "life existed on the moon as well as on thousands of other worlds" (Fara, 2004, p. 146). Fontenelle described Venusians as "little black people [...] very amorous" and Jupitereans as "flegmatic and grave," but did not surmise that they are human (Crowe, 1999, p. 19).

The emergence of the Enlightenment world view, concisely conceived by the German sociologist and theologian Ernst Troeltsch (1865–1923) as a passage from a supernaturalistic-mystical-authoritative to a naturalistic-scientific-individualistic type of thinking (Crowe, 2008), dispensed with mythological speculations and supported rationalist thought. But in astronomy, as in some other cultural domains, the passage conceived by Troeltsch was not abrupt, but only gradual.

Religious ideas continued to influence the approach to the issue of extraterrestrial life of eighteenth-century Enlightenment thinkers. Crowe (2008) asserted that "although some Enlightenment figures analyzed the issue of extraterrestrial life in [...] scientific terms, the majority were heavily influenced [...] by religious or metaphysical suppositions" (excerpts from Crowe, 2008, chapter 8, n.p.). Thus, the theologian Thomas Burnet (1635–1715) declared "that there are more orders and degrees of Intellectual beings betwixt us and the Almighty, than there are kinds or species of living Creatures upon the face of the Earth" (Fara, 2004, p. 152), in fact imagining a hierarchy of extraterrestrial beings paralleling the angelic ones in the Great Chain of Being.

Fara pointed out that even by mid-eighteenth century, "natural philosophy and theology were inseparably tied together in discussions of other worlds," and that "the boundaries between theology and natural philosophy, between imaginary and factual travel narratives [...] were far more fluid then they are today" (2004, p. 149). Though neither Descartes nor Newton explicitly endorsed the idea of inhabited planets or of' a plurality of worlds, their followers did. Several of Descartes' followers inferred, using Cartesian arguments, that some planets might be inhabited. Newtonian natural theologians "made belief in intelligent extraterrestrial life an orthodox component of Newtonianism. Natural theologians enthusiastically taught that God could be glorified by praising the size and population of His universe" (Fara, 2004, p. 143).

But the eighteenth century also saw fundamental conceptual changes in astronomy. In 1750, Thomas Wright (1711–1786) published a theory of the universe, considered to be "the founding text of a scientific approach to the stars that culminated in the 1920s." Though most astronomers of the time paid it little attention, Wright's work became the basis of modern approaches to the cosmos (Fara, 2004, pp. 144, 148). In the course of the following half-century 1750–1800, astronomy was gradually transformed from a science of the solar system to a science of the Universe (Crowe, 2008). As "theological hypothesis gradually became converted into scientific certainty, there was a general shift in authority away from the Bible towards natural philosophy" (Fara, 2004, p. 156).

But that shift, influenced by the rapidly increasing astronomical discoveries, did not erase the belief in the existence of life on other planets; rather, "as telescopes revealed more and more stars, which might too be suns with their own orbiting planets, many writers assumed that these other worlds must be inhabited" (Fara, 2004, p. 149). According to Crowe, "by the 1770s, the extraterrestrials had attained a level of acceptance, even among eminent astronomers, that probably exceeds what they now have" (2011, p. 171). By the mid-eighteenth century, "the existence of inhabited planets was a standard tenet of Newtonian natural theology" (Fara, 2004, p. 146), and even the Moon and the Sun (Crowe, 2011) were believed to be inhabited.

The poet Thomas Gray (1716–1771) "argued by analogy that as well as its own clouds, mountains and rainbows, the Moon must also have men who farmed, built and fought" (Fara, 2004, p. 155). While the German astronomer J. E. Bode (1747–1826) in 1776 described the sun in geomorphic terms, as a "dark planetary body which as our earth consists of land and water [...] exhibiting on its surface all the unevenness of mountains and valleys and also surrounded [...] by a thick atmosphere" (Bode, 1776; cited in Crowe, 2011, p. 171), and proclaimed that it is populated by creatures and rational inhabitants, the most prominent astronomer of the eighteenth century, Sir William Herschel, believed that the Sun is probably inhabited and that clusters of stars which he observed were in fact lucid planets inhabited by extraterrestrials (Crowe, 2011, p. 172).

Fara points out that "the principle of uniformity [of nature] required life elsewhere to resemble that on Earth" (p. 152). Accordingly, "by the end of the [eighteenth] century many people were convinced that human beings are not alone in the universe." Some believed that quasi-terrestrial creatures were found on other planets with the right temperature (Fara, 2004, pp. 154, 152). The astronomer Christiaan Huygens (1629–1695) assumed that the inhabitants of Saturn and Jupiter "would need hands and feet, although they might be much larger than us and covered in fur" (Fara, 2004, p. 152), while the philosopher Christian Wolff (1679–1754) calculated the height of inhabitants of Jupiter (Crowe, 2008). But some other commentators did not commit to "what the inhabitants of other worlds might look like, although they were [...] assumed to be intelligent" (Fara, 2004, p. 152).

Immanuel Kant (1724–1804) and other thinkers, influenced by the discovery that stars are suns, deduced that they are also possibly surrounded by inhabitable planets (Crowe, 2008). Kant was "enthusiastic about extraterrestrial life ideas" (Crowe, 1999, p. 48) and formulated "his own theory of multiple worlds" (Fara, 2004, p. 148). He perceived the Heavens as a "densely denizened domain where millions of inhabited planets orbited suns in an endless hierarchy of systems" and believed that most solar planets were inhabited. Kant inferred on the planets' inhabitants according to the type of matter the planets consisted of and their distance from the Sun. He perceived the Mercurians and Venusians as dullards, the Earthlings as on the middle rung, and the Jovians and Saturnians as greatly superior beings. In later writings, Kant described extraterrestrials as similar to man (Crowe, 1999, pp. 55, 53). Szendy says that "Kant even went so far as to propose a kind of comparative theory of classification of these beings living on other planets, more or less a rational *alienology*" (2013, p. 5).

The steadily growing astronomic discoveries raised profound new problems in Christian theology; they made it "hard to reconcile the existence of multiple inhabited worlds with the Christian belief that God had singled out the human race for special attention." The realization that "the Earth [is] just one among many [worlds], [also] raised thorny questions about the special nature of Christ which implies that the Earth is singular", and fostered attempts to "make pluralism consistent with Christianity" (Fara, 2004, pp. 144, 151).

But cosmological theories gradually separated from Christian theology. Thus Kant, taking a deistic position, "tried to reconcile his Newtonian physical theories with a non-Newtonian version of god, one who never intervened in the universe after the Creation" (Fara, 2004, p. 148), thereby implicitly confirming the autonomy of astronomy from theological speculations. While the thinker and revolutionary Thomas Paine (1737–1809):

> called on science to support his anti-Christian position, stating that Newtonian astronomy made it probable that God had created other worlds, but stressed that He had not singled out Earth for special attention. God's many millions of other intelligent beings […] enjoy the same benefits as us and also know the same science as us. (Fara, 2004, p. 151)

The separation of astronomy from theology culminated in the work of the astronomer William Herschel (1738–1822) who:

> Developed a complete cosmology that included inhabited planets, but […] relied on physical rather than theological arguments, and distinguished himself from "fanciful poets […] making the sun the abode of blessed spirits […] [or] a fit place for the punishment of the wicked". (Fara, 2004, p. 156)

By 1800, "the extraterrestrials had made more inroads on the human intellect than at any time before – or perhaps since" (excerpts from Conclusins, Crowe, 2008; n.p.). In the early nineteenth century, the astronomer Thomas Dick (1774–1857) prepared "a population table […] for all known objects in our Solar System except the sun" and even "determined that every planet and asteroid […] had a greater population than the Earth" (Crowe, 2011, p. 173). By the mid-nineteenth century, William Huggins (1824–1910), the pioneer of spectroscopy, published a chapter (with W. A. Miller), asserting that "at least the bright stars are, like our sun, upholding and energizing centres of systems of world adapted to be the abode of living beings" (Crowe, 2008; excerpts from chapter 12, n.p.). Even by the early twentieth century:

> the idea of a universe filled with life was [still] widely accepted, completely unproven, and heavily burdened with a long and checkered history that finally held the promise of more successful scientific scrutiny. (Dick, 2013, p. 13)

But this scrutiny did not eventuate in the expected confirmation of this idea.

The disenchantment of the celestial bodies in the solar system had already commenced in the course of the nineteenth century. With scientific developments, such as spectroscopy and the general progress in physics and astronomy, "various critiques of claims for life on the Moon and [solar] planets began to carry more weight, until by century's end, extraterrestrials have been banished from most planets, with the exception of Mars" (Crowe, 2011, p. 177). But Mars eventually became the most poignant example of the disenchantment process. In the last-quarter of the nineteenth century, a controversy regarding life on Mars broke out, following the claim of the Italian astronomer Giovanni Schiaparelli (1835–1910) to have discovered "canals" on the planet. The crucial question became whether the "canals" were natural or made (Crowe, 2008).

The businessman and astronomer Percival Lowell (1855–1916), who had been convinced of the existence of vegetation on Mars, argued that the canals were not a natural but rather an artificial phenomenon, featuring just "such markings as an intelligence might have made," and hence constituted an "artificial product of a mind" resembling our own. Lowell argued that "In the canals of the planet, we are looking at the work of local intelligence now dominant on Mars." In other words, he claimed that our nearest planetary neighbor possessed a human-like civilization (1908, pp. 188, 95, 203).

Not long after Lowell published his books on life on Mars (1906, 1908), the notion of canals on the planet was already disputed: in 1909 the Mount Wilson's 60-inch telescope revealed that structures, which Lowell had interpreted as canals, were in fact irregular geological features (Guthke, 1990). But the controversy went on for almost half a century longer and was only settled in 1965 when the Mariner IV probe "revealed a heavily cratered moonscape where canaliform features ought to have been" (Zahle, 2001, n.p.). The Mars "canals" proved to be an optical illusion (Sagan & Fox, 1975; Walter & Davies, 1999).

Traphagan claims that Lowell's ideas about Mars were biased "by a personal desire to observe a civilization resident on our cosmic neighbor" (2015, p. 30). The wish "for the existence of an alien civilization just around the corner, influenced the collection and interpretation of data" (Traphagan, 2015, p. 36). But though the illusion of a civilization on Mars was dispelled, the belief that vegetation existed on the planet, was still "very much alive at mid [twentieth]-century." However, "hopes were completely dashed [...] when the Viking orbiters and landers in 1976 seemed to demonstrate not only the lack of vegetation on Mars but also the complete absence of any organic molecules on the two landing sites" (Dick, 2013, pp. 134, 135). While the search for life on the microlevel on Mars and some of Jupiter's moons continues, these findings dispelled the last hopes for the existence of developed life-forms on other planets in the solar system.

The literature review showed that the mytho-theological representations of multifarious life in the cosmos, and particularly in the solar system, common in Western imagery in the past, suffered growing disenchantment in modern times. The gradual decline and eventual demise of the belief in life as we know it on the Sun (Crowe, 2011), the Moon, Mars, or any other solar planet rendered an increasingly more impoverished image of our immediate cosmic surroundings than that which has prevailed in the past, eventually leaving a bleak picture of lifeless rocky, icy, barren, or gaseous celestial bodies orbiting our Sun.

The caption beneath a photo of a rock-strewn plane on Mars epitomizes the difference between the imagination of the past and the discoveries of the present time:

> The reality of space exploration during the early years of the venture, differed considerably from the romantic vision offered by advocates of cosmic flight […] Robotic expeditions on Mars, such as this 1997 Pathfinder mission, did not reveal the lush and habitable planet of imaginative lore, but a dry and frigid sphere. (McCurdy, 2011, p. 8)

A significant implication of this disenchantment is that the prospective attractiveness of the celestial bodies in the solar system for earthly visitors declined progressively, due to scientific exploration, at the very historical moment when those bodies became increasingly accessible to them, owing to rapid technological progress.

Stellar Civilizations

Despite the dissipation of the optimistic beliefs in the existence of extraterrestrial life in the solar system, the belief in its existence elsewhere in the cosmos was rising and ebbing in the course of the first part of the twentieth century, in accordance with prevailing theories regarding the presence of planets, later called exoplanets, around other stars (Dick, 2013, pp. 135–136). But it flourished again from the mid-century onward, as estimates of their frequency increased (Dick, 2013, p. 136, table 1), up to the discovery of the first exoplanets toward the century's end. The discovery of thousands of exoplanets in the first decades of the twenty-first century gave further impetus to the belief in the existence of life in the cosmos. But biologists warned that "the evolution of life beyond Earth might lead to forms of life and intelligence very different from the humanoid form, and alien to the human concept of intelligence" (Dick, 2013, pp. 137, 138).

The space race between the United States and the Soviet Union during the Cold War, and the first human space flights, put the outer space onto the public agenda and increased support for deep-space exploration. That exploration became increasingly driven by four issues, related to the existential question raised in the Introduction of this volume: One, are we alone in the universe? Two, does life exist on habitable exoplanets in our Galaxy? Three, if so, do intelligent extraterrestrial civilizations exist elsewhere in the cosmos? Four, if they do, could they be contacted?

The search for life outside the Earth (or exo-life) is expected, in contrast to popular but unfounded hopes, to find on the exoplanets (at least initially) only microbial life rather than intelligent civilizations. This expectation stands in contrast to that popular in the broader public:

> Although most astrobiologists assume that "first contact" with extraterrestrial life will be the discovery of microbial life beyond Earth, in the public discourse, and especially in popular culture, "first contact" tends to be characterized as contact with extraterrestrial intelligence. (Billings, 2015, n.p.)

The search for extraterrestrial intelligence (ETI) might need a much longer effort, and has a much lower chance of success, than the search for exo-life. Notwithstanding that, a largely unfounded, myth-like belief became widespread among twentieth-century astronomers and space scientists that somewhere in the vast cosmic space there existed intelligent life in some as yet unknown form (Papagiannis, 1984; Zuckerman, 1985). The most prominent twentieth-century American astronomer, Carl Sagan (1934–1996), was an ardent believer in extraterrestrial civilizations (Shklovskij & Sagan, 1966), who went so far as to proclaim, in a 1980 TV series, that there are millions of civilizations in our Galaxy and that intergalactic space is filled with radio messages from extraterrestrial transmitters (Basalla, 2006, p. XI), an image of intelligent life in the cosmos resembling, on a much larger scale, his predecessors' belief that hominoid beings inhabit the planets of the solar system. In a sense, those beliefs resemble popular fantasies and works of science fiction, though they might be less colorful. Basalla, seeking to understand how scientists like Sagan came to believe in the existence of superior alien civilizations, argued that there is "no boundary line between scientific perceptions of extraterrestrial civilizations and popular treatments of the subject" (2006, p. XII).

Whatever the plausibility of this belief, it led to the initiation of a "search for extraterrestrial intelligence," known for its acronym SETI, by mid-twentieth century (Dick, 1993; Tarter, 2001). The search was spurred by an article by Cocconi and Morrison who suggested that "near some star rather like the Sun there are civilizations with scientific interests and with technical possibilities much greater than those now available to us" and suggested the 21-cm radio emission line as the optimal wavelength to intercept communications from extraterrestrial civilizations (1959, pp. 844, 845). In 1960, the astronomer Drake initiated SETI on a minor scale (Time, 1960), but in the following years, it branched out into a multitude of various projects over the globe (Tarter, 2001). However, since 1992 the principal SETI project is NASA's High Resolution Microwave Survey which is "searching the sky for evidence of a microwave signal of artificial origin" (1993, p. 93), supposedly emitted by an intelligent extraterrestrial source. But several decades of intense search have not yet yielded any results.

However, a failure of the search to discover any extraterrestrial intelligence (ETI), though disappointing, would not be meaningless. If "the search [for ETI] continues for centuries, perhaps to the dawn of the next millennium [the thirty-first century], then we will [have to] live with the implication that we are alone in the universe" (Harrison & Dick, 2000, p. 11). Such a conclusion would by itself have far-reaching philosophical and theological implications.

However, the discovery of ETI would have much more far-reaching implications, engendering a thorough examination of its diverse consequences and possibilities for humanity's long-term future. Harrison and Dick argued that "information from ETI may help us grapple with some of the greatest scientific and existential questions of all time" and examined the possible implications of the discovery of ETI on human science, religion, politics, law and the arts. They claimed that the discovery will probably "accelerate our views of ourselves as part of cosmic man or 'interstellar humanity'" (Harrison & Dick, 2000, pp. 15–20), thus extending our identity from earthly to cosmic beings.

However, it is in fact as yet unclear even what is meant by the term "extraterrestrial intelligence," which SETI is supposed to find. Cabrol (2016) hence describes this as "a search that includes looking for [intelligent] life as we do not know it" (p. 661). In 1995, Sagan, a SETI enthusiast and one of the initiators of the project, warned that the chances of finding humanoids on exoplanets are nil. Rather, he conceived of extraterrestrial intelligence as "the functional equivalent of humans […] any creature able to build and operate radio telescopes" and expressed his conviction that "any long-lived civilization will be forced by natural selection to develop the technology of SETI" (Sagan, 1995, n.p.), which is obviously a pre-condition for its discovery by the SETI project on the Earth.

A question more central to our theme is, if discovered, what might such an extraterrestrial civilization be like? Vidal notes that popular culture depicts extraterrestrials as "similar to us in many ways. They are at our scale, have eyes, limbs, body symmetries" (2015, p. 55). While images of intelligent beings in other worlds are in the popular imagination generally formed in anthropomorphic terms, Harrison and Dick maintain that people "wrongly impute human characteristics to nonhumans." In fact, we have no idea how ETI would look like. Harrison and Dick point out that "ETI could be almost anything: a giant gas bag, creatures reminiscent of those portrayed in *Alien* or *Star Wars* – perhaps even free-floating consciousness" (2000, p. 9). Moreover, Dick more recently argued that while "SETI programs usually assume the existence of flesh-and-body intelligence, extraterrestrials may have long ago advanced […] to artificial intelligence, constituting a postbiological universe" (2008, p. 499).

However, rather than focusing on the appearance of extraterrestrials, as did eighteenth-century thinkers, contemporary space scientists are concerned with more abstract potential similarities between our and an extraterrestrial civilization, which might make contact possible. Shostak points out that SETI scientists do not consider "what form extraterrestrial intelligence might take" (2018, n.p.). Rather, their premise is that any technically sophisticated species will eventually develop similar technologies, irrespective of their biology or physiology.

SETI itself recently came under criticism for its unacknowledged cultural pre-suppositions and was denigrated as "a product of Western world view […] heavily influenced by assumptions contained in both Western theology and philosophy"; some authors even claimed that SETI became a new religion (Traphagan, 2015, p. 87). In a recent dissertation, Bozeman (2015) considered SETI as a technological mythos, motivated, and propelled by values and visions that have motivated founders of religious groups. Such criticisms imply that the very cultural forces which led to its creation, imposed on it limitations, which had reduced its chances of discovering ETI.

Even as the SETI quest went on without, as yet, any positive results, an extensive speculative literature emerged, produced primarily by astronomers, mathematicians and space scientists, which focuses on the probable frequency, detectability, and characteristics of stellar civilizations on the galactic or cosmic scale. This literature is predominantly based on unsupported assumptions and lacks empirical groundings because it is concerned with issues beyond the reach of contemporary means of empirical investigation, but it certainly helps to focus research on those issues.

Most of the speculative studies have been framed in terms of one of two leading paradigms: the Drake equation (Evans, 2014; Vakoch & Dowd, 2015) and the Kardashev typology of stellar civilizations (Kardashev, 1964; Tang & Chang, 1991). The Drake equation provides a heuristic to estimate the number of extraterrestrial civilizations in our galaxy. It states that this number:

> depends upon a combination of physical, biological, and social variables […] These are the number of suitable stars in our galaxy, the fraction of those stars that have planets, the fraction of those planets that give rise to life, the fraction of life forms that evolve into technically advanced civilizations, and […] the average longevity of advanced civilizations. (Harrison & Dick, 2000, p. 8)

However, while it might list the main relevant factors, "the parameters of the equation [the probable values of each factor] are not well known, resulting in [estimates] ranging from one planet in our galaxy with intelligence (our own) to 100 million or more." But "this uncertainty has not prevented [the equation's] use as a basis for discussion of the abundance of technological civilizations in the galaxy" (Dick, 2013, p. 139), thus indicating the highly speculative and often optimistic (Wandel, 2017) character of much of the literature on ETI.

On the assumption that the more advanced a civilization, the more energy it will demand, Kardashev (1964, p. 219) proposed a typology of three hypothetical types of extraterrestrial, technologically developed civilizations, according to the level of their energy consumption: Type I, technological level close to the level presently attained on the Earth; Type II, a civilization capable of harvesting the energy radiated by its own star; and Type III, a civilization in possession of energy on the scale of its own galaxy.

Kardashev argued that "estimates of the possibility of detecting a Type I civilization and related experiments […] have revealed the extremely low probability of any such event." But he claimed that estimates show that "should there exist even one Type II civilization within the confines of the local system of galaxies, there will be [a] realistic possibility of securing an enormous quantity of information. The same holds for the existence of even one single Type III civilization in the portion of the universe accessible to observation," thus implying that the search for Type II or Type III civilizations has a greater prospect of success, than a search for the Earth-like, Type I civilizations (1964, p. 219).

Kardashev's ideas led some researchers to speculate about the frequency of Type II and Type III civilizations and the technologies deployed by them (Inoue & Yokoo, 2011; Olson, 2017; Sagan, 1973; Tang & Chang, 1991), although there does not yet exist the slightest evidence of their existence. Robert Zubrin (1999) even organized his visionary work on creating a spacefaring human civilization on the lines of Kardashev's typology, whereas Galántai extended Kardashev's typology by adding an additional type, the ultimate Type IV civilization, which "can manage the energy of a whole universe" (2004, p. 85).

Contradicting the expectation that we shall first discover highly advanced civilizations, implicitly very different from ours, stands the philosopher Lewis W. Beck's (1913–1997) dictum that, "everything that makes extraterrestrial societies different from us reduces the probability of their disclosure" (Beck, 1985, p. 8). Hence, there is a greater chance that we shall first discover an extraterrestrial civilization similar to ours, rather than a very different one. This raises the question of the salient indicators of such similarity. Dunér (2013) has suggested that "intersubjectivity" or "shared cognition" would be the crucial condition of communication with an extraterrestrial civilization (in other words, that its mode of thinking be similar to ours). Next, Dunér surmises, are "sociability" and "social complexity," the latter entailing a "high degree of communicative complexity and high degree of cognitive flexibility," crucial for successful interstellar communication.

However, such reasoning disregards the question of the readiness of an extraterrestrial intelligence to communicate with us. Vidal poses the question, "How would it affect out worldviews to find non-communicative [extraterrestrials]?" Since Vidal believes that we "will most likely find microbial life or stellar civilizations, but nothing in-between," he predicts that the "extraterrestrials we will find will not communicate, for the simple reason that they would likely be either immensely inferior or immensely superior to us" (2015, p. 55).

Vidal introduces a note of caution into the somewhat naïve rush to contact extraterrestrial civilizations. He proposes a multidimensional model of the possible characteristics of extraterrestrials and of their potential impact on us. In his view, the more complex their nature, the higher their impact on us will be. But he stresses that their intent toward us could be varied: neutral, benevolent, or malevolent, just as "if ten million humans were to colonize a new planet, they would also not all be benevolent with its inhabitants" (2015, pp. 62–63). Dick drew attention to possible analogies between anthropological research on historical contacts between different cultures on the Earth, and human contact with ETI. He quotes an early Committee on Science and Astronautics report which warned that "substantial contact [with ETI] could be seriously destabilizing." But Dick (2006) points out that though anthropology has "tackled the problem of culture contact for terrestrial societies," but "it has not yet systematically studied the implications [of its findings] for extraterrestrial contact" (2006, p. 3).

Harrison and Dick discuss the various risks involved in contact with ETI. While disregarding the threat of war or subjugation to an extraterrestrial civilization (a theme often invoked in popular culture), they draw attention to a possible culture shock, provoked "by the import of ideas and technology that are so radical that they disrupt our value system and pose severe threats to [our] social order." But they strike an altogether positive note: they surmise that interaction with many ETI societies will expose us to unprecedented levels of diversity and stimulation. The interaction could even "shape human leisure time and recreational activities [...] people may adopt extraterrestrial costumes, dances, foodstuffs, and customs [...] Amusement park rides could be based on ET conveniences." And, of direct relevance to out theme, "if interstellar travel proves to be much less daunting than it appears right now, then it is conceivable that in thousand years, extraterrestrial societies could become desirable tourist destinations" (Harrison & Dick, 2000, pp. 21, 15).

Even as the SETI search is still going on inconclusively, the very idea of extraterrestrial intelligence became interwoven with contemporary cosmological thought. Farman has noted that modern astronomical "discoveries [had] produced a picture of an infinite, random and indifferent universe, thus paradoxically revealing the utter insignificance of the master/dreamer" (2012, p. 1069). However, this secularized modern image of the universe has recently been challenged by a new cosmic paradigm of a "biological universe," proposing a biological model of cosmic evolution, according to which "the universal replicator, or Biocosm, organizes itself in a way so as to give rise to the repeated emergence of life and very likely, although less frequently, also to the evolution of highly advanced intelligence." Martinez asserts that "life from this perspective is envisioned as an essential process in the naturally proceeding auto-complexification of the Cosmos" (2014, pp. 342, 245).

Following ideas previously suggested by Dick (2003), Martinez predicts, "While the origin of extraterrestrial civilizations must lie within the realm of biological complexity, their eventual destination could certainly be a post-biological one. The enabling factor on the Earth that might cause the redirection of biological toward increasingly technology-mediated evolution is human culture." From a "conceptual amalgamation of astrobiology, SETI and the Biocosm hypothesis," Martinez derives a far-reaching proposition regarding the future "evolutionary convergence of cosmic cultures in the direction of a state of maximized computational power, and thereby maximized cosmic intelligence" (2014, p. 346), which theologians might recognize as resembling a technologically created divinity. Advanced techno-scientific imagery thus opens visions of human intelligence playing a crucial role in a purposeful unfolding of the universe. This could be seen as a reversed, bottom-up re-enchantment of the universe: humans contributing to the creation of a new cosmic divinity, rather than God creating the world and the humans.

Aliens on the Earth

Sightings of unexplained aerial phenomena on the Earth have a long history (Denzler, 2001, pp. 4–8). By the middle of the twentieth century, a myth of alien spacecraft landings emerged in the United States, and reports of abductions of humans by aliens became increasingly frequent and were widely believed. Two incidents, which contributed significantly to the creation and dissemination of the aliens on the Earth myth, are the "Rosswell incident" in 1947, in which an alien spaceship had supposedly crashed on the Earth (Saler, 2009); later debunked as the collapse of a US Army balloon (Saler, Ziegler, & Moore, 1997), and the alleged abduction of Batty and Barney Hall by aliens from a spaceship in 1961 (Newman & Baumeister, 1996, p. 101). The sighted objects became popularly known as "flying saucers," but were later officially renamed "unidentified flying objects" (UFOs). Reported sightings of them multiplied, particularly during the Cold War period, and a growing number of people reported to have been abducted by aliens (Holden & French, 2002; Mack, 1994). Estimates of abduction cases vary widely: conservative estimates put the number of alleged abductees in America at several thousands, but some studies claim that several million Americans had abduction experiences (Newman & Baumeister, 1996, pp. 102–103).

Denzler drew attention to the historical relationship between the emergence of the UFO myth and the disenchantment of the modern world. He proceeds from the argument that "Since the Reformation depopulated the saint-filled cosmos of the Middle Ages, followed by the gradual abstraction and then elimination of God from cosmos by rationally enlightened scientific minds, a newly orphaned humanity has been asking 'Are we alone?'". It should be added that this question became even more acute as about the same time the myth of intelligent life on Mars or any other solar planets was finally debunked and no extraterrestrial life elsewhere, not to speak of civilizations resembling our own, had been discovered. Under the circumstances, Denzler infers that "The UFO experiences reported by thousands of people are one hint that the answer to that forlorn question may be 'No, we are not alone'" (2001, p. XVIII), since visiting aliens provide proof of the existence of life on other celestial bodies (though what and where these bodies are remains a moot question).

The encounter with an UFO has therefore been interpreted as akin to a religious revelation (Gomel, 2014, p. 12). As reports of sightings and alien abductions became widely believed, they eventually fostered some new religious movements (Denzler, 2001; Hunter, 2014; Partridge, 2003a), known as UFO religions. Owing to the spiritual significance of these believes, Denzler stresses that "an essentially scientific approach to UFOs needs to be augmented by the insights of religious mystics and metaphysicians" (2001, p. XVII). Such arguments eventually influenced the direction of the study of alien abductions and other alleged contacts with extraterrestrials.

The reports of alien abductions share some common features. These were summarized by Newman and Baumeister: Abductees often report sightings of a flying saucer or spaceship; they feel paralyzed and are taken unto the alien craft, where they find themselves in a strange, brightly lighted room. They are subjected by the aliens to "painful procedures of an ostensibly medical nature." Abductees report "sexual activities between the aliens and their victims," including rape of female abductees. Some accounts describe tours of the spaceship and even journeys to other worlds. Victims' memories of the episode are supposedly erased at the conclusion of the abduction (1996, p. 101). Blackmore reports that abductees are said to be "physically taken from their beds, cars or homes to an alien craft or planet" (1998, p. 23). But such "other worlds" or "planets" are never identified or clearly described.

There are some differences between reports regarding the appearance of the abducting aliens. In popular parlance, aliens on the Earth are stereotypical described as "little green men" (Steiger & Steiger, 2011, p. 1). But Bryan in a study of the 1992 conference on abductees emphasizes that this conference was not:

> on people who have reported their abductions by "little green men" (which ought to be dismissed out of hand). Rather it is about people who gave incredible accounts about abduction by spindly-limbed, 3.1/2 to 4.1/2-foot tall telepatic gray creatures with outsized foreheads dominated by huge, compelling tear-shaped black eyes. (1995, n.p.)

Newman and Baumeister found that "The examiners and other occupants of the craft almost never look quite like normal people, but they are generally hominoid in appearance" (1996, p. 101) and note that other authors have emphasized remarkable similarities in the humanoid appearance of abducting aliens.

The same authors also note that descriptions of aliens by abductees are less exotic than descriptions in the "[non-scientific] UFO literature" in which readers "will encounter a bewildering variety of other beings, including some with 'golden, strawlike hair', [and] others that look like 'a combination of earth animals', 'creatures with wrinkled skin, crab-claw hands, and pointed ears', and a women with 'long red hair and violet eyes'" (quoted by Newman and Baumeister (1996, p. 101) from Steiger (1988, pp. 59, 62, 71, 175, respectively)). Such descriptions of the abductors resemble the representations of aliens in science fiction and in popular media. More recently Gomez pointed out that in popular culture, such as Hollywood movies and television, the representations of aliens "are either anthropomorphic […] or have tentacles" (2014, p. 1), while Cohen (2016) found that on cartoons such representations in fact range from anthropomorphic hominoids to monsters with tentacles.

As UFO sightings and associated alien abduction reports persisted, they were submitted to extensive socio-psychological and sociological examination, directed to the interpretation of the nature of these experiences, but touching also upon the question of their veracity. These issues were first addressed by psychologists and psychiatrists. The Swiss analytical psychologist Carl Gustav Jung (1875–1961) already in 1958 (Jung, 1969[1958]) interpreted the "flying saucers" as archetypes, emanating from our collective conscious, but "dressed in 'technological garb' in response to modernity" (Robertson, 2016, p. 9), thus implicitly denying them any reality or veracity. Psychiatrists studying reports of alleged abductions by aliens toward the end of the twentieth century were divided on the latter point. Most interpreted the abduction reports as purely imaginary psychological phenomena (Holden & French, 2002; McNally, 2005; Newman & Baumeister, 1996). Jacobs, in fact, asserted that the scientific and academic community never deviated from the assumption that the phenomenon was psychologically generated (2009, pp. 74–75), and hence unreal.

Following a review of the circumstances under which alleged UFO abductions had taken place, Newman and Baumeister concluded that "there is no compelling evidence that extraterrestrial aliens have actually abducted American citizens" and that therefore "it seems most parsimonious to reject the literal reality of abductions" (1996, pp. 103, 104). But John E. Mack (1929–2004), a respected Harvard psychiatrist, following an extensive study of abductees (Mack, 1994), accepted the reality of their experience, an inference which earned him the reprove of his colleagues (Boyce, 2012). However, Mack's position helped to destabilize the professional opinion regarding the fictional status of alien abduction reports and fostered a discussion of the epistemic status of alien experiences.

Some researchers began to vacillate regarding the epistemic status of aliens arriving on UFOs on the Earth. Partridge, the editor of a book on UFO religions, states his own ambivalence clearly:

> I am a little skeptical but nevertheless open-mined about such phenomena [...] On the one hand, it is difficult not to believe that there is, in the vastness of space and orbiting one of its innumerable suns, a planet on which there exist intelligent beings. On the other hand, it is difficult [to go] from that [...] to the claim that such beings are so intelligent and technologically advanced that they are able not only to leave the surface of their planet [...] but to leave their solar system and travel to a tiny blue planet many millions of miles, if not light years, away. (Partridge, 2003b, p. 4)

While Partridge's position regarding the reality of UFO phenomena is framed within the basic premises of modern scientific epistemology, this epistemology itself was put into question by some post-modern critics. The sociologist Dean states the epistemological issue clearly:

> It is not that UFO believers are irrational. Rather, being unable to judge their rationality points to the lack of widespread criteria of judgement about what is reasonable and what is not: ufological discourse upholds the very criteria for scientific rationality that mainstream science uses to dismiss it. (1998, p. 9)

More recently, Robertson stated that "belief in UFOs makes one being in opposition to epistemic norms." For people who experienced UFOs, "the subjective experience disregards claims to scientific objectivity, and therefore the alien comes to operate as a symbol of the perceived boundary between the objective and the subjective." Robertson (2016) refers to Kripal, a scientist of religion, according to whom "UFOs are described as neither entirely subjective nor properly objective" (2016, pp. 8, 9), thus disrupting that dichotomy and creating an in-between epistemological position, coming close to Victor Turner's (1969) notion of liminality.

But students of religion gradually moved the focus of attention from the problem of the veracity of the alien encounter reports to the study of the spiritual quality of the experience of such encounters. Mack had already drawn attention to the transformational effects of such experiences (Hind, 2005; Mack, 2000) and, doubtlessly on the basis of his work with abductees, sought in his later work to introduce a "spiritual point of view" into psychoanalysis, arguing that "spirituality is often associated with dramatic personal events [...] and often peak 'hights' or mystical experiences" (Mack, 2006, n.p.), which should not be discarded as mere illusions.

Alleged experiences by UFO abductees and contactees with aliens became the basis of some new religions, known collectively as UFO religions (Lewis, 1995; Palmer, 2004; Partridge, 2003a; Sentes & Palmer, 2000; Whitters, 2012). The most widespread UFO religion, Reëlism, based on alleged revelations from extraterrestrials received by a French ex-car-racer, Claude Vorilhon, who took on the name "Reël," is sad to have replaced "the supernatural with the extraterrestrial and technological in order to demystify and demythologize [...] the Abrahamic religions, simultaneously [...] mythologizing and ideologizing science and technology" (Sentes & Palmer, 2000, p. 86).

Reël claims to have had "a series of interactions [...] with an extraterrestrial race called the Elohim" who "informed him that he was the ideal candidate to deliver 'the truth' to his fellow humans." Though using deistic names, Reëlism "is an atheistic religion," which "through an imaginative reinterpretation of Genesis," teaches that "the world was created by the Elohim race as a scientific experiment" and that once "the Elohim decided that the human race is sufficiently peaceful and educated for them to return to earth, there will be a final 'judgement'," in which, "using human DNA technology and memory stored in advanced computers […] the Elohim will 'resurrect' their chosen using cloning technology" (Whitters, 2012, p. 11).

The important point to note is that Reël, and other founders of other UFO religions, while quite specific about the messages they received from their alien contacts, are generally vague about these aliens' cosmic origins. Melton noted that the alleged origins of the extraterrestrials with whom the founders of new religions claimed to be in contact have been changing over time. He explains that the contactees of the 1960s and 1970s "had to respond to increasing knowledge […] that very little chance for intelligent life in this solar system exists. Therefore, they had to abandon talk of contact [with extraterrestrials on planets]." Consequently, "all of the new contactees […] either fail to reveal the planet from which their extraterrestrials come, or place it on the remote edge of the universe, far from the prying eyes of the space programs" (Melton, 1995, p. 9).

The vagueness of the cosmic origins of the extraterrestrials with whom the contactees communicated is well illustrated by the case of Reëlism. Its founder, Claude Vorilhon (alias Reël), offers accounts of "meetings and communications with his extraterrestrials, the Elohim, 'those who come from the skies'" (Sentes & Palmer, 2000, p. 86). But there is no indication in his accounts on where exactly the Elohim come from. Melton quotes the vague response Vorilhon claims to have got from one of his extraterrestrials to a question on their origins: "We come from a distant planet about which I will tell you nothing for fear that if the men of the earth weren't wise enough they could come and trouble our peace" (1995, p. 9).

From the perspective of this chapter, the important point to note is that, in contrast to established religions such as Christianity or Islam which encourage visits to the earthly abodes of their founders, the UFO religions do not seek to engender a desire in their adherents to travel or engage on a pilgrimage to the celestial abodes of the extraterrestrials with whom the founders of their religion had allegedly been in contact. Though the UFO religions are based on messages from aliens on other worlds who have visited the Earth, these religions do not encourage space exploration, space tourism, or cosmic religious tourism.

CONCLUSION

The three myths examined in this chapter offered various responses to the question: Are we alone in the universe? But their dynamics showed very different patterns:

(1) The myth of extraterrestrial planetary life, resembling life on the Earth, was gradually debunked by modern science, which eventually establishes with certainty that no forms of developed life exist on the Moon or any other planets, while microbic life forms are yet to be found. It can thus be argued that the gradual impoverishment of the Western imaginary of extraterrestrial life on other celestial bodies made them increasingly less attractive to prospective earthly visitors, even as they become ever more realistically accessible to them.
(2) The myth-like belief in the existence of stellar civilizations or, more abstractly, ETI has engendered an extensive search for transmitted signals from such civilizations (SETI), but no such signals have yet been detected; the existence of such civilizations and the prospects of a future contact and possible encounter with them are still open questions. But the crucial point is that, since the search has as yet failed to discover any such civilization, we have no idea of whether they exist or how they might look like, and hence they lack an image which could attract (or repulse) human visitors, their fantastic representations in the popular media notwithstanding.
(3) The disenchantment of the cosmos by modern science, resembling the decline of beliefs in angels and demons in major Western religions, was followed by the recent dissemination of a post-modern myth of aliens visiting the Earth by UFOs from unspecified stellar origins. While a source of mirth for non-believers (Cohen, 2016), by others the existence and presence of aliens was taken with deadly earnest, even as the alleged encounter with them engendered new religious movements. The emergence and expanding popularity of the myth provoked an epistemological split between unbelievers, supported by the scientific establishment, and believers, basing their convictions on alternative, often post-modern epistemologies, with some researchers remaining undecided regarding the question of the objective or subjective (or in-between, liminal) nature of alien experiences. But the important point is that this myth, in all its many variations, is silent about the aliens' cosmic origins, while even the new religions which the myth fostered, do not encourage adherents to visit or undertake pilgrimages to their abodes.

From the perspective of this chapter, the important conclusion is that, at present, none of these myths offers much incentive to the wider public for space travel and tourism. The disenchanted solar planets, either gaseous or, if terraneous, offering mostly views of barren, rocky, and crater-pocked landscapes, which are presumably much less attractive to moderns to visit them, than could have been the images of rich planetary life to our ancestors. The discovery of developed life or extraterrestrial civilizations around other suns would significantly expand the potential horizons of human travel and tourism. It could offer a response to the existential question of whether we are alone in the cosmos and enable humanity to form a comprehensive identity in contrast to the extraterrestrial Oher. It would also endow with deeper meaning the exciting, though also frightening, encounter with a non-human civilization on a distant planet, frequently imagined in popular culture and science fiction. But the search for such civilizations has not yet born any results.

The disclosure of the cosmic abodes of the aliens visiting the Earth, or of the Elohim in Reëlism, could pose a challenge to human believers to visit them, but it is doubtful that they will ever be identified. As long as there is no evidence of accessible forms of life elsewhere in the cosmos, it remains questionable whether space tourism to lifeless celestial bodies, such as solar planets or exoplanets around other stars, even if it becomes feasible and affordable in the future, will become attractive to the broader social strata. Without a realistic chance to encounter developed life forms on other celestial bodies, space tourism will probably not become a widely popular form of tourism.

Chapter 4

SPACE TOURISM IN CONTEMPORARY CINEMA AND VIDEO GAMES

Maud Ceuterick
University of Bergen, Norway

Mark R. Johnson
University of Alberta, Canada

Abstract: Contemporary cinema and video games express considerable skepticism toward the colonization of further planets. Contemporary films including *Elysium* and *Passengers* depict space travel as the prolongation of inequalities within human civilization, while others such as *Gravity* and *The Martian* predict a rebirth of the human species through technological advances and space travel limited to a lucky few. Games, meanwhile, explore topics ranging from private spaceflight to the genetic modification required for long-term space habitation, especially in *EVE Online*, which we focus on in this chapter. Although both contemporary films and games celebrate technological advances, these media also show that multiple inequalities lurk behind the celebratory human renewal into a multiplanetary species. **Keywords**: transhumanism; human rebirth; social inequalities; film; video games; simulation

Space Tourism: The Elusive Dream
Tourism Social Science Series, Volume 25, 93–115

ISSN: 1571-5043/doi:10.1108/S1571-504320190000025005

INTRODUCTION

This book observes a tension between the way private companies envisage space tourism and the social, political, economic, and environmental challenges that come alongside space travel. In films and video games, this tension often brings about ethical and philosophical reflections, while also critiquing or glorifying diverse aspects of space tourism or travel. As films and games offer virtual experiences of space tourism to spectators and players, they produce myths that underlie space tourism as a human undertaking and a business. According to Brent Sherwood (2011), the future of human space flights (to Mars, the Moon, as tourism more generally, or for exploitation of natural resources) builds on various popular myths: the "hero," the notion of jet-setting, the possibility of a green future, and a pioneering spirit. Films and games depict the adventures of humans flying in the Earth's orbit, setting foot or settling upon another planet, and attempting to solve environmental issues through space travel. These representations inevitably feed popular imagination and, as Sherwood (2011, p. 347) points out, can subsequently foment political will and funding.

Through the production and reproduction of the myths that nourish space tourism or travel as an enterprise, film, and games also reinforce the idea of a *human* presence in space as opposed to a *robotic* one. As in road movie and adventure genres, there are many reasons to leave "home": in this case the planet Earth. Whether the quest of the protagonist is to flee a critical situation, or to solve the existing social, environmental, or political problems through settling elsewhere, films and games often question the type of human beings that may be allowed to travel. Super-rich astronauts or half-human half-machine cyborgs appear as characters, which does not leave much hope for ordinary people to be able to settle on another planet. Ordinary humans, it seems, would have to undergo a rebirth at the level of both the body and the body politic if they are to exist beyond the confines of our homeworld.

Films and games feature a recurring tension between humans and technology. Tension also exists between humans' desires to follow their dreams of becoming heroes, pioneers and solving contemporary sociopolitical issues, yet attempting to do so within the limits and consequences of technology on civilization. If the long travel times and lack of atmosphere are immutable obstacles to settling on other planets, the modification of the human body through the so-called nanotechnology, biotechnology, information technology, and cognitive science may offer a chance for this ambitious project to come closer to reality. For transhumanists, the development of this knowledge would allow a radical change of humanity, a complete redesign of morphology and cognitive powers through technology. In the transhuman view, people would become enhanced cyborgs "indistinguishable from their technology," and perhaps "better at being rational, sensitive and expressive—better at being human" (Roden, 2015, p. 16).

Although transhumanists differ from humanists in their envisioning of "new forms of embodiment" as ways to overcome the constraints of nature and human biology (Roden, 2015, pp. 13–14), both groups share the idea of self-overcoming and humans as a "work in progress" (in the words of the transhumanist philosopher Nick Bostrom, cited in Lemmens, 2015, p. 434). For humanists such as Peter Sloterdijk and Bernard Stiegler, people are technicized creatures in themselves, "fundamentally technological [...] right from the very start, being born from technology as [...] the effect of the becoming-technical of a primate life-form" (Lemmens, 2015, p. 436). In space travel films and games, technology is tantamount to bring humans into space, both as heroic explorers and as pioneering settlers. If technology is essential to the spatial future of the human species, films and games disagree on whether it will be used as a *tool* or as *intrinsic* to our beings. The uneasy relationship between humans and technology even makes us question the future of the Earth and humanity, and in particular whether becoming a multiplanetary species would solve the social, political, economic, and environmental problems on the Earth or extend them into space instead. These are questions that this chapter explores in both films and video games.

HUMANITY'S SPACE FUTURE IN FILMS AND GAMES

Space Travel Films

Stanley Kubrick's *2001: Space Odyssey* (1968) has often been described as the science-fiction film that determined and defined the specific genre of *space travel* films. While his film came out in an era when the Apollo tests were taking place and as human beings were about to land on the Moon, it was vastly ahead of its time both in the technologies it displayed and in the humane mental expressions that Kubrick gave to HAL, the computer "in charge" of the space mission. The film certainly nourished popular imagination regarding space tourism and led the airline company Pan Am (featured in the film as operator of the aircraft) to sell tickets to space before having even built the spacecraft (in a comparable manner to Virgin Galactic today). Whereas in 1968, Kubrick presented space travel, technologies, and scientific progress in a ceremonial way—with a soundtrack that has become universally known and used to produce a grandiose effect—the films that came out the next decade, such as *Close Encounters of the Third* Kind (Steven Spielberg, 1977), *Star Wars* (Georges Lucas, 1977), and *Alien* (Ridley Scott, 1979), took space travel for granted.

In the 1970s, space already became a "décor" for getting in touch with other civilizations, for dramatic battles or for scientific work. Similarly, *The Hitchhiker's Guide to the Galaxy* (Garth Jennings, 2005), adapted from Douglas Adams' 1978 BBC radio series and novels (1979–1992), treats space as already well-traveled. *The Hitchhiker's Guide to the Galaxy* figures as the only film (to our knowledge) to thoroughly bring space travel as far as space tourism. From the 1980s onward, however, after government funding for space exploration had decreased, the genre started to question our capacity to live in or travel to space destinations, let alone for pure pleasure.

If government space agencies have historically showed more interest in scientific exploration and colonization than for tourism, private companies have recently taken up the challenge to build a space tourism sector in order to subsequently fund colonization. In various talks, interviews, commercial videos, and documentaries, the billionaire founders of Virgin Galactic (Richard Branson), Blue Origin (Jeff Bezos), and SpaceX (Elon Musk) assert their goals of developing space tourism as a means to fund space travel, and further exploration and colonization. In the race to make space a touristic destination, Virgin Galactic aims to produce a reusable commercial spaceplane, which would make it affordable to more people and launch satellites at a cheaper price than is feasible now. Jeff Bezos' grand project, beyond bringing tourists into space in Blue Origin's reusable rocket system, is to facilitate the development of space exploration and ultimately relocate heavy industries in outer space (Beard & Cox, 2017). However, while Bezos recognizes that humans are depleting the Earth of its resources while they are abundant in the Solar System, he does not consider the potential damage and contamination that this industrial relocation could cause to near-Earth space (which satellite debris is already causing; Smith, 2000, p. 11). Similarly, SpaceX's founder, Elon Musk, wants to transform humans into a "spacefaring civilization and multiplanet species" (SpaceX, 2017, n.p.). For Musk, it is important for the survival of the human species to settle on other planets and on Mars as a priority.

Looking at the promotional videos of Virgin Galactic (but also at Bezos' and Musk's discourses), it appears that the rhetoric of an almost childlike dream is at the heart of their projects. While enchanting music produces an atmosphere of a fairytale, the videos on the Virgin Galactic's website and YouTube channel also display a certain (albeit limited) amount of technical and engineering knowledge, giving thus the impression that space tourism will soon be a reality rather than solely a fantasy. Although their marketing strategies consist of a mix of inspiration, impressive engineering, and claims over the protection of the Earth, these companies rarely discuss the environmental impact, psychological consequences, and social and physical selectivity linked to the development of space tourism, or space travel more generally. If in terms of machinery it is Branson's, Bezos', and Musk's big dreams that are driving the space tourism sector forward and potentially bringing the human species closer to multiplanetary life, contemporary cinema still points at the many political, social, ontological, and scientific challenges for the conquest of space to become a reality.

Since *2001*, sci-fi films have tackled many different issues related to space tourism: from the supremacy of machines and vulnerability of the human body, to problems of property, colonization, citizenship, and international politics. They have explored a variety of forms of travel or tourism such as scientific explorations, medical tourism, and interplanetary travel. However, the diverse subgenres and esthetics of these films seem to share the common idea of a "rebirth" through space travel. Traveling to space becomes an opportunity to be reborn as a species, create a new home for humans, and find a replacement for an Earth that has become contaminated, overpopulated, and inhospitable. Starting with Kubrick's film, the image of a reborn or newborn human appears as a motif of space discovery and colonization.

In *The Hitchhiker's Guide to the Galaxy*, it is the Earth itself that is being reborn from a "backup." Everything on the Earth is reconstructed as it was before the Vogons demolished it (the Earth being in the way for the construction of a space highway through the Solar System). As mentioned earlier, the film can be described as the only one of the genres that stages genuine space tourism, that is, travel for the sole purpose of leisure and experiencing other planets' civilizations. Space tourism here serves to have people realize that the Earth is probably the best planet for humans. The film borrows from the "road movie" genre, using the concept of home as the place that one both leaves to start a quest and comes back to as a grown-up individual. Home is what allows the protagonists to preserve their ontological foundations while retaining the privilege of traveling and discovering themselves through remote worlds.

As a comedy, *The Hitchhiker's Guide to the Galaxy* does not take itself nor the science of space exploration seriously. Instead, the characters make use of teleportation and "magical" hitchhiking to travel in a way that reminds us of the *Star Trek* and *Star Wars* series. What is most notable in the film is the presence of many species—with their own language, customs and culture—and the relative absence of hierarchy between them. This situates humans as a species among many others and puts its supremacy and the very idea of colonization in question. Governments of the different planets must learn to discuss and negotiate in a friendly manner, and individuals traveling to other planets must adopt the humility of tourists and rely on a guidebook to help them decode the habits and languages of other populations. Similarly, robots and computers have a life of their own and are capable to decide whether to help humans. All in all (and this is the take-home message of the film), everything is a matter of point of view and how we perceive home, tourism, and others. While remaining light in tone, the film relativizes the notion of home and planet ownership and insists on the necessity to remain humble before the universe and preserve the diversity of the species on the Earth.

The environmental and social issues that emerge from the idea of colonization in *The Hitchhiker's Guide to the Galaxy* appear throughout the sci-fi genre of space travel; traveling to space often amounts to an ontological and/or sociopolitical rebirth of the human species. In one way or another, all films that tackle space travel or colonization reimagine Kubrick's final images of the dying and newborn human in *2001*. As film theorist Michel Chion writes about *2001*, *la mort est renaissance* (2008, p. 217): in order to successfully establish a life in space, human civilization as we know it must be reborn, learn from its past mistake and build anew. In an attempt to understand this motif of rebirth in cinema and games in light of the current space tourism aspirations, we will deal with two groups of recent "serious" films (as Chion, 2008, calls them), that is films that display a certain degree of realism and scientific plausibility. While the first group of films (including *Gattaca*, *Elysium*, and *Passengers*) situates the rebirth of the human species in the social, political, and ontological transformations "needed" before settling in space, the second group of films (including *Moon, Gravity, Interstellar*, and *The Martian*) each feature single protagonists who are "reborn" in space and must learn to handle its various practical challenges.

Gattaca (Andrew Niccol, 1997), *Elysium* (Neill Blomkamp, 2013) and, to a lesser extent, *Passengers* (Morten Tyldum, 2016) all present space travel as a dystopia by exaggerating several sociopolitical aspects of human civilization. In these films, the rebirth metaphor posits the drastic transformations needed before expanding human life into space. In his excellent history of the sci-fi genre, Chion (2008, p. 222) suggests that recent space travel films express the impossibility of both leaving and remaining on, the Earth. In addition to their sci-fi characteristics (which the second body of films entirely rely on), these three films borrow filmic forms from other genres, namely the 1930s American *noir* (*Gattaca*), the war genre (*Elysium*), and Hollywoodian romantic comedies (*Passengers*). By blending cinematic genres, these films place space travel at the margins (contrary to the films of the second group) while bringing forward other aspects of human society.

In spite of their very different filmic aesthetics, *Gattaca*, *Elysium*, and *Passengers* link space tourism to three main social concerns: the environmental-medical (what are the consequences of environmental degradation on health, and how can machines solve them?), the socioeconomic (who can travel, and is health the future commodity and determining factor for space tourism?), and the political (is space tourism dependent on the merging of private and public sectors?). This last question is particularly interesting in the current context where the private is overtaking the public sector in the conquest of space, with SpaceX's extravagant launch of its reusable rocket Falcon Heavy at the beginning of 2018. The political aspect of a possible future in space is also the least challenged in these three films, which preserves capitalism and patriarchy as the dominant ideologies.

We wish to concentrate here on the medical, social, and political issues of space tourism through the blockbuster *Elysium*, which is thematically and esthetically the closest to the video game *EVE Online*, which will be discussed in the second part of this chapter. In 2154, as the Earth has become overpopulated and polluted to the extreme, the richest in society have constructed Elysium, an orbiting open "green" space station, in order to preserve their lifestyle. The difference between the two habitats (the Earth and Elysium) is primarily racial and economic. Blomkamp's film plays on stereotypes to easily convey its message; while the richest (of mostly French descent) enjoy a luxurious, safe, and healthy lifestyle, the poorest (of Spanish and South American descent) are left on the Earth to work for the profit of the former and die of poor health and unhealthy living conditions. The dystopic narrative of the film is based on a hyperbole of current immigration policies, social, and racial discriminations and seems to point to the profound revisions needed in order to give the Earth a fresh start.

While playing on popular fears (overpopulation, robots in control of the administration and the police, and no human and social rights), the film suggests that space tourism or interplanetary colonization would not generate a rebirth of the species (or the Earth itself) as other space travel films seem to suggest (such as *Interstellar* or *The Martian*). In Elysium, both the overpopulation of the Earth and its subsequent dreadful environmental conditions and disparities between people appear inevitable (a dystopic situation that is presented at the outset of the film). Rather than ensuring a renewal, delocalizing some of the Earth's inhabitants on the orbiting habitat Elysium while leaving the heavy industries (and the poorest people) on the Earth (contrary to what Jeff Bezos suggests) prompts a state of war: the orbiting station becoming thus the ultimate expression of social injustices and political abuse.

The excessive violence of the film and its gray and dirty *mise-en-scène*, with narrow dark corridors and dangers lurking around every corner of Los Angeles, situate it in the war genre. The genre calls for a dichotomy opposing allies on the Earth against enemies on Elysium, the poor versus the rich. To change the order of things (while pushed by an individual motivation to stay alive), Max (Matt Damon) transforms into a cyborg, half-human half-machine (a name and situation that resonate heavily with the injustice-fighter and main characters of the *Mad Max* series of films). This transformation allows him to defeat the robots in charge of the protection of Elysium's citizens and the subjugations of the citizens on the Earth. As in *EVE* and other video games, the protagonist requires this ontological transformation to engage in a fair combat. While machines in the sci-fi genre tend to allow humans to travel to or settle on other planets, they also often reinforce and protect the fragile human body, or even ensure the (almost) infinite prolongation of human life through cloning (in *EVE* and in the film *Moon*) or a regenerating capsule (in *Elysium*, *Passengers*, and *EVE*).

Although technology in *Elysium* is to remain at a machine stage maintained under human control (such as the police robots), it also integrates and benefits humans both physically and cognitively. If the film celebrates transhumanist ideas, such as the technological enhancement of humans' physical force, life-span, and cerebral capabilities, it also warns against the severe social inequalities that technology would intensify in the process. Similar to *Gattaca, Elysium* suggests that a transhumanist future in space would intensify social-class divisions and create a planetary divide between "enhanced" and "unenhanced" humans. Pure robots are devoid of emotions and free will and form a third category, which is subjected to the power and will of enhanced humans (the citizens of Elysium). This anthropocentric division opposing humans to nonhumans highlights the film's failure to formulate a thorough critique of the dualisms (of gender, race, and social class) within which humanity is currently trapped.

Elysium, *Passengers* and *Gattaca* take technology and space travel for granted, and feature political and medical, rather than scientific challenges, facing humanity. In Elysium, space travel occurs mostly as "medical tourism." While the high social class—who generally benefit from medical treatment in foreign lands—already lives on Elysium and has unlimited access to regenerating capsules, the sick lower-class Earth's citizens need to go on an illegal and very expensive journey in order to reach a regenerating capsule before being killed or forcefully repatriated to the Earth. As Max and the "allies" defeat the "enemies" on *Elysium* at the end of the film, however, the social and political system is reborn through a communist kind of health care. What is most paradoxical about the film is that the act of converting all the Earth's inhabitants into citizens of Elysium, giving them thus the same unlimited access to health care (and potentially an infinite prolongation of their lives by regenerating machines), aggravates—rather than solving—the problem (the overpopulation of the Earth) on which the whole narrative is founded. *Elysium* reinforces the pioneer myth, which Sherwood recognizes as supporting the idea that human beings could settle the Moon and become a two-world species. In spite of Max's social victory against the elitism of *Elysium*, the film neither eradicates nor deeply challenges the capitalist and patriarchal status quo. In *Elysium*, as well as in *Gattaca* and *Passengers*, citizens remain divided between social class, ethnicity, or health condition, and women are either mothers or victims to be seduced, saved, and protected, or abusive and unsympathetic characters.

If traveling to or settling in space offered a potential renewal (by alleviating the Earth of some of its population and contamination), it fails to transform the social and political organization of the human species. Rather, *Elysium, Gattaca*, and *Passengers* suggest that only the fit and healthy would be able to travel into space. While the technological modification of bodies (through hibernation, healing, resurrection, or genetic selection) may ensure an ontological rebirth for the human species, it may also exacerbate social dysfunctions. For these films, the development of space tourism and the technologies linked to it are intrinsically dependent on current social, medical, and political issues, which must be addressed for space travel to become a renewal rather than a site of potential destruction.

In opposition to the dystopia presented in *Elysium*, other films of the last decade, such as *Moon* (Duncan Jones, 2009), *Gravity* (Alfonso Cuarón, 2013), *Interstellar* (Christopher Nolan, 2014), and *The Martian* (Ridley Scott, 2015), aim at scientific accuracy (while also retaining narrative appeal) and focus on the scientific practicalities of living in space. Perhaps, the most interesting aspect of these four films is the solitary travel of their skilled protagonists; these films place emphasis on the very ability to live in, or even deal with, space. This seems at odds with the discourses of Richard Branson, Jeff Bezos, and Elon Musk, according to whom space tourism would soon become available to the general public (as discussed in Chapter 5, this discrepancy is also present in the current use of virtual reality, as possibly the only "travel" accessible to the masses). Whereas this chapter does not allow the thorough analysis that these films deserve, we want to note the touristic experience that they offer and their presentation of space travel as a rebirth. As spectators of these films, we travel into a poetic and artistic vision of space. Viewers sit in awe of majestic landscapes, natural phenomena, and expansive human knowledge and technology, all serving a narrative, touristic, and educational purpose. While these four films portray the fragility and insignificance of human beings in front of the immensity of space, they point to the scientific and technological progress that might, one day, help humans to settle in space.

In contrast to the first body of films considered, *Moon, Gravity, Interstellar*, and *The Martian* return to a more realistic and humanist depiction of space travel that does not merge cinematic genres. While in *Gattaca*, *Elysium*, and *Passengers* private companies (or states functioning like private companies, such as in *Elysium*) initiate and ensure space travel, in the second group of films, governmental agencies are the ones that lead space expeditions. Whereas the first group somehow warns against the economic and political supremacy of private companies over state agencies, the second group of films tends to express a reserved admiration toward governmental (and more generally human) progress with regard to space exploration. As "realistic" films of science fiction (albeit somewhat an oxymoron), *Moon, Gravity, Interstellar*, and *The Martian* demonstrate great interest in the practicalities of space travel and in the human desire and power to make it a reality, which subsequently foment a continual public interest in aeronautics and astrophysics. Some aspects of their aesthetics in fact remind us of the grandeur of *2001: A Space Odyssey*, and of the utopia and rhetoric of the childhood dream used in the promotional videos of Virgin Galactic, Blue Origin, and SpaceX. Contrary to *Elysium, Passengers*, or *Gattaca*, in these films, the rebirth of the species is about to occur *through* space travel and colonization, not prior to it.

The image of the reborn human appears in different forms: through cloning and mental programing (in *Moon*), as a presence in several time-space dimensions (in *Interstellar*), and as near-death experiences and learning processes (in *Gravity* and *The Martian*). In *Gravity* (Alfonso Cuarón, 2013), images of the fetus and newborn are omnipresent, both as individuals and as a species. When Dr Stone (Sandra Bullock) imagines the death of her colleague Kowalsky (George Clooney) disappearing into orbit with his detached (umbilical) cord through the window of the spaceship, it is the death of her own child that replays in front of her eyes while she remains helpless at the wheel of the spaceship (similar to how she was driving her car when she got the news of her child's death). In spite of the many obstacles that Dr Stone encounters (among them a fire, space debris, and loss of communication), she lands safely back on the Earth, crawling out of the ocean to the beach and remaining in a fetal position (like several times in the film) before getting back on her feet. This ending acts out both the evolution of the human species from aquatic to terrestrial stage, and her own physical and psychological rebirth as a human being coming back from a difficult journey in zero-gravity. The film alludes to various questions that arise regarding space travel, namely complicated communication and transport, the extreme solitude (explored in *Moon* to a further extent), the physical unsuitability of the human body to live in space, and the (inter)national aspects of colonization and responsibility with regard to the spatial environment.

In contemporary cinema (and contrary to space companies' promotional videos), life in space often manifests as a distant dream that is not yet ready to be fulfilled. Among recent films, *The Martian* (Ridley Scott, 2015) considers space travel in the most optimistic light. The "resurrection" of the protagonist Mark Watney (Matt Damon again)—thought dead and left alone on Mars—gives a unique opportunity to test long-term life on the planet. In spite of Mars' thin atmosphere and natural disasters (albeit fictitious, see Gibney, 2015), the film argues that colonization is possible as long as we can grow crops in a protected environment. In opposition to most sci-fi films, nobody dies in *The Martian*, and Mark Watney, the crew that left him behind, and NASA ground crew solve the challenges that arise step by step in a Cartesian manner rather than through successive destructions such as in *Gravity*. Human knowledge in fact becomes the main character of the film.

Contrary to the transhumanism of *Elysium, The Martian* celebrates the potential of humans to grow and reach their objectives of exploration and conquest thanks to their own capabilities of mastering technology. Instead of a physiological transformation of the human body through technology, determination becomes the key to space travel. *The Martian* in fact overemphasizes the humanist ideals of reason, progress, and individualism (although for the supposedly common "good" of colonizing Mars), at the cost of a renewal of humans' ethics and social relation. The determination to save the stranded astronaut (and arguably the project to explore Mars) even crosses national borders as the Chinese space agency unexpectedly shares their technologies with NASA, perhaps in view of building a path for future collaboration and joint imperial conquest of space. Whereas this element of the narrative could be seen as a necessity for international collaboration to explore Mars, Ridley Scott decided to replace two Asian-American characters of the book from which the film was adapted by black British actor Chiwetel Ejiofor and white blonde actress Mackenzie Davis, which brought upon him the accusation of whitewashing (Davé, 2017). As the sci-fi genre (including the selection of films in this chapter) and the companies forming the space tourism sector today demonstrate, the conquest of space remains very much, and often uncritically so, white, patriarchal, and American centric.

Without much deviation from normative Hollywoodian happy-ending films, the white male protagonist of *The Martian* Mark Watney undergoes a twofold rebirth: first as a stranded astronaut and a botanist learning how to ensure his own survival with the least possible means and, when returned to the Earth, as a university professor encouraging students in astrophysics to pursue the conquest of space. By offering solutions to transport and international collaboration, the film appears as a response to those like *Moon* and *Gravity*. *The Martian* intentionally positions itself as an optimistic scientific exploration of the technological resources available for multiplanetary life. Rather than fighting all the dangers that space presents like Dr Stone in *Gravity*, Mark Watney builds a self-contained greenhouse in order to grow potatoes on Mars and survive, makes small videos of himself to endure solitude, and restores an old machine to establish communication with the Earth. More than machines like in *Elysium* or *EVE*, human skills and ingenuity are above all at the core of success in *The Martian*. If *Elysium* and *EVE* consider that machines and cyborg transformations are a prerequisite for space travel, *The Martian* (like *Gravity*) places emphasis on human reasoning, machines remaining mere tools created and controlled by humans in order to achieve their goals. Historical headlines and the ideal of a fresh start on a new territory provide the rationale for a human (as opposed to a robotic) spaceflight in *The Martian*. Astronauts who put their lives in danger build upon and reinforce the myths of the hero and the pioneer that Sherwood (2011) identifies regarding human space flights. The bright and warm orange and green colors create optimism and emphasize the positive (almost utopian) attitude of the characters in *The Martian*. When watching Scott's film, it seems that Enlightenment values such as reasoning, determination, and confidence (similar to the ones displayed by the leaders of the space tourism sector) form the recipe to convert human beings into a multiplanetary species.

While films like *Elysium* and *Gattaca* represent space travel as a potential cause of further social and political issues, both *Gravity* and *The Martian* depict it (almost purely) as a scientific challenge, which is either hardly or highly feasible. Although they portray space travel as requiring cross-border collaboration, *Gravity* and *The Martian* in fact ignore the political issues that are likely to arise, and only tackle indirectly the environmental impact of space colonization (by alluding to the nuclear waste left on Mars in *The Martian* and the dangerous orbiting of debris in *Gravity*). Similarly, very few films, except *Moon* and perhaps *Passengers*, deal with psychological disorders such as the profound and problematic solitude of astronauts and future space tourists. Compared to earlier space travel films (such as *2001: A Space Odyssey*) and video games (as we will see below), the narratives of contemporary space travel cinema have left behind depictions of long-lasting trade and leisure in space, and now mostly focus on the capabilities and problems of space travel. What a number of space travel films, such as *Gravity* and *The Martian*, offer to the space tourism sector, however, is to go along their dream rhetoric by creating esthetic and touristic experiences that both inspire and reinforce belief in the renewal that space travel would bring to the human species.

Video Games and Interactive Media

We turn now to considering space tourism, and space travel more broadly, within video games. As a growing and increasingly dominant medium of media production, video games are a major site at which future visions of space tourism can be displayed and directly interacted with, allowing players to experiment with modalities of extraplanetary transit. Virtual worlds offer the ability to teach us about new and possible-future intersections between society and technology (Boellstorff, 2015); they let designers release immense digital spaces, ranging across planets, solar systems, and even galaxies, limited only by imagination and technical constraints. In turn, with the continuing improvement of computing hardware specifications and the refinement of programing methodologies, the virtual universes we will be able to explore are likely only to expand in their size, scope, and detail. This is a valuable moment to take stock of the kinds of space tourism that games have so far offered their players and what imaginaries of the industry's future are being directly *experienced* by millions of gamers every day.

A complete list of video games involving space tourism or space travel is far too lengthy to analyze in a single chapter, but we can identify a small number of major titles in this area: games that have achieved international popular and critical recognition and also offer the most detailed and comprehensive perspectives on how space travel might emerge. The first major release that attempted to deal seriously with the topic of space travel is perhaps *Elite* (1984). This was a space-based combat and trading game set in eight galaxies of 256-star systems, each of which was navigable through a range of spacefaring vessels. During the player's travels they would encounter alien species, interstellar police and enforcement personnel, and a range of natural resources and potential in-game activities.

In the more recent *Mass Effect* (2007–2012) series, players captain the *Normandy*, a top-secret military-exploration vessel, in an epic space-opera narrative that takes place across years, uncountable solar systems and planets, and around a dozen fully developed alien races with their own cultures, societies, and religions. Space travel here expresses the cosmopolitanism of the imagined universe, trade and cultural exchange, and also military power. In the *Dead Space* series (2008–2013), immense spacefaring mining vehicles with little interest in comfort or leisure dominate the game's aesthetic scope, with interiors and exteriors that ruminate on the pragmatics of spaceflight, the challenges of surviving in zero-gravity, and the struggle of humanity to become a multiplanetary species. Alternatively, a game such as *No Man's Sky* (2016) is about the emancipatory beauty of privatized space travel, in which one controls a character able to explore a staggeringly vast algorithmically generated universe (with stars numbering in the billions); but the variety of the worlds that can be explored, not the means that allow this exploration, is the focus.

All of these games display detailed futures of space travel, but there is one game that stands above all others for the depth of its interstellar imagination and its focus on a "rebirth" of the human race heralded by affordable space travel. In this section, we will focus on one of the most striking, famous, and often controversial depictions of the future of space travel, both for leisure and for other purposes, to be found in video games: that of *EVE Online* (2003–present). In *EVE*, players control a human character, normally within a spacecraft, as they carry out whatever actions interest them in a vast virtual universe with several hundred solar systems, thousands of planets, tens of thousands of moons, and hundreds of thousands of players. In contrast to many other games which portray solar systems and the stars, planets and other structures or natural features that occur within them, the solar systems one explores in *EVE* are truly immense in scale.

New pilots find themselves flying smaller vessels, such as "frigates" or "cruisers" which, although still significant in size (the smallest being the size of a commercial airliner) are dwarfed by the vessels more experienced players can pilot, such as "titans," which stretch to around 20 kilometers in length. The player is able to equip their ship with a tremendous range of "modules" that enhance or alter its abilities and capacities in various ways: one can boost its speed, its offensive or defensive capabilities, cargo capacity, or any number of other parameters. All of these serve to protect and assist the player's actual human character, known as a "capsuleer," who is buried deep within each ship they pilot; as we will show shortly, the human individual whom the player controls, is otherwise both harmless and defenseless, and it is this state that creates one part of the space tourism interest that *EVE* has to offer.

When remaining in the central or "high-sec" (high security) solar systems of the game universe, players are generally protected by an AI-controlled police force, who pilot powerful vessels, enforce the game's very few rules, and cannot be evaded or prevented from carrying out their jobs. However, the further out from these core systems the player ventures, the less this police force protect them, until upon reaching "null-sec" (no security) systems the player is entirely on their own, and at the mercy of vast player-controlled corporations who continually vie for dominance in these wild, uncontrolled areas of the virtual universe. Owing to this freedom *EVE* is also noteworthy as an "unbounded" game (Carter & Gibbs, 2013, p. 47), which is to say a game where an unusually broad set of activities are permitted for players. Players are actively allowed to lie, cheat, and deceive others, as well as take actions that will fundamentally shift the play experiences of others, which in most massively multiplayer games would be frowned upon or entirely prevented. Although only a brief summary, it should be clear from this description that *EVE* is unique, vast in scope, deep in complexity, and concerned with both gameplay and the creation of a convincing universe where space travel has become *de rigueur* and accessible to many.

Within this unusual and often brutal universe, there are two elements of space travel (which, in *EVE*, is closely interwoven with present notions of space tourism) which we think are valuable to consider. Both of these elements, as with our previous analysis of cinema, point toward an emphasis on the role of "rebirth" in contemporary media depictions of space tourism. The first involves the portrayal of the lives of space pilots in *EVE's* universe, and the sacrifices and compromises—mechanical, cybernetic, biological—they must be willing to make in order to explore the universe.

This element foreshadows the possibility of a profound ontological rebirth for the human race, wherein people become *something* quite new in order to take advantage of space travel. The second is the profound shift *EVE* hypothesizes will take place in human society, economies, and politics as a result of affordable space travel, shown through the mutual constitution of *EVE's* politics, social structures, and technologies of spaceflight. In this second case, a rebirth of human society is promised with the advent of widespread public space travel, of which space tourism is a central element, and suggests a deep relationship between space technology and the sociopolitical dynamics of human civilization. As such, space travel in *EVE* shows a rebirth of both the body, and the body politic, in both cases leading to quite profound shifts in human experience.

We now turn to the role of the human in *EVE*. Although almost all of one's time as a player entails controlling spacecraft, strictly speaking the player is controlling a human character, who is in turn controlling the vessel. The characters one plays as in *EVE* are what we might call symbiotic humans. Although a player's character is able to get up, walk around, and perform many of the functions we would normally associate with the baseline human condition, characters are paired fundamentally with two other technologies. The first is the "capsule," a small, minimalist spacecraft resembling an "escape pod" which is devoid of any leisure or luxury and serves, effectively, as nothing but a self-contained life-support system for space travel.

The second is a cloning technology, which enables the player's characters, if (or far more likely in *EVE*, when) killed, to return to life at a space station where their cloned body has been stored. This has led to a range of behaviors by players to manipulate their capsules and to the possibility of multiple clones to be used in different contexts; because human bodies can also be enhanced, different cloned *copies* of the player character can be developed by the player, possessing various strengths and weaknesses. However, all of this, in a narrative sense, is contingent on being comfortable with the reproduction of one's body and memories, and the synthesis between these bodies and the capsule hardware supporting it, making spacefaring humans functionally immortal but at the cost of the uniqueness and distinctiveness of the single, once-lived life. As a vital part of the viability of personalized individual space travel, in *EVE* the human race has to undergo a rebirth from individual living forms into something perhaps like a *hydra* (a functionally immortal microscopic organism) or a fungus, able to produce perfect copies of themselves in order to weather disaster, expand its reach, and survive in the space environment. Although

EVE does not explore the psychological or social implications of this shift much outside of the game's background fictional detail, which few players actually engage with, it suggests a form of biological rebirth appropriate to space travel which would no doubt bring with it profound social implications.

EVE, therefore, emphasizes an interesting dichotomy: the tremendous potency and technological sophistication of the vessels the player flies around in against the almost complete defenselessness of the capsule, and the human within, once a ship is destroyed. When a ship is destroyed, the capsule's only "move," so to speak, is to flee the site; the capsule is slow, lacking in weapons, and its armor paper-thin; it is consequently easy prey for those who might wish the player's character harm unless it successfully flees. In turn, *EVE* also suggests that this fundamental frailty of humans in the face of extraplanetary space will necessitate some of the less-than-appealing compromises with technology.

Within the capsule, one's human character is shown as being hooked up to pipes, tubes, consoles, and numerous other technological devices that allow for indefinite survival; additionally, because it is so likely that the character *will* be slain, cloning technology has been developed to replace the physical form of the daring space traveler. *EVE* thus suggests that, unlike air travel, space travel will *always* be dangerous, due to both the inherent threats of the environment and the political structure that has been mutually constituted alongside normalized spaceflight (more on this shortly). This challenges claims that space tourism or private spaceflight will eventually be akin to air travel, arguing instead that despite human mastery of technology, the dangers of the two environments (and the political and economic models associated with them) are profoundly different. *EVE* also implies that the pressures on the human body in space travel are not just qualitatively distinct from other modes of transportation (which we know to be true), but also that these pressures can only be overcome through the fusion of human and machine. This, once more, challenges the techno-utopian assertion that all challenges of the extraplanetary environment (on bone density, blood pressure, and the like) will eventually be fixed through non-invasive technological means. *EVE* suggests that these can be fixed, but only through a level of cybernetic melding likely unacceptable to the majority of humans walking around today.

The second element in this rebirth is the shift in sociopolitical formations depicted in *EVE* as a result of affordable space travel. The shift is manifested in numerous ways—a new form of democratized space exploration, a distinctive economic system, and new dominant political structures that have emerged (without deliberate intervention from the game's developers) within this "unbounded" virtual simulation. We begin by considering the democratization of space exploration; there are numerous examples in the game of this process, but a most striking one came from an addition implemented into *EVE* almost a decade ago. In the *Apocrypha* update in 2009, the universe of *EVE Online* was expanded by the arrival of a new range of solar systems for players to explore, known as "wormhole systems" or "W-space."

Until the appearance of wormhole space, players existed in what was retrospectively known as "known space" or "K-space." These were solar systems linked across a complex and expansive nodal grid, and as described earlier, they ranged from safe systems to systems where only one's allegiance to the ruling corporation is sufficient to (generally) keep one's ship intact. By contrast, wormhole space came with a set of interesting characteristics. It could only be entered or exited through wormholes, which would regularly appear and disappear outside of player control; these would sometimes link to other W-space systems, and sometimes to K-space systems, profoundly upsetting the fixed topology of the in-game universe and creating an ever-changing network of potential travel routes. Whereas players visiting systems in K-space were always told how many other players were inhabiting that system (although not their locations), visitors to W-space were left entirely in the dark; one could be the only capsuleer in a certain system, or there could be a vast fleet of battleships waiting around the next moon. Lastly, a number of locations in W-space were replete with rare and unusual items, connected deeply to the game's overarching mythos, and could only be located through the use of the game's "exploration" system: the deploying of sensors and the triangulation of points of potential interest. This can be done by any player who equips their ship appropriately; the resources needed for exploration are strikingly cheap. It requires some level of understanding about coordinate systems and a level of spatial reasoning, but it is nothing a player could not quickly master.

These elements of exploration indicate *EVE's* understanding of the place of the individual in the outer space of the future (space tourism), and the role of corporations and larger bodies (space travel more generally). In exploration in *EVE*—foremost in wormholes—the game speculates about how space travel will intersect with space exploration. To date, space *exploration* (and space science as a whole) has remained profoundly divorced from space *travel*. Space exploration and space science are domains of national agencies and carried out in the pursuit of globally relevant scientific discoveries, while space travel and space tourism are understood primarily as being something for use by individuals who would pursue these space activities for the purposes of leisure and personal enjoyment (or rapid transport) rather than a greater intellectual benefit for the human race. In *EVE*, however, space exploration and space tourism become unified into a single whole, foreshadowing the possibility of a future where the lowering of costs for space technology leads to exploration and science conducted by a wider public. This could be seen as a sustained, concentrated task, or even as a passing, trivial interest, a distraction, something to be done by the wealthy amateur (akin to much of the travel performed by Western Europeans during the "age of exploration"). *EVE* thus combines these two forms of the present real-world space industry into one, suggesting that space exploration and space science might undergo profound democratization in the future, reshaping how knowledge is acquired.

Next, we consider the roles of trade and business in the *EVE* universe, what these can show us about space travel, space tourism, and the role of the individual in the space environment. As noted previously, one of *EVE's* defining features is its complex and dynamic in-game marketplace. Players are able to buy and trade a wide number of goods; set up "buy orders" and "sell orders" as one would in real-world markets; view graphs and charts that relay to the viewer the progression of the prices, demand, and the geographical purchasing patterns, of particular commodities; and the like. A central part of the market is the moving of items within the space of the game world. Unlike many massively multiplayer games where commodities are, in essence, intangible, and in many cases can simply be "sent" to a player (wherein that item magically finds its way to the other player), in *EVE* items and resources must actually be shipped from one system to another.

In order to do this, players utilize vessels ranging from small cargo ships up to vast and monolithic freighters that ferry huge volumes of cargo slowly, gradually across the galaxy. CCP Games, that produced *EVE*, boasts a professional economist on their staff who assists with studying and refining the in-game economy (Schiesel, 2007), so this element is central to the game's overall presentation, and its depiction of space. Just as the aesthetic and thematic elements of the spacecraft emphasize industrial pragmatism, the possibility of space-based trade focuses on the difficulty of trade, the everyday requirements of such exchanges, and the expansion of contemporary capitalist forms into a space environment.

The third element that shows us the rebirth of human society afforded by regular personal space travel, on both the macro- and the microscale, is the political–economic climate depicted in *EVE*. This climate is simultaneously enabled by the form of space travel imagined within the game but also shapes the kinds of space travel that are available to players and, in a fictional sense, what kinds of space travel are understood as being the most valuable or the most viable. Numerous scholars have noted that *EVE* can be readily understood as a "neoliberal project" (Carter, Bergstrom, & Woodford, 2016; Johnson & Mejia, 2017; Taylor, Bergstrom, Jenson, & de Castell, 2015); its powerful economic simulation, complete with a set of game mechanics that encourage an almost anarchocapitalist approach to business, loyalty, territorial acquisition, and military conflict, have become some of the game's more famous and defining features. *EVE* is a game that rewards and praises "unfettered capitalism and the pleasures and powers of/in accumulation" (Taylor et al., 2015, p. 380). This is performed through the use of spacecraft traveling around a spatial structure (the extraplanetary environment) that enables a profound freedom. The expansionist push of the games' politics is well reflected by this means of travel, while the scarcity of boundaries or borders that can be easily imposed around "space" suggest a political structure which emphasizes individual achievement, competition, and the striving for the accumulation of wealth, territory, and other symbolic markers of possession.

To summarize, *EVE* posits a reciprocal determination between spaceflight and the social structure that surrounds, enables, and is constructed by it. Space travel of the sort depicted in *EVE* seems ideally suited to a competitive universe of extreme, unfettered capitalism, while such a tacit political consensus encourages the construction of military and trade vessels, the constant expansion of human reach, and routine contests for supremacy. *EVE* thus assumes existing neoliberal forms and explores their potential future conflation and entanglement with personalized space travel, resulting in a future both recognizable and more intense than the neoliberal world we presently inhabit.

In this section, we have examined the depiction of space tourism, and space travel more generally, through *EVE Online*, a massively multiplayer video game. *EVE* offers, perhaps, the most detailed vision of space travel to be found in any video game. In a tremendously complex virtual universe with hundreds of thousands of players, spacecraft are used for battle, for trade, for exploration and science, and much else besides. Although in many cases these purposes require very different vessels used in very different contexts, *EVE* also addresses the convergence or synergy between domains of space activity that are currently distinct, such as the nascent space tourism sector and the well-established domain of space science. It posits a world where space tourism does not just entail the notions presently being imagined by its supporters, which is to say a domain of pure leisure, frivolity, and sightseeing, but also entails a number of other possible activities (exploration, trade, etc.), all contingent upon a considerable growth in the availability of space travel as a whole. Nevertheless, despite the excitement and possibilities of space tourism (imagined broadly) that *EVE* displays, an emphasis on the *pragmatics* of space travel shines through, a far cry from utopian imaginaries of space travel that are ubiquitous in the promises presently surrounding space tourism (as noted at the start of this chapter).

In the game, one can take it upon oneself to explore the uncharted reaches of space as a private citizen, but doing so is dangerous and risky, due to both the particular natural challenges of the extraterrestrial environment and the decisions and actions of other human pilots who occupy the same territory. One can travel the universe to see its more distinctive sights and spectacles, but one must still pay for one's spacecraft and for appropriate defenses, even as the unwary pilot remains under the existential threat of the airless outer space environment. Humans in *EVE* have gone to the far reaches of this galaxy and colonized those distant corners, yet they remain continually fought over, uncontrolled by any central authority, and are hence some of the most dangerous places to live.

In turn, the vision of space travel presented in *EVE* is intricately tied to the vision of the surrounding wider political–economic climate (colonization, conflict, politics, and espionage). *EVE* posits that a far-future space-faring civilization will be structured along political lines which are indistinguishable from, and intricately interwoven with, the technologies with which its citizens travel, do business, do battle, and explore. *EVE Online* thus reproduces the axiomatic sociological precept that all new technologies do not exist independently but are rather constituted by, and constitute, political and social relations. Therefore, the future of space travel and space tourism will be contingent not just upon technology, but how that technology becomes embedded in society and for which purposes it will be used.

CONCLUSION

In both cinema and video games we have explored some of the prominent depictions of space travel and tourism, and the technological, social, and political entanglements they show. Although their visions share some commonalities, they also demonstrate important distinctions, especially when we compare them to the media output of the space tourism sector. If it considers technology as a means to achieve economic prosperity, in *EVE, Elysium* and *Gattaca*, among others, technology is at the heart of political and social relations. Not only does technology allow humans to travel to and settle in space, but also allow the development of new or additional mechanisms of control. The enhanced humans or cyborgs that technology engenders remain within an anthropocentric and dualistic system of values. As such, transhumans are rational, generally male, from a Western origin, abiding by capitalists and patriarchal ideas, and opposed to nonhumans.

In *Elysium*, the (apparent) final victory of the citizens of the Earth over the government of it is above all a victory of human beings over machines, of a social system over a computerized one. As Dónal O'Mathúna writes, "the portrayal of enhanced humans in many movies is of those who are missing something deeply human" (2014, p. 294), such as the minister of foreign affair on *Elysium* and the director of the factory where Max works, or in *Gattaca* the man selling his "superior" DNA to the unenhanced protagonist, allowing him thus to go into space. In both *Elysium* and *Gattaca*, ordinary human characters end up winning over the enhanced ones, which seems to be a symptom of the lack of readiness of humans to become posthuman cyborgs in the sense intended by Donna Haraway (1985), namely as "creatures in [a] post-gender world," that have transgressed the boundaries of the animal, machine, and physical realms. Similar to space tourism entrepreneurs, *EVE, Gattaca*, and *Elysium* fail to situate humans as social and historical figures and refuse to integrate transhumans within their original embodied and material network of political, social, and biological relations as promoted by posthumanists (Ferrando, 2013, p. 32).

EVE and space tourism enthusiasts suggest that affordable space travel will lead to transformations in human society, economics, and politics, whereas it seems that space travel cinema sees it differently. Genuine touristic opportunities in space (travel for leisure and novel experiences) would only take place after social and political concerns such as gender and human/non-human divides have been addressed. While *Passengers* promised a kind of (idyllic) space tourism, both technological failures and social issues (such as isolation, medical condition, and social class) hinder the protagonists' exploratory journey. In opposition to the space tourism sector, it seems that serious sci-fi films still doubt that space tourism can become a reality in the near future. Developing a kind of posthumanist world, *The Hitchhiker's Guide to the Galaxy* points to the political, ethical, and environmental transformations that the human species needs to undergo before harmonious space tourism can be envisaged. According to O'Mathúna, to prevent the enhancement of humans inevitably leading to new social inequalities and discrimination—a recurrent outcome in the film—humanity would need to "develop a powerful ethic of defending the vulnerable" (2014, pp. 292–293), a moral standpoint noticeably absent from our history.

Throughout this book and in the literature of space travel, we observe how space travel often appears torn between being a solution to and an extension of humanity's problems. While films such as *EVE*, *Gattaca, Elysium*, and *Passengers* suggest that space exploration, settlement, and tourism will be interwoven with deeply problematic dynamics, *The Martian* reinforces the myth of the hero. For Sherwood (2011), the option of possible-future human spaceflight exploring Mars is deeply linked to the myth of the Hero in a way, similar to the Apollo missions when humankind first landed on the Moon. Myths, Sherwood writes, are essential for creating the political will to develop human space flight. *The Martian* appears as an ode to the Enlightenment and to human beings as reasoning and "technicized creatures" (Lemmens, 2015, p. 3), who escape the material reality of their world and environment. In a striking moment that supports Sherwood's idea of the hero myth, people all around the planet are awaiting the return of the American astronaut. The production of the film even created an interactive marketing campaign for the film, encouraging potential viewers to "Save Mark Watney."

In *The Martian*, the astronaut is in fact reborn within the ideals, and anthropocentric and sexist flaws, of this Enlightenment humanism. By denying his embodiment as a mortal being that is embedded in an intricate network of social, political, historical, economic, environmental, and technological relations, Mark Watney refuses to become a posthuman cyborg (Haraway, 1985). Nowhere in popular media do we see the idealistic image of space tourism, outlined earlier in this paper, repeated—such an image appears either naïve or possible but with deep political repercussions. Examining these media depictions allows us to both consider the different kinds of regenerations that space travel could bring to the human race and imagine what future space tourism might (or might not) look like, beyond its portrayal by enthusiasts.

Acknowledgments – We are grateful to the editors Erik Cohen and Sam Spector for their insightful comments and the opportunity to contribute to this collection.

This page intentionally left blank

Chapter 5

VIRTUAL REALITY AND SPACE TOURISM

Katarina Damjanov
David Crouch
University of Western Australia

Abstract: Virtual reality technologies have given rise to a new breed of space travel, enabling touring of cosmic environments without leaving the Earth. These tours democratize participation in space tourism and expand its itineraries – reproducing while also altering the practices of tourism itself. The chapter explores the ways in which they alter modes of establishing "authentic" tourism destinations and experiences, rendering outer space into a stage for the performance of space travel, while themselves facilitating novel avenues for its social organization and technological assertion. Virtual space tourism not only reflects the progression and metamorphoses in tourist practice and production but also has the potential to influence both the aspirations and prospects of our space futures. **Keywords**: virtual reality; experience; media technologies; touring; simulation

INTRODUCTION

During 2016, NASA's Kennedy Space Center Visitor Complex in Florida offered the public exclusive tours of Mars. Rather than launching its visitors

Space Tourism: The Elusive Dream
Tourism Social Science Series, Volume 25, 117–137

ISSN: 1571-5043/doi:10.1108/S1571-504320190000025007

into orbit and space-shipping them to the neighboring planet, its exhibition space was transformed into a Martian landscape. However, there was no rusty red dust covering the ground, the hazy pink skies did not appear overhead, and there was no sudden drop in temperature or atmospheric pressure. Instead, the room became part of the virtual reality (VR) installation *Destination: Mars* (2016). Visitors were individually fitted with a headset which enabled them to "walk into" a realistic 3D simulation of the red planet. Wearing the Microsoft HoloLens, they were able to experience an augmented or mixed reality in which a virtual rendition of imagery collected by the sensory apparatus of the Curiosity rover was overlaid upon the layout of the exhibition space, allowing them to experience the sensation of moving through an alien environment. This was enabled by the adaptation of software called OnSight, originally co-developed by Microsoft and NASA's Jet Propulsion Laboratory to support Curiosity's operations by aiding the rover's command in analyzing terrain and determining pathways.

The sightseers followed Curiosity's tracks and were led through several Martian sites by a digital holographic projection of astronaut Buzz Aldrin and rover driver Erisa Hines from Jet Propulsion Laboratory; they toured the key scientific activities and discoveries that make it possible for the visitors to "be there." Through *Destination: Mars* terrestrial space tourists shared an "immersive" interaction with the landscape of another planet (see Chapter 2 for discussion of terrestrial space tourism). While unique, this experience of touring places in outer space from the Earth is becoming increasingly common; this VR attraction set on Mars signposts far wider developments in VR technologies, in the practice and production of tourism and in the nature of space travel.

Destination: Mars is just one of the many virtual tours that feature outer space in their itineraries. There is an increasing host of VR packages that offer forms of tourism set beyond the globe. They span a range of destinations, proposing journeys across our solar system and beyond – from a *3D Virtual Tour of the International Space Station* to *StarTracker VR – Mobile Sky Map* (2016), which enables its user to "dive into a 3D star field" (2016, n.p.). Generated from the imagery and data gathered through the enterprise of space exploration, these tours combine diverse virtual interfaces with equipment such as goggles and headsets, wands, data gloves, and head-mounted displays to provide immersive simulations of environments in which to move, see, and interact with virtual artefacts. A range of them can be accessed through desktop computers, laptops, tablets, smartphones, and gaming consoles at home or while on move. Others are presented at public forums for group experiences such as *Destination:*

Mars, or Lockheed Martin's *Mars Experience* (2017), which transformed a school bus into a setting for a trip to Mars, its windows acting as the screens through which to experience a virtual journey on the red planet. Increasingly "out there" in their varied forms, these virtual tours not only register a popular interest in outer space, but also suggest the emergence of a distinct form of space tourism – one which harnesses the intermediation of technologies, the synthesizing possibilities of VR, and our collective aspiration toward outer space.

The proliferation of these remote space tours emerges from ongoing developments in VR technologies. Since hesitant beginnings in the late twentieth century, VR technology has grown significantly in scale. Advances in hardware and software – in particular the rise of affordable domestic headsets such as Google Cardboard, Microsoft HoloLens, HTC Vive, Samsung Gear VR, and Oculus Rift – have brought VR to the masses, providing what they describe as "fully immersive" experiences "with realistic graphics, directional audio and HD haptic feedback" (HTC Vive, n.d., n.p.). Propelled by ever-present market forces, the consumption of virtual realities has become an everyday activity for many, with "reaches far beyond gaming and entertainment" (Scolaro, 2016, n.p.), and it is anticipated that consumer spending on VR will grow from "\$108.8 million in 2014 to \$21.8 billion worldwide by 2020" (Ewalt, 2015, n.p.).

The virtual tour has thus far emerged as one of the most noteworthy and popular forms of VR application; tourism industries themselves increasingly incorporate them in order to market their products, to inspire consumers, and to enhance their experience of certain destinations. However, VR is used not only as a means of attracting visitors to museums, galleries, noteworthy places and panoramas, or particular hotels and resorts, but also as a form of tourism itself. Its purview is to give a preview of a destination, and also to enable an intrinsic kind of "armchair" travel. VR tours have increased not only the overall numbers of those who can be considered "tourists", but also the display of destinations exponentially – their synthetic worlds now even take the users to locations that they would otherwise be unable to visit, places which are expensive, dangerous, or impossible to reach. It is no surprise, then, that outer space is one of the key directions being taken by the evolving courses of virtual tourism. It is an inhuman environment, financially and logistically inaccessible to most, and thus far very few have toured it. Set in outer space, the VR tour promises the experience of traveling its expanses while never leaving the Earth. As a means of exploring the cosmos, it might thus also indicate the evolution of space travel, in general, and of space tourism in particular.

The design of these armchair tours emerges from transactions between the hard-science and creative industries which gather around the exotica of outer space to provide novel, virtual modes of its exploration. VR technologies are prominently used for astronaut-training simulations and a range of space activities such as scientific research, planning, and aerospace engineering. For example, a HoloLens aboard the ISS is used to "provide virtual aid to astronauts" (NASA, 2015, n.p.), augmenting procedures with holographic images superimposed onto objects the astronaut is interacting with and allowing those on the Earth to "see from an astronaut's point-of-view and send them drawings and other visual instructions on how to complete tasks" (Franzen, 2016, n.p.).

NASA has developed various VR applications designed to advance and bolster space endeavors, such as systems that assist "scientists in planning rover drives and even holding meetings on Mars" and make "studying Martian geology as intuitive as turning your head and walking around" (NASA, 2017a, 2017b, n.p.). These virtual advances in outer space are increasingly finding their way into public culture. *Destination: Mars* (2016), for instance, was not only adapted from the VR set-up used in Mars operations, but after its time as an attraction in Florida, it was further re-developed into a freely available application – *Access Mars: A WebVR Experiment* (2017), which now allows "anyone with an Internet connection [to] take a guided tour of what […] scientists experience" (NASA, 2017a, 2017b, n.p.). Part of an interest in outer space and its exploration more broadly – transposed from the fields of science to the marketplace – such products have, in other words, opened up the cosmos as a public tourist domain. Combining educational and entertainment content with the novelty of virtual environments, they contribute to the gradual domestication of outer space and the socialization of its exploration – moving space tourism from the province of the very few, into the realm of the masses.

VR tours set in outer space are the outcome of ongoing innovations in informatics, media, and communication technologies that have been profoundly altering the domain of tourism. Facilitating the production, circulation, and consumption of tourist sights and experiences, these developments have not only complemented, but also increasingly constituted, the registers of travel. These technologic conditions have created a situation in which tourist experiences are no longer only contained within classic modes of travel but also exist as an experience of "simulated mobility through the incredible fluidity of multiple signs and electronic images" (Urry, 1995, p. 148). As part of this, VR augments tourism. The VR experience is equated with tourist experiences, contributing to a more general movement which conflates real and representational spaces, meaning places are not "fixed or given", but "emerge as 'tourist places'" when they are "assembled" or "produced through networked mobilities of capital, persons, objects, signs and information" – as "places to play" (Urry & Larsen, 2011, p. 119). At the same time, VR tours of space extend the arena of tourism beyond the confines of the globe, affording the experience of space travel for all. As part of the new socio-spatial interface that complicates distinctions between home and away, the presence and the absence, authentic and staged (Hannam, Butler, & Paris, 2014), they amplify the metamorphoses that technologic advances have conferred upon tourist modes and suggest the prospective forms they may take.

The effects of VR space tourism are many and varied, and their repercussions are yet to be established. VR itself is still an emerging medium, and extraterrestrial tours still an undeveloped manner of travel. However, our primary aim in this chapter is to review the recent and current forms of virtual space tours in their nascent stages, to chart their proliferation and growing sophistication by providing examples of their different manifestations, emphases, and the range of locations they include in their itineraries. We consider how these synthetic spaces transpose the practice of touring into outer space, explore how virtual space travel might influence the constitution of our "touristic" disposition, and suggest some of the changes that VR space tours appear to introduce into the broad motivations undergirding our desire to "go beyond."

Outlining the range of "immersive" experiences offered to VR space tourists, we suggest that this medium not only appears to widen the stage upon which we are able to perform the role of tourist – elongating its acquisitive gaze and complicating its prerequisites of physical presence – but also contributes to the greater mapping of outer space as a tourist site. We close with a brief consideration of the potential limitations and future possibilities of virtual tourism in outer space, reflecting upon the ways in which these tours technologically extend the tourist into the spectacle of space exploration as well as reveal a social and organizational capacity to influence the direction of space tourism and also our collective aspirations in outer space – to determine, in other words, the very conditions of how we approach, arrange, conquer, or acquire, new places to travel.

VIRTUAL REALITY EXPERIENCES OF SPACE TOURISM

Accelerations of interest and investment in progressing the itineraries of space tourism and the capacity and applications of VR technologies have rendered outer space into an infinitively travelable site. While the journeys of the very few tourists who have ventured beyond the globe have consisted mostly of visits to the ISS, the affordances of VR are permitting space travel into myriad other destinations, supplying tours of popular celestial bodies such as the Moon and Mars or more exotic locations such as the planet "40 light years away" featured in *NASA VR: On the Surface of Planet TRAPPIST-1d* (2017, n.p.). VR technologies have the potential to change not only the entertainment industries, information consumption, and the mobility of the masses, but also the way we interact with the world. If on the Earth, virtual travel enables "transcending geographical and often social distance through information and communications technology" (Szerszynski & Urry, 2006, p. 116), set in outer space, it "transcends" the terrestrial geographies of this world, redefining the ambits of tourism and our relationship with outer space. VR space tours compound the novelties of a virtual environment and space travel; this amalgam, in which both form and content appear new and different, gives birth to a tourist who is part of a "culture of flows" and the hybrid "spaces of 'in-betweenness'" (Rojek & Urry, 1997, p. 11). However, the question that continues to undergird "virtual tourism" (and the idea of simulated travel and movement more generally) concerns the authenticity of the experience itself; as a setting, outer space only further complicates this uncertain and undecided purview.

What we know of the experience of space travel can only be garnered from the limited records of people who can claim first-hand experience, but what we do know of outer space is that it is essentially an inhuman environment, a place in which our presence is both restricted to temporary sojourns and necessarily sustained by technology, where all humans are in effect tourists. By crafting an interpretation of outer space based upon the wealth of techno-scientific data generated through its observation and exploration, VR tours strive to simulate a realistic sense of presence "out there", attempting to bring their audiences as closely as possible to the cosmos without having to leave the Earth. But there are limits to this, and there are as yet no "genuine" replications of inhuman space environments as VR experiences. While a VR gaming simulation like *Adr1ft* (2016) might realistically recreate the "nauseating" and enclosed sensation of floating in zero gravity in a spacesuit, it disregards most of the physics and atmospheric effects of outer space – which ultimately undercuts the illusion of real presence that it sets out to establish. Similarly, *Destination: Mars* (2016) makes it possible to "walk on Mars" in the steps of rovers without the need for oxygen or any thought given to the effects of radiation or a different surface gravity; the authenticity of the experience wavers at the realization that Mars is a place where we cannot be without technological artifice. Yet, it is perhaps also the realization of this utter reliance upon technologies that returns a certain authenticity to the prosthetic VR experience.

While travel in outer space means surrounding yourself in a "bubble" of mediating technologies, touring in VR is an immersion in a technologically created digital environment. In this sense, VR technology could be a suitable substitute for real space travel; technological necessity makes the experience of one continuous with the other. That said, VR space tours are nonetheless consistently concerned with their own presentation or performance of a "real" experience. What the VR industry categorizes under the de facto term experiences are packaged and presented as interactive real-time simulations. For example, a variety of space apps offered through Oculus like *Hello Mars* (2017) and its rendition of the "7 minutes of terror" landing sequence "created strictly based on NASA's public data & research" (Oculus, 2018a), *Solar System* (2015) in which one "can almost feel the structure of distant planets and moons under the feet" (Oculus, 2018b, n.p.), or *Discovering Space 2* (2017), which lets one "[e]xperience the mood and atmosphere of worlds far away from home" (Oculus, 2018c, n.p.) – are all (among many others) marketed as in some way "realistic" experiences. This authenticity is, however, produced through their design – the hardware and software that they rely upon becoming a necessary part of the equation, influencing questions of perception, imitation, and reality. These mimetic environments are increasing in sophistication, becoming more precise, more accurate, but also more able to trick the eyes and mind, and at the same time, they are becoming more accepted as legitimate sites of social practice and authentic interaction.

If the "touristic consciousness is motivated by its desire for authentic experiences" (MacCannell, 2013, p. 101), then the consciousness of the VR tourist complicates our conceptions of what is authentic and reopens questions of what is "real" experience. It is an experience of travel that occurs only through the simulation of presence and interaction with a synthetic environment, and while tourists might "enter" these "tourist areas precisely because their experiences there will not, for them, be routine", they perhaps cast aside "a quest for authentic experiences, perceptions and insights" (MacCannell, 2013, p. 106). While their authenticity might be wholly "staged" (MacCannell, 2013, p. 91), VR tours nonetheless concentrate a distinct form of what Wang describes as the "activity-related situation" of "existential authenticity" (1999, p. 350). Unconcerned with originals and lacking physical substance – but also not entirely the "constructed" product of the imagination – the forms of authenticity that VR tourism navigates are related to both individual activity and technical fidelity rather than the original aura, or the symbolic "social construction" of certain "objects" (Wang, 1999, p. 352). The authenticity here instead lies in the VR experience of space itself – and the validity of a mediated experience, whereby our sense of presence is established through technology. As Wang points out, the emotive experience of something as authentic is not merely an "effect" that "necessarily entails, coincides with, or results from the epistemological experience of a 'real' world out there" (1999, pp. 350, 352, 351); the experience accords with particular ways of relating to and encountering things.

VR tourists in space do not wander about as if they were in a museum, captivated by the experience of being in the presence of authentic things, nor do they feel the weight of places made, constructed, judged, or authorized as authentic; rather than questions of "whether and how the toured objects are authentic", the "existential experience" of this mode of tourism "involves personal or intersubjective feelings activated by the liminal process of tourist activities" (Wang, 1999, p. 351) themselves. As a product of "contrivance" (Cohen, 1995), the VR experience is then in part a projection of the tourist self onto the technologic possibilities of the medium – incorporation of new conducts of experiencing the world. Synthesizing elaborate "non-places" (Augé, 1995, p. 78) that convey the impression of being both "everywhere and nowhere", VR enacts a placelessness characteristic of digital environments – the world as information exchanges and mediated spaces – an experience of "post-place." Suggesting "the interdependencies" and "increasing convergence" between "changes in physical movement and in electronic communications" (Hannam, Sheller, & Urry, 2006, p. 4), it offers the "assemblage" (Germann Molz & Paris, 2015, p. 175) of tourist places – and new constructions or conceptions of spatial experience, that might require new notions of place. In this sense, VR itself might eventually define our experience of the extraterrestrial – a suggestion which only prompts further questions of how tourist experiences of "pre-prepared realities" might come to express our collective sense of occupation and moving in place and space.

While VR itself complicates the geographical nature of tourism, VR in outer space adds still more problematics to the idea that tourist practice involves material experience, a corporeal sense of presence. If real tourism is about "being there" – about a material, bodily experience of physical things – "to be there oneself", as Urry and Larsen describe, "is what is crucial in most tourism" (2011, p. 21) – then the disembodied simulacra of virtual space can offer little in the way of a "real tourist experience." In virtual tourism in outer space those things which are said to drive the urge to physically travel to particular places – such as Urry's (2007) notions of "corporeal proximity" and "compulsion to proximity" – appear to be subsumed by the practices of digital reproduction, duplication, and the screen-based cultures and customs of contemporary information and media technologies. This is not to say that VR erases the need for physical space or replaces bodily experience with something that is purely immaterial. All forms of VR space tours necessitate some material provisions (involving the bodies of tourists and often-cumbersome equipment) and occur in certain physical spaces, but this terrestrial arrangement is only a stage itself, set to be overlaid with virtualizations of data and images designed to mingle with and manipulate the senses.

VR space tours incorporate various virtualization techniques to simulate as-immersive-as-possible environments and enhance a sense of presence. For example, Lockheed Martin's *Mars Experience* (2017) includes a gigantic Martian dust storm with atmospheric effects added to the transparent HD displays that filled the windows of the moving school bus. While VR presence is still primarily evoked through sight, such experiences also involve haptic controls, vibrating grips, analog joysticks, rolling balls, buttons and triggers; while "touch controllers" provide "intuitive hand presence in VR – the feeling that your virtual hands are actually your own" (Oculus Rift, 2018, n.p.), a set of sensors track and translate the movement of the body into VR. VR equipment is hand-controlled and "hands on" (adding kinds of tactility into the activity and experience of navigation). There have been many other examples in which bodily sensation is blended with virtual imagery: experiments visually enhancing the experience of weightlessness accompanying human space travel, for instance, the *EarthlightVR* (2017) display, which used HTC Vive in combination with visual and tactile effects to simulate the experience of spaceflight training. VR tourisms are increasingly directed toward different forms of sensing the external world and indicate the potential to become truly multisensorial. However, their fusion between the body and technology suggests a new kind of "sensorium", a new medium of sensory experience that suits a place of expanded optics and multiple, manipulable gravities. Encouraging an intertwining of the tourist and technology, virtual travel in space validates "accounts of tourism as embodied, multi-sensuous and technologized performances" (Muecke & Wergin, 2014, p. 228), while making possible "effects and sensations that would otherwise be beyond human experience"

(Haldrup & Larsen, 2006, p. 285). Grounded in what Virilio describes as an "innovation of artificial vision," these interpretations of outer space involve "delegating the analysis of objective reality to a machine" – and proliferate as a symptom of "the new industrialization of vision" and the "growth of a veritable market in synthetic perception" (1994, p. 59).

If authenticity itself no longer appears as an objective quality, then it too is only ever constructed. In VR, the quest for real experiences of exotic places becomes the quest for places that are well-staged (minutely stage-managed as "authentic experience"). This substitution is in part legitimated through social constructions but also in the pleasures of reflexive play and the coded "enjoyment" of digital "surfaces" (Cohen, 1995). However, as Wang describes, once something "is turned into a kind of tourist *activity*, it constitutes an alternative source of authenticity" (1999, p. 359). When constructed in outer space, these "alternative authenticities" are again reframed, and through the technologies of VR, the act of substitution becomes a form of compensation, a matter of surrogate activity.

Using a prepared and prearranged choreography, VR tours offer an optical, symbolic, sensorial, and above all potentially "enchanting experience" (Bærenholdt, 2016, p. 407). This is what Bærenholdt describes as "a relational accomplishment that requires both the performance of visiting 'experiencers' and the affordance of the spatial design of the place and artefacts visited" (2016, p. 407). While individually negotiating their experiences, virtual space tourists themselves become involved in processes structuring the "emerging authenticity" (Cohen, 1988) of extraterrestrial destinations and ultimately "authenticate" tourist places beyond the Earth. If authenticity is performative (Wang, 1999; Zhu, 2012) and "connective" (Bærenholdt, 2016, p. 400), then the "immersion" of VR itself becomes a process of what Cohen and Cohen (2012a, 2012b) call "authentication." This is not a matter of discerning truth, but instead, as Bærenholdt puts it, an awareness of the play of "real-fake tensions" (2016, p. 401). From this perspective, the experiences of VR tours are "authenticated" as the toured objects and sites are experienced as "real", despite an awareness of the illusion that underlies them. A tourist in virtual outer space might "almost delight in inauthenticity", knowing "that there is no authentic tourist experience" (Urry, 1995, p. 140), neither on the Earth nor outside it.

While tourism might transform "authentic" spaces into settings suitable for its ongoing operation, the extraplanetary environment has no "ordinary flow of life" or any "natural texture of the host society" to reflect, and thus its authenticity is one which is entirely "reconstructed, landscaped, cleansed of unsuitable elements, staged, managed, and otherwise organized" (Cohen, 1972, p. 170). While VR presents a state that is perhaps "more real than reality" (a reality beyond the mundane, an ultra-real experience composed of more than mere simulation), the tourist experience itself is not independent of the ordinary world. As space tourism, VR might be technically inflected fantasy, but as Wang puts it, "such a fantasy is a real one – it is a fantastic feeling. Despite being a subjective (or intersubjective) feeling, it is *real* to a tourist and thus accessible to him or her in tourism" (1999, p. 360). Because any space travel itself requires an "environmental bubble," VR products that offer to technologically extend the tourist's "*generalized* interest in things beyond" (Cohen, 1972, p. 165) are thus made part of the practice and production of tourism and recognized as genuine experiences within its registers.

Staging Tourist Sites

Virtual space tours emerge from our relative absence beyond the planet. Although the humans who venture off the Earth have only been as far as the Moon, ever-increasing portions of outer space have already been well charted and mapped, scrutinized and classified with increasing detail, including areas in which no human has yet arrived. Our progressively sophisticated digital maps of extraterrestrial space (which are virtual spaces in themselves) are inscribed with cartographic symbols, names of topographical features, celestial objects, formations and events, discovery dates and the courses of past missions, suggesting points of human interest, or at least human bearing, and marking out our exploratory ventures into space. Outer space in this sense appears as a destination already plotted with tourist itineraries, with the equivalent of brochures, postcards, and travel information.

VR space tours develop directly from these extrapolations of space exploration; they are set in a pre-emptively coded space and themselves "package" it for consumption. As such, they may afford the impression that everything has been done already – a virtual environment accessed hundreds of thousands of times might not elicit a sense of discovery or suggest the experience of exploring the untouched territory. Yet, it is in this pre-ordained process that places are marked as and become tourist destinations, complete with identifiable spots to visit, routes to follow, sights to see, and sites to consume. Through naming attractions, plotting tours, selectively presenting and manipulating inviting images of significant places, and providing celebrity guides as "points of contact", VR tours preset outer space for all the practices and performances that tourism might involve. Incorporated into virtual realities, specific locations like craters on Mars or the Moon, technologies like Curiosity and the ISS, and figures like Buzz Aldrin, themselves become crucial, recognizable, navigational coordinates which are vital for preserving the tourist bubble in a space otherwise mostly empty of recognizable human "signs."

Rendering outer space into a tourist site, VR tours offer new ways of looking (fresh and multiple perspectives on place) through a combination of advancing imaging and data visualization techniques and the cutting-edge optics of space exploration; they suggest new formations and reconstitutions of what is called the "tourist gaze" (Urry, 2002; Urry & Larsen, 2011). In VR, vision is penultimate, the ability to see is still equated with the freedom to move – a mobile gaze is made to move through the VR environment, but there is often the chance to choose destinations as they appear, to zoom in upon locations at will. The emphasis on sight in these journeys confers new possibilities on the embodied tourist gaze (Urry & Larsen, 2011). It is these possibilities in particular which are exploited and encouraged by VR space tourism.

Using information "disembodied" in signal transmissions and re-embodied through a gaze that is situated in place via technology, VR tours of space return elements of sensory, bodily experience to something that would otherwise remain abstract. For example, the current prevalence of "360-degree" excursions into space locations employ state-of-the-art video technology and the omnidirectional format in order to provide panoramic studies of optical vertigo such as the European Space Agency's *Space Station 360* (2016) tour of the ISS. Many of these provide the tourist an imaginary viewpoint, but often also take on the view of particular humans and technologies in space. Russia Today's panoramic 360-degree video tours of modules of the ISS (best watched through a VR headset) are taken from the perspectives of astronauts such as Andrey Borisenko, and applications like *Access Mars* (2017) involves the tourist "walking on Mars" by adopting in part Curiosity's view and using its optical apparatus to navigate. Offering perspectives anchored by particular people or devices, VR productions of tourism in space strive to make places like Mars feel both individual and familiar (to give it a human bearing). In other words, they are another way to mark or make it accessible to humans. Collecting information as a kind of experience, the gaze of the tourist is "embodied" in the VR environment, and thus these tours are able to duly deliver the tourist into the broader spectacle of space exploration.

Beyond the limited range and vision of human space activities, VR space tours are also able to provide impossible spectacles, inhuman perspectives, standpoints that are alien, and unfamiliar (even for space technologies such as rovers). For example, *Titans of Space 2.0* (2016) promises to take audiences on "a ride" across an "authentic miniature Solar System" with "accurate visuals" of "over 40 celestial bodies" and the chance to "squint your eyes in the intense light of a few of the largest known stars" (Oculus, 2018e, n.p.). These tours offer the inhuman ability to fly, dart in very near, and out very far, to jump vast divides and move around huge objects. They provide a God-like omniscient vision through which one can see not only what individual technologies and missions have been able to record but also a composition of what space exploration has been able to grasp. The visual experience of tourism is thus in a way heightened in virtual realities of outer space, given dimensions, capacities, and emphasis which not only exercise, but enhance, the tourist gaze. These synthetic environments both compound the image-saturation of tourism and tourist practice and perpetuate its dependence upon spectacle. If the tourist gaze is a performative gaze, and VR vision is likewise part of a performance and if space exploration itself performs our ability to "see" beyond our planet, then the kind of performance delivered in VR space tours involves a very particular set of practices that relocate and replace the touring body "out of this world."

VR experiences involve performing the "tourist" itself, requiring a space traveler to perform their own experience. But outer space is nearly empty of tourist activities. In reality, there is little to do in space: no hotels or restaurants to try or museums to explore. Striving for realism and similitude, however, these applications avoid elements of fantasy. They, for example, include no encounters with aliens or other life forms (see also Chapter 3). Instead, like all forms of tourism, they provide some form of structuring narrative to additionally augment a tourist experience. For example, the BBC's award-winning *Home: A VR Spacewalk* (2017), which is based on NASA spaceflight training simulations, combines "a compelling narrative with multisensory technologies like haptics and biofeedback", opening up the "emerging possibilities of interactive storytelling" (Melcher, cited in REWIND, 2018, n.p.) that "puts you at the center of the story, taking you on an emotional and personal journey while delivering beautiful, heart-stopping, and memorable moments" (REWIND, 2018, n.p.).

VR tours use varied forms of narrative to immerse the tourist into space exploration. Sometimes, they even assign specific roles and tasks such as in the "NASA approved", "VR experience" *Mars 2030* (2017), which involves "taking on the role of an astronaut" in order to traverse "Mars and collect geological samples that uncover the planet's past" (Fusion Media Group, 2017, n.p.). Similarly, *Home: A VR Spacewalk* (2017) creates an experience "that'll put you in the (space) shoes of astronauts like Tim Peake" (Svetlik, 2017, n.p.), and *Mission: ISS* (2017) lets the users "learn how to move and work in zero-gravity" (Oculus, 2018d, n.p.), while *Access Mars* (2017) and the "free drive" function of *Experience Curiosity* (2015) put the tourist in control of space technologies like rovers. Placing VR tourists as space explorers – whether human or non-human – these roles and characterizations indicate narrative performances designed to enhance the development of an extraplanetary imaginary. However, the narrative forms of these space tours only operate within the multiple yet "fixed" settings of outer space, and there are only certain roles available to perform.

The possibilities for action and activity in a VR space environment are determined by the particularities of its digital simulation. In other words, they are "already decided by both the technical procedures and social organization of their terrestrial 'moorings'" (Damjanov & Crouch, 2018, p. 7). Whether it be a matter of just passing by, casually observing various nebulae and a constellation or two, or doing more interactive activities such as "docking cargo capsules, conducting spacewalks, using tools for maintenance" (Singletary, 2017, n.p.), the field of possible action has already been mapped and calculated. Even when set in the future, places are pre-plotted and pre-programmed. For example, *Mars 2030* (2017), featuring "40 square kilometers of open Martian terrain, accurately mapped and modeled using NASA's Mars Reconnaissance Orbiter HiRISE satellite data" (Fusion Media Group, 2017, n.p.) allows one to wander Mars with the "displays for your suit and rover" showing "biometric data and life support gauges to add authenticity to the experience" (Moon, 2017, n.p.). It includes a precise set of tasks rehearsing a performance or story of inhabiting Mars: "collect samples and then analyze them under the virtual microscope in your habitat that's designed after an actual NASA concept for the first Mars-bound spacefarers" and then follow the steps to "beam your findings back to Earth like a real astronaut would" (Moon, 2017, n.p.). The scripted form of these interactions means that these "performances" are highly regimented by what is known about space but also by our aspirations toward space. Although these tourist experiences are staged in a pre-emptively plotted outer space and require additional inscriptions of it as a tourist site, they themselves pre-plot the future direction of space exploration, envisioning its settings, actors, and actions. While doing so, they mimic and also delimit and condition (even perhaps predetermine) the way our futures in space might proceed.

Virtual Reality Futures of Space Travel

The ability to access virtual environments which afford the sensation of "being there" in space stems from the material and social conditions underpinning the interrelated momentum of technological innovation, the evolution of tourism, and the progress of space exploration. At the same time, the extension of space travel through accessible VR technologies also transforms it into a social, everyday practice – into a form of touristic "conquest" of new domains which may itself shape the circumstances from which it emerges. VR space tours underpin, in other words, what Lefebrve calls the "historical problematic of conquests" (2004, p. 97), as it now begins to appear beyond the globe.

Through their choreography of science and technology, education and entertainment, experience and exploration, they reframe conquest as forms of mediated and momentary occupation, giving a new direction to its unfolding in outer space. If the contemporary practice of tourism is now something constituted from "a complex 'assemblage' of bodies, mobilities, portable technologies, concrete infrastructures, networked spaces, and virtual places in which the social and the technological are mutually determined" (Germann Molz & Paris, 2015, p. 176), then VR tourism in space extends these terrestrial "assemblages" into potentially infinite space beyond the globe. However, these applications also maintain tourism as a social practice within space that is otherwise empty of relational activity. Thus, they not only reflect terrestrial socio-technical aggregations of tourism, but also elongate them outside the globe, and in doing so also indicate the potential for different kinds of tourist, new ways of seeing, performing and feeling places, new organizations of human movement and extraplanetary mobility. The ways in which these tours and tourists are incorporated in our exploratory agendas surrounding outer space might then inform how we domesticate its technologically driven "conquest."

Just as real space tourism is beginning to be more organized on the Earth through companies such as Virgin Galactic and SpaceX – which promote and promise future tourist visits to the ISS and suborbital and orbital flights, signposting a potential mass form of space tourism – this is also true of VR space tours. Like in real space tourism, where a set of key players are already emerging, the organization, the direction, emphasis, and possibilities of the VR space tourism sector is decided by their producers – the tech companies such as Microsoft, Google, and Facebook, which develop particular itineraries and certain experiences. There are already attempts to impose familiar, "terrestrial" ways of organizing mass forms of tourism on the practices of VR tourists in outer space, undertakings to arrange and dispose its varied itineraries. For example, *The Intergalactic Travel Bureau VR* (2017) app suggests a traditional and frank (albeit satiric) way to order space tours: through the institution of the "tourist agency." It is designed around a variety of tailored tours and adopts forms of organized mass tourism reminiscent of the tourist "junket" or all-in-one group vacations. This further asserts narratives of tourism into the broader experience of VR space tours, alongside certain forms of sociality. What this suggests is that the production and organization of these VR space tours might eventually become part of a potential struggle around the broader "representation" of outer space – that the rights to VR space tourism will in part involve the right to imagine human itineraries, experiences, and prospects in space. Their location outside the Earth does not preclude them from terrestrial matters of power and control. The image-politics and strategies of representation of VR space tourism have the potential to manipulate the masses' perspectives on outer space, and thus may influence our more concrete approaches to it. Whether outer space becomes a site of "cosmic commodities" (Cubitt, 1998, p. 68), may be in part resolved as a matter of tourism or, more precisely, as part of the extension of the organization of tourism through VR space travel.

Although VR space tours are in a way a democratization of space travel, whereby the cosmos is organized and laid out as a visual, interactive story for the masses, these products are still very much made by the elite and for the elite. Their tourists are perhaps a different kind of elite. They are not only tech-savvy and "at home" at a digital interface but, perhaps more importantly, those who can afford the time and equipment (or the entry fee) needed to roam synthetic galaxies. Thus, they also imply a different kind of tourist with different tourist imaginaries and appetites. Casting the "complex assemblage" of tourism out into space even before real tourists can properly reach it, they register what Johnson and Martin call the "anticipated futures of space tourism" (2016, p. 135). Catering for both the VR elite and the "emergent" VR tourist, these space tours both widen the scope of possibilities for evolving concepts and practices, such as "personal spaceflight", "citizen space exploration", and also encourage a far broader vision to emerge: one that involves emancipatory kinds of space travel, formed from a more individualistic, lifestyle-oriented model. Travel in VR might sharpen and give three-dimensional form to "the imaginative visioning" of real space tourism: the imaginaries "of eventual passengers, and their mobilities, that is co-produced with industry representatives and stakeholders" (Johnson & Martin, 2016, p. 148). It extends these imaginaries of exploration and future travel through the mediation of techno-enhanced social performances of tourism. These tours enable us to envision human prospects far into space (rehearsing and reflecting the desires and aspirations encouraged and engendered by space industry stakeholders) but they also present a new instrument for the manipulation and management of human imagination and aspiration.

VR tours extend the general participation of the masses in space exploration. They help conceive it as a collective endeavor (even if this is only an "elite" segment of the masses). They do allow a far broader group of people to participate in the scientific exploration of outer space. Programs such as *Access Mars* (2017), which was originally designed for NASA research into the topography of the Gale Crater, enables a wholly mass-tourist-orientated "experience" of the virtual modes of space exploration used by science. This tendency toward encouraging citizen space exploration and "citizen science" is likely to evolve and will just as likely involve VR users participating even more closely in space exploration through popular strategies of "crowdsourcing" the collective intelligence to aid scientific research. The *SpaceVR* project, for example, has elaborate plans for further integrating VR technologies with space exploration in the near future. Starting with launching 360-degree VR cameras that will "feed footage from low earth orbit back to Earth", they aim to create the "world's 1st Virtual Reality (VR) satellite, delivering Cinematic, Live, Virtual Space Tourism", in which "consumers can experience space travel in immersive virtual reality" and through which "anyone can explore the universe" (*SpaceVR*). While such plans are indicative of the "consumption" of space by VR, they also have the potential to both further the democratization of space exploration and heighten our collective immersion in it, potentially enabling everyone to be involved in its techno-scientific "conquest".

While VR tours of outer space could soon occur in real time and be concurrent with space exploration, they already extend into its prospective futures. Usually, space tourists arrive at a location after it has already been surveyed by professional explorers. For example, it is only after years of occupation by astronauts who are officially designated as the "envoys" of humans in space that tourists are permitted to visit the ISS. VR tourists, however, are not only able to retrace the routes of an astronaut's exploration, surveying the territory after it has been conquered, they are themselves also able to participate as our envoys in space. Our Martian futures, for instance, are frequently portrayed by VR tourism, anticipating various scenarios regarding our presence on the planet. *Mars 2030* (2017) imagines a future astronaut "habitat", while *Mars 2117* (2017) envisions even more distant futures and projects the

United Arab Emirates' plans to "build the first settlement on Mars" through a "virtual illustration of what life might look like" (Hale, 2017, n.p.). Although both present different visions of Martian futures and perhaps anticipate different forms of its conquest, they also bestow their users with the distinction of being our envoys on the red planet. In this process, they also stake a claim to the future tourist imaginaries of Mars, to a particular image and interpretation of how our interactions with other worlds will unfold.

In addition to these future scenarios, there are more practical and immediate plans to integrate VR technologies into real space tourism. For example, in prospective suborbital tourism, spaceflight will provide the effects of weightlessness but not offer a good view (of the Earth or of space), so tourists could be equipped with VR to extend or complete the experience (Guarino, 2015). While astronauts are already using it on the ISS, perhaps in the future tourists on the ISS or elsewhere will use goggles and VR to enhance their experience. In the creation of virtual worlds, space exploration itself merges with the tourist story. Like the "prominence of maps and geographical exploration as a narrative trope in 'cartographic fiction'" (Leotta, 2016, n.p.), VR aids in triggering the "tourist imagination" (Crouch, Jackson, & Thompson, 2005). It's blurring between mediums and media, the superimposition of filmic imaginaries, gaming environments, science fiction, with the realities of technology and scientific practice complements, attempts to tap its symbolic potential. Yet, on the other hand, the dominant way in which VR space tours will function in the future might not be to augment human space exploration and tourism, but as a major substitute for it.

The lived experience of space travel might not only remain too expensive for most – and be so uncomfortable, risky or boring, and the fidelity and comfort of the VR travel so high – that human travel in space would be made redundant, as it could be achieved more easily by technologies. Be that as it may, the merging of virtual and real environments of space exploration continues to develop, suggesting that it may eventually become difficult to distinguish between the two. As VR is progressively made part of the space exploration through the possibilities of real-time imaging, tele-robotics and three-dimensional printing, it also extends the aspirations for space tourism and sculpts the ways in which it evolves.

CONCLUSION

Strapped to your face, VR goggles are prone to fog; sweat can build up on the insides, which become blurred and humid, and after extended use, red marks can rim strained or sore eyes. Some virtual environments are sensitive; if one moves too fast, the fracturing images cause instant headaches. The cord that connects the system can often entangle the user's legs, tripping them up. The visual affordances of VR tourism, its "immersive potential" and ability to simulate kinds of embodiment on other worlds, are thus "brought back" to the Earth by very material bodily requirements and discomforts. In other words, they are checked by a still-uncomfortable interface between our bodies and the material assortment of VR technologies, and by the difficulties encountered in attaching, or accommodating, the apparatus adapting virtual environments to physical space. These discomforts and problematics currently appear as limiting factors in the development of the kinds of tourist practice that we have discussed here. It should be acknowledged that VR is still a developing medium and that VR tourism in outer space is still in emerging form – and thus our commentary can only be provisional. Yet, as the global market responds to the desires and needs of an already growing population of virtual space tourists, it seems plausible to expect that along with VR hardware and software advances, these forms of travel will continue to transform and develop.

While its current modes might change (and such possibilities may already be indicated through the haptic interactivity of augmented and mixed realities), it is the immersive qualities of the VR medium which appear to offer the most potent forms of change. In the enterprise of space exploration, the physical discomforts of VR appear slight. The practical applications of not only VR technologies – but also the advantages of having so many sets of eyes able to observe and record – are many and varied. VR tech has proven useful for walking astronauts through tasks and overlaying instructions and manuals, it has also encouraged a democratic, or at least demotic, participation in the observation and exploration of outer space. For example, Jet Propulsion Laboratory's Matthew Clausen imagined that through VR there is not:

> just going to be the astronaut walking around, but there will be millions of people here on Earth that are untethered from the limitations that they have, because it will be safe for them to fly above the surface and go ahead of the astronauts and actually help them gather the data. (cited in Lewin, 2016, n.p.)

In this speculation, the whole of outer space is opened up to the surveillance by the masses and exposed to the all-seeing, armchair tourist gaze. Here VR operators would be intimately involved in not only a social performance of travel and tourism but also a performance of the greater human aspirations toward outer space.

Virtual reality experiences are commonly described as "intense," and while narrative might undergird them, VR itself is not merely a genre. The novelties of the medium itself hold potential for influencing the leisure, practice, and spaces of everyday life. As Guttentag suggests, the "guaranteed experience" (2010, p. 644) of VR tourism might offer a "substitution" for physical travel. As a replacement, it would trigger a variety of potential transformations in the ways in which we define authentic experience, establish our presence in particular places, perform our ability to move through and "capture", and how we organize the mass exploration of unoccupied territory. While much of this potential lies in new visualizations of the social interactivity facilitated by flexible networks of digital communications, VR does not have to be a "social" technology (in the narrow sense of being a platform for socializing, for seeing, and being seen). While it has that social potential, as demonstrated by various emerging online VR chat spaces, it is also a medium which invites immersive isolation (akin to an isolation tank), a respite from the social interaction of media-saturated lives. At the same time, VR is also increasingly incorporated into highly public, location-based experiences, variants of the *Destination: Mars* (2016), *Earthlight* (2017), and the *Mars Experience* (2017) exhibitions discussed earlier. A future of "VR parks" suggests a different direction in the application of the medium that may indicate both the establishment of new kinds of VR tourist and a series of alternate tourist routes. Alternatively, they may fade away as the novelty wanes. In either case, VR tourisms that are set in outer space appear as a product of *supplementation* rather than substitution.

The social potential of VR might, however, also be seen in a quite different application of VR in space travel. Rather than transporting those on the Earth into space, it could be used by both astronauts and space tourists to entertain themselves on long or monotonous missions, distract themselves from unpleasant sensations and effects, maintain social connections, and prevent isolation. From this perspective, they could themselves tour the virtual Earth from space. The implications that virtual realities might present for tourism, travel and human mobilities, in general, remain uncertain. There appear few real consequences for the virtual space tourist: no impact is made upon a local culture or ecosystem, and there is little risk of injury or death. But while VR might remove the historically negative impressions left by tourism, it might also remove its history of adventure and imaginative potential. An enhanced and easily accessible intimacy with outer space might have the reverse effect and "extraordinary" touristic experiences might become routine, standardized, and blurred with the mundane (Cohen & Cohen, 2012a, 2012b; Guttentag, 2010). As a form of mass tourism, VR might continue the erasure of "heroic travel" (Wang, 1999, p. 352), instead offering the common people an opiate of simulated images and "pseudo-events" (Boorstin, 1964) as compensation for the adventure of real travel in space. This would remain an activity solely reserved for the elite or very rich. While separated from any real experience of outer space, VR tourists could thus be made to prefer the imitation or at least left unable to assess its authenticity. Dictated by the design of these virtual realities, the touring mass could be controlled, lulled into insensibility – the "fantasy" and "enchantment" of tourism used to compensate for a lack of real travel – for the otherwise earthbound condition of the mass.

Nonetheless, VR space tourism not only reflects the progression and metamorphoses in tourist practice and production but also has the potential to influence both the aspirations and prospects of our space futures. VR technologies may "offer new resources and new disciplines for the construction of imagined selves and imagined worlds" (Appadurai, 1996, p. 3), but this also means that virtual tourism reflects upon the wider condition and transformation of human societies and suggests that new modes of perception, interface navigation, data mapping, and the manipulation of complex three-dimensional spaces will not only become part of everyday life, but be made a measure of our general disposition toward futures beyond the planet. Alongside these changes will be attempts to capitalize upon the "tourist traffic" in outer space. The codes that dictate virtual space may also become moral or social codes, a new set of rules, classifications, and borders dictating how we approach, establish, and police the presence of tourists in outer space. In the meantime, it appears that the sophistication, supplementation, and compensations of dwelling and traveling in virtual space will progress; as this technologically mediated tourist practice not only continues to fracture into wider arrangements and rearrangements of real and imagined destinations, it may also influence the design and direction of how we move on and outside our own planet.

This page intentionally left blank

PART III
ADVANCES

This page intentionally left blank

Chapter 6

EXPLORING MOTIVATIONS OF POTENTIAL SPACE TOURISTS

Jennifer Laing
Warwick Frost
La Trobe University, Australia

Abstract: While there have been several quantitative studies about potential motivations for space tourism, there is a lack of qualitative research which explores these motivations in greater scope and depth. This chapter, based on the data gathered from face-to-face, telephone, and online interviews of potential space tourists, identifies nine likely motivations for space tourism, with hedonic examples such as thrill-seeking or risk-taking; eudaimonic examples such as challenge, curiosity, spirituality, and nostalgia; and extrinsic cases such as seeking distinction or a desire to motivate and assist others. Suggestions are made for marketing future space tourism experiences, as well as recommendations for succeeding research. **Keywords**: motivation; space tourist; eudaimonic; hedonic; experience

INTRODUCTION

The search for new and unique tourism destinations is seemingly never-ending, with space being one of the latest tourist experiences on offer. Although people have dreamed for centuries of flying in space, until recent

Space Tourism: The Elusive Dream
Tourism Social Science Series, Volume 25, 141–161

ISSN: 1571-5043/doi:10.1108/S1571-504320190000025008

times it was a pleasure reserved for the elite few, generally professional astronauts or cosmonauts. Space tourism officially became available to civilians, albeit the wealthier element, in 2001, when US millionaire Dennis Tito flew to the International Space Station (ISS). Between 2001 and 2009, seven private citizens traveled to the ISS as space tourists, alongside Russia's cosmonauts in their Soyuz capsule, and paid between US \$20–40 million for the privilege. This pipeline concluded in 2010, as the seats were thereafter used to accommodate larger crews of professional astronauts. Space tourism has not since resumed to the ISS, leaving an opportunity for commercial operations to fulfil latent demand and extend space tourism beyond the high-end customer.

Recent developments include the construction of Spaceport America in New Mexico (Spector et al., 2017), designed specifically for commercial spacecraft, such as those belonging to Elon Musk's SpaceX, and Sir Richard Branson's Virgin Galactic companies. SpaceX plans to send a tourist in 2023 on a lunar free-ride trajectory aboard its Dragon V2 spacecraft, while tests are continuing on Virgin Galactic spacecraft, with the aim of taking private tourists to suborbital space, just beyond the Earth's atmosphere. This is likely to herald a new era of tourism: one that sees space tourism available to a greater segment of the population, albeit those able and willing to pay on average US \$250,000 a trip.

Space tourism might be characterized as one of the growing number of "extraordinary" hedonic experiences that have attracted attention from tourism researchers, such as river-rafting, sky-diving, polar trekking, or explorer travel (Arnould & Price, 1993; Celsi, Rose, & Leigh, 1993; Gyimóthy & Mykletun, 2004; Laing & Crouch, 2011; Laing & Frost, 2014). It has been argued that space tourism might differ in terms of the level of independence or personal control over decisionmaking that a tourist will have with respect to the experience, given the "technical and organizational complexity of space travel" (Cohen, 2017, p. 25), at least in the current era. These are issues that need further investigation. To date, there has been limited academic research on this emerging but still rarefied form of tourism, including exploration of the motivation and demand for these experiences and how these data might be used for marketing purposes.

MOTIVATIONS FOR SPACE TOURISM

Current evidence of the demand for space tourism comes from a variety of sources, including commercial and government reports and the occasional academic study. However, the eclectic nature of space tourism makes it difficult to compare studies, as some focus on orbital or beyond orbital, while others deal with suborbital experiences, which are the cheapest available due to reduced energy costs required (Spector et al., 2017). The broad nature of space tourism may also include terrestrial tourism activities that are linked to space, such as visits to radio telescopes, space-themed museums and attractions, planetariums (Laing & Crouch, 2004) and, more recently, virtual space travel (as discussed in Chapter 5 of this book).

Crouch (2001) reviewed extant studies and argued that they were essentially a starting point, suggesting that there was positive demand for these experiences, although he felt that this previous work over-emphasized the importance of price. These studies also failed to take into account or "trade off" other attributes such as perceived levels of safety and risk, the conditions within the spacecraft, the length of the journey, and the type of activities offered to potential tourists. For example, would consumers accept a higher price if it meant higher safety levels or a longer journey? Is safety something that people would be willing to even trade off for other attributes? As Crouch notes,

> The more detailed the question in terms of its realism and explicit indication of the costs and tradeoffs involved for each alternative, generally the more valid the results […] [and thus researchers should be] quite clear as to the attributes and costs of possible alternatives, including the 'no-choice' alternative. (2001, p. 218)

With this in mind, Crouch recommended that choice-modeling techniques be used to study space tourism demand, allowing for this trade-off between attributes to be measured.

Crouch et al. (2009) address this call through a series of choice experiments within an online survey sent to a consumer panel of Australians, which elicited 783 usable responses. Findings indicate that:

> there is a significant portion of the public, in general, and of high-income/high-net-worth individuals in particular, who are favourably disposed towards engaging in some form of commercial space tourism flight activity. (Crouch et al., 2009, p. 451)

While these findings suggest high interest in engaging in space tourism, it is important to bear in mind that while someone might be willing to pay a certain price for space tourism, this does not necessarily mean that they have or will have the means to do so (Crouch, 2001). Similarly, even where they do have the financial wherewithal, behavioral intention does not always translate into actual behavior.

Respondents in this study were sensitive to price in the case of zero-gravity flights, particularly suborbital flights. Limited training requirements were preferred, rather than a more extensive program. Interestingly, the degree to which people engaged in other risky activities appeared to have a negative impact on their choice to take part in space tourism. Crouch et al. (2009) note that this may be attributed to greater levels of awareness of the risks inherent in space tourism or the fact that their desire for risk may be met through their other risk-taking activities. Cohen (2004, 2017), however, suggests that the lack of personal control over these experiences might make them less attractive to the adventure tourist, who prefers more active activities during which they can pit their skills and display mastery over their surrounds. The findings of the Crouch et al. (2009) study indicate that age also appears to play a part here. The older the respondent, the less likely they are to choose to take part in space tourism. While they are likely to have a greater spending power than younger respondents, they appear to be more risk-averse.

More recent work by Reddy, Nica, and Wilkes (2012) in a UK context also suggests that safety will be a key factor in the decision to undertake space tourism. Contrary to the findings of Crouch et al. (2009), the level of training required is seen as important, with 47% of respondents willing to undertake training for a period of two weeks up to one month in duration. This was linked to minimization of risk in this study but might also have other benefits. While not a finding in this case, high levels of activity and challenge within the training regimen might also help to alleviate the essentially passive nature of the space tourism experience and provide tourists with a sense of achievement. Like the earlier studies, there is evidence of demand, with the majority of respondents believing that this will come from the wealthier echelons of society, who have taken risks to get to where they are and have an adventurous personality.

Crouch and Laing (2004) conducted a quantitative survey of consumer demand in Australia and compared the findings to those of studies carried out in Japan, Germany, the United Kingdom, the United States, and Canada. This study also suggests that a majority of respondents would travel in space if they are able to, subject to various factors such as cost, safety, and product design. Interest is highest among young male respondents, and risk-taking behavior is positively associated with a desire to travel in space. The majority indicate that they would pay one to three month's salary for a space tourism experience, which rules out many of these experiences at present, although 12% are prepared to pay up to a year's salary, which begins to make the suborbital offerings of the likes of Virgin Galactic potentially within the reach of these individuals.

Chang (2015) also reviewed various studies on space tourism demand and pointed out that Astrium, a subsidiary of the European Aeronautic Defence and Space Company, had estimated market demand in 2008 to be in the order of 13,000–15,000 passengers a year. Chang felt this should be of concern to the industry, given that it appears to be much lower than the combined capacity of the leading companies planning to provide these services (Virgin Galactic and XCOR Space Expeditions), which he estimated at more than 21,400 at the time of writing his article. This excess capacity compared to demand may lead to business failure. It is unclear whether high-profile wealthy entrepreneurs such as Richard Branson and Elon Musk would be willing to bankroll an underperforming space tourism business, or to treat the latter as a loss leader, especially if the viability of their other business interests were to change. Therefore, understanding what attracts people to consider a space tourism experience is imperative in order to tailor marketing to reach this audience and develop products that meet consumer needs.

Few studies have considered the motivations for space tourism, but those that have been conducted suggest that they are multifarious. The Reddy et al. (2012) study surveyed respondents in southern England and found that the three most important reasons to travel in space are to see the Earth from space, to experience the sensation of weightlessness, and to experience something which is unusual or novel. Cohen (2017) argues that these studies indicate that space tourism is not seen as a sublime or transformative experience, but rather a hedonic experience that is fun and enjoyable. Chang, in another quantitative study, surveyed Taiwanese respondents about their attitude toward space tourism, as influenced by consumer innovativeness, or "a consumer's attraction to newness" (2017, p. 1435). The latter was defined as underpinned by four types of motivation: functional, social, hedonic, and cognitive. Confirming some of the views expressed by Cohen (2017), Chang's study found that hedonic and social innovativeness are associated with a positive consumer attitude toward space tourism and that this relationship was mediated by perceptions of *novelty*. It should also be acknowledged that some future space tourism activities might be motivated by prosaic reasons linked to its savings in travel time, if spacecraft were to be used for point-to-point travel

(Peeters, 2010; Webber, 2010a, 2010b). There is also the paradox that while space tourism might be motivated by a desire to experience a pristine or untouched environment, the very fact of venturing into these areas defiles their purity (Cohen, 2017).

There is a need for qualitative studies about motivations for space tourism to augment and flesh out the quantitative studies conducted to date, as well as to explore Cohen's (2017) premise that space tourists will not be motivated by spiritual or transcendent reasons but instead are seeking fun, hedonic, and novel experiences. It is also important to consider how these findings might be used for marketing purposes. This chapter aims to fill this gap by addressing two research questions: What are the motivations of people actively planning to undertake space tourism experiences and what are the implications of those findings for future space tourism marketing?

Study Methodology

This study was based on an interpretivist paradigm, to get inside the "heads and hearts" (Wearing & Wearing, 2001, p. 155) of the space tourists studied and explore their experiences and motivations. The methodological approach used was grounded theory. As conceived by Glaser and Strauss (1967), this involves an approach to analysis where theory is generated from data or grounded in the data collected (Neuman, 1997; Seale 1999) and helps to establish themes and patterns (Strauss & Corbin, 1990). It rejects "logico-deductive" methods of building and verifying theory (Ezzy, 2002) that start with an abstract preexisting theory and hypotheses deduced from that theory, which are then tested to verify their truth or falsehood. Instead, "[t]he researcher compares unlike phenomena with a view towards learning similarities" (Neuman, 1997, p. 334). With grounded theory, the researcher is flexible enough to change the focus of the research and the direction as it happens. According to Charmaz (1995, p. 28), grounded theory provides a rigorous way to deal with "rich" qualitative data and is useful for studying motivations, as well as being compatible with the stated research paradigm.

Data were collected through interviews with four proposed space tourists conducted by the lead author, as well as an analysis of four published interviews with two individuals who had flown to the ISS as space tourists: Mark Shuttleworth and Greg Olsen. The participants formed part of a larger study on adventurous tourists (Laing & Crouch, 2004, 2005, 2009a, 2009b, 2009c, 2011; Laing & Frost, 2014). They were asked about their views regarding various forms of space tourism, ranging from suborbital flights to travel into orbit and eventually to the Moon and Mars, even though current technology does not allow them to fulfil all of these desires. The respondents were selected by:

> choosing cases to study, people to interview, settings to observe, with a view to finding things that might challenge the limitations of the existing theory, forcing the researcher to change it in order to incorporate the new phenomena. (Seale, 1999, p. 92)

Data collection was discontinued, once it was felt that no new categories or issues were emerging from the data; a process known as saturation (Glaser & Strauss, 1967). Potential interviewees were contacted mostly by email, requesting an interview and enclosing a copy of the information statement and consent form. This initial contact was followed by an email or telephone call to set up the interview, once the individual had expressed interest in joining the study, at a time and date to suit the study participant. Interviews were recorded and later transcribed to increase accuracy (Sommer & Sommer, 2002; Taylor & Bogdan, 1998).

The interviews, three of which were face to face and one over the telephone, gave respondents the opportunity to tell their stories in their own words (Sommer & Sommer, 2002). Three were male and one was female; three were members of teams competing in the X-Prize, while the fourth was a balloonist planning a space tourism experience. Participants in the interviews are identified here using a pseudonym, although background information for each individual appears in Table 1. Few research interests are served by publishing interviewees' names (Taylor & Bogdan, 1998), with potential downsides including legal problems, the possibility of exaggeration or self-aggrandizement, and/or concealment of important details or information by the interviewee. For these reasons, the identities of the interviewees are not disclosed.

The actual space tourists are nevertheless identified with their real names and identities (Table 2). This is because their information is contained in published interviews in the public domain and thus the objections to identifying participants noted by Taylor and Bogdan (1998) do not apply in this situation.

Techniques set down by McCracken (1988) were adopted in the analysis of data in this study to maximize the usefulness of the data gathered; they

Table 1. Interviews with Potential Space Tourists

Pseudonym	Age[a]	Country of Birth	Country of Residency[a]	Background	Type of Interview
Emily	51	USA	USA	Potential space tourist; works for X-Prize company	Face to face
Evan	55	UK	UK	Balloonist; potential space tourist	Face to face
Leo	32	Canada	USA	Potential space tourist; works for X-Prize company	Face to face
Sean	55	UK	Gibraltar	Potential space tourist; Director of X-Prize company	Telephone

Note: [a]At the time of interview.

Table 2. Online Interviews of Tourists to the International Space Station

Name	Age[a]	Country of Birth	Country of Residency[a]	Background
Mark Shuttleworth	31	South Africa	Isle of Man	Visited the ISS in 2002
Greg Olsen	62	USA	USA	Visited the ISS in 2005

Note: [a]At the time of interview.

are based on the constant comparative method developed by Glaser and Strauss (1967). The first step was to search for individual perspectives and nuances of language (McCracken, 1988). Fragmented conversational data were coded, although less rigidly than the method advocated by Strauss and Corbin (1990) or the line-by-line coding method recommended by Charmaz (1995). The third stage involved forming overarching categories for these coded categories, while the fourth stage compared all coded categories and developed umbrella categories. The final stage encompassed a search for patterns and themes across all categories.

Study Findings

Nine key motivations were identified from the data. Some reflect an interest in *hedonic* experiences, confirming the work of Cheng (2017), implied by motivations such as thrill-seeking, excitement, risk, and novelty, while others reveal an interest in more *eudaimonic* motivations, which involve the self-development and self-realization of the individual (Ryff & Singer, 2008). These include challenge, curiosity, and spiritual motivations concerned with a search for meaning, and nostalgia about a youthful interest in space tourism, even though the experience itself is novel. The findings also suggest there are some *extrinsic motivations* for space tourism, involving the seeking of a goal or reward independent of the experience of space tourism. The data reveal that some participants sought prestige or status from engaging in space tourism, or displayed pro-social motivations, such as the desire to use their trip to educate others about what a space tourism experience might be like or to encourage women to travel into space.

Thrill-seeking, Excitement, and Risk Respondents spoke openly about the potential space tourism offered for hedonic thrills. For example, Emily highlighted the exhilaration that she was anticipating, even in the face of her extreme fear, observing:

> I think I will be scared to death [laughs]. I think I will be excited and very scared, because […] the real possibility will be that this could end up in the worst [laughs] possible way, but the fear is really overcome by the excitement.

For some, the desire for thrill-seeking provided a performative aspect to their fantasy of a space tourism experience. They would resemble an actor in their own dramatic narrative. Thus, Evan commented, "I think I've always been adventurous since a very young age […] creating a bit of theatre. It's fun." He used a dramatic metaphor several times, elaborating on his comment above, "The fact that it's perceived by the general public to be absolutely terrifying is fine, because that's all part of the theatre." *Evan* also referred to space tourism as "a romantic thought, that's all it's ever been really." He was keen however to clarify that while he saw the experience as thrilling, he did not see it as highly risky:

> I wouldn't do this if I wasn't 99% certain I was going to come back alive. I'm not an adrenaline junkie and would never pretend to be. I don't do this for the kicks.

The risks were felt to be real, but still acceptable to most participants. According to Sean, "I wouldn't say [it was] dangerous. I would say the probability of something going wrong is probably higher than with a jet plane, but again, that's the risk you take." Several interviewees remarked that they did not want to look back with regrets on their life, if they did not take this opportunity. According to Leo:

> It sits in the back of your mind that it is an actual risk and the consequences are the utmost. But when you have a dedication to something, you don't really think about it as much. It's not that you're saying "Well I don't really care, if I die, I die", it's more that, well, you're going to go sometime, and if you're doing something that you love, then so be it. Better that than being on your death-bed at seventy and being bored. Do you know what I mean? […] It's not like I'm going to strap myself in without taking a look at everything and making sure I'm comfortable with it.

The latter comment was interesting, given that the likelihood that space tourists will be able to check out the equipment before take-off will be minimal. Mark Shuttleworth (2002a) was also sanguine about the level of risk, observing:

> Of course I'll be scared on the day […] there have been some scary experiences during the training too. But my desire to be part of this pushes through every time. There have been some rocky days but I don't dwell on morbid thoughts. None of us has a licence to potter around on Earth indefinitely. Avoiding every risk won't alter the inevitable. Whatever happens, at least I know I'm choosing to be ALIVE, which I think is more interesting than trying to choose not to get dead at all costs.

His comments reflect a eudaimonic dimension to his desire to be a space tourist, in that he feels he will be more fully alive by taking these risks.

Freedom and Escapism Participants also mentioned the freedom and escapism that they felt that space tourism offered. This might be an example of the hedonic motivations identified by Cohen (2017), but also confirmed the findings of the Reddy et al. (2012) study regarding the attraction of weightlessness. The physicality of outer space appealed to Emily: "Wouldn't [floating in space] be just an incredible sense of freedom?"

However, though seeking freedom, the interviewees noted the paradox that space tourism experiences would need to be highly structured and controlled by others. For example, Sean explained why he normally liked to travel independently, instead of on guided tours:

> You can explore by yourself with no one to stop you from doing anything you want and there are no restrictions really. Unlike [the situation] where you go to a holiday camp and you've got all sorts of restrictions.

He later expanded on these comments: "I think I like to be in control of myself rather than someone else in control of me […] I like to be master of my own destiny," but he concedes that this will not be possible in the space tourism experience he is anticipating. This may make a space flight for Sean less than ideal, due to the likely strictures, routines, and legal requirements which will accompany early space tourism experiences. This point was also made in the literature by Cohen (2004, pp. 323–324):

> The relative insulation and passivity of the space tourist thus contrasts sharply with the exposure and alacrity of the adventurer on Earth. Whether future developments in space technology, and especially the colonization of space and of the planets, will eventually alleviate some of the present constraints on space tourists and endow them with a greater opportunity for autonomous action is at present not yet predictable.

Novelty Space tourism also appealed to some participants for its novelty. This finding was in line with the work of Chang (2017) and Reddy et al. (2012), but this chapter fleshes out why this motive was attractive to participants. In some cases, there was a link with egocentric motivations of doing something that few others have done. As Sean noted, "I like new things and new ways of doing things. Having gone where […] no-one has gone before, because it's getting a bit difficult [to do that] on the Earth at this point." Mark Shuttleworth was conversely interested in how he would react in novel situations:

> Challenges that test me in different ways, that are going to force me to learn new skills and for which I may have no obvious qualifications […] For whatever reason, I'm driven to take on new things and new challenges […] I'm not a mountaineer […] but Everest is there and waiting. (Shuttleworth, 2002b, n.p.)

This desire for novelty might also manifest itself in *metempsychotic* journeys (Laing & Crouch, 2011), where the tourists imagine themselves walking in the footsteps of other pioneers. For example, Leo liked to see himself as one of the people "pushing" the boundaries of exploration:

> Someone's got to push. I mean the Wright Brothers obviously started something when they went flying. Christopher Columbus coming over here obviously started something. Someone's got to start this [space tourism] too, because you can see the results of it. This is just another step.

Curiosity Feelings of curiosity about what they might experience was another motivation to engage in space tourism, which contrasted with other, more hedonic motivations identified earlier. This also reflected an element of metempsychosis, where "the tourist takes on the persona of a significant other or group, as a role model for a particular repeated journey" (Seaton, 2002, p. 155). In this study, this meant that some participants likened themselves to explorers (Laing & Crouch, 2011). Space was ripe for discovery, according to Emily: "There's always a next step, a next frontier. A further going out, a new horizon." She elaborated on this idea:

> It's the same thing that puts sailors on these little biddy wooden sailing ships to sail thousands of miles of uncharted seas, it's the same thing. I think it's a […] it's a type of

> curiosity and you just want to do it because, I think, you want to experience it for yourself. There is not a writer or a commentator or a news reporter or an astronaut who can tell you what it's like. You have to go yourself and find out for yourself what is your response, your reaction. How do you feel?

For Sean, the curiosity arose from speculating how he might feel in space: "I would definitely like to see the Earth from that height and just see how it feels myself really. What does it actually feel like? Psychologically." His reference to seeing the Earth from space reflects the findings of Reddy et al. (2012), but Sean expressed curiosity about how he might react to that sight. This suggests a desire for self-actualization, understanding oneself better after the experience. Greg Olsen (2005) expressed a similar view:

> People who know me understand that this is going to be a life-changing experience for me [...] Dennis Tito [first space tourist] says he thinks about it every day and when you know you've had an experience like that, you feel special about yourself. My guess is that I will appreciate life and try to do more.

For Leo, a potential space tourist, curiosity lay purely in not knowing what is out there:

> You're sitting there, staring at the stars, you know, going, "What's out there? How much further can we go?" You know, there's got to be something more out there than this old planet. So the intrigue about space is I think in everybody. Everybody looks up and says, "Oh I wonder what's out there?"

Again, this crosses over into egocentric motivations, where the individual experiences something that few others have done, and/or have merely wondered about. This potentially sets the space tourist apart from their peers. Olsen specifically refers to feeling "special" as a result of undergoing this experience. This motivation is discussed in more detail later in this chapter. It is interesting, however, to speculate whether this motivation will still be present in the future once space tourism becomes more commonplace. In this way, it might be likened to air tourism, which was once an exclusive pursuit, but is now accessed by an increasingly large segment of the population.

Challenging Oneself The adventurous side of space tourism as a challenge was emphasized in both sets of interviews, and this motivation has not been highlighted in previous studies of space tourism motivations (Chang, 2017; Reddy et al., 2012). Participants looked forward to a sense of achievement or accomplishment in what they were setting out to do. This often involved the physical testing of the individual. As Shuttleworth (2002b) confessed:

> I've always been a geek. I was a bookworm […] What's really interesting for me about this space adventure has been how rewarding it is to challenge yourself physically. I never took sport particularly seriously. Of course now I have to. Some of the physical tests are pretty strenuous. (n.p.)

This perceived need for and interest in physical fitness manifested itself in discussions about the level of training that would be required. Its importance in terms of the experience was both articulated and welcomed by most of the participants. For example, Sean saw training as offering both physical and mental challenges, to which he was looking forward:

> Centrifuge, skydiving, hyperbaric chamber, full medical, lung capacity, all that sort of thing. I think [they] are an essential thing to do. Psychological profiling […] I also think it is part of the whole package as well, you know, the experience, rather than just go up in shirtsleeves in a plane.

Evan also liked the idea of a solid pre-training period and noted, in perhaps a subtle dig at the likes of Richard Branson:

> The millionaire adventurer wouldn't want to do it, because there's a lot of processes and training to go through. But for me, that's part of the adventure, actually going through all that.

Interestingly, according to millionaire Shuttleworth (2002b), "I'm taking on one of the greatest challenges of my life […] the actual training was incredibly disciplined, very detailed, very technical" (n.p.). Leo also thought that space flight would combine both physical discomfort and mental toughness, and the combination appealed in terms of the challenge that it would set him:

> I think for me, the mental challenge [occurred] a long time ago. The commitment to actually do this was completed a long time ago. The physical challenges are this vehicle, [as it] is not a gentle flight, right, you're experiencing five to six g's on the way up and four or five g's on the way down, which on the body is pretty hard.

Emily was one of the few who played down this aspect, stating "I don't think it's going to be that much […] basically it's to know the systems, the controls, if, for some reason, the pilot's incapacitated or whatever." She didn't, however, think that this was something she would be called on to do: "I don't claim to be a pilot or an engineer or something like that. [I'm] strictly a passenger." For her, the major challenge involved dealing with her fear. She referred to a phobia about heights and faced "getting beyond that challenge or those fears." This also accords with Mark Shuttleworth's comments before he left the Earth for the ISS:

> I have moments of great fear when I think about the extreme forces and technological difficulties of manned space flight. Walking through that fear has been one of the ways this project has already been personally rewarding. (2006c)

Spirituality One of the most interesting findings was the suggestion that space was perceived as a potentially spiritual experience. This is interesting given Cohen's (2017) assertion that sublimity may not be present for early space tourists. It appears to go beyond merely the spectacle of looking down on the Earth from space. Emily was particularly loquacious in this regard:

> I think the experience of venturing into space covers all facets of those components that make a human being, and of course that's the physical and the intellectual, the emotional and that certainly would cover the spiritual. I know that it seems to be a common perception that the more scientific you are, the less spiritual you are, but I've met very spiritual

> people in the space program and I personally don't know how you *can't* be spiritual! I don't see how this could not affect you, spiritually.

She went on,

> I know other astronauts from other countries have commented that one of the things that struck them when they were looking down on Earth is that there's no boundaries, there are no state or country boundaries. You know, that's all a human device, a human device. And I think I get some of that from my father, who's in his 80s today, and still speaks of when he flew high, you know, in the atmosphere on the edge of space. It was very spiritual for him.

Leo made similar comments about the meaningful side of space tourism as he saw it, beyond mere thrill-seeking: "You know this is an itty-bitty planet in the middle of a vast space. And you know, just to really put things in perspective." Sean went further, discussing the effect it might have on his beliefs, which suggests a spiritual awakening rather than a religious epiphany:

> I'm an atheist so anything spiritual will be [...] I might get some sort of spiritual [experience] but not in the nature of a God-spiritual type thing or religious spiritual thing but maybe a self-fulfillment or enlightenment [...] I think it may well happen but I'm not kind of expecting it [...] I'm open to it if it happens.

There are suggestions that space tourism might encompass elements of spirituality for some tourists, although further work is needed to tease this out. Future studies could look at the potential contrast in motivations between those who would classify themselves as religious, compared to those who saw themselves as atheistic or agnostic, or consider whether spiritual motivations might play a lesser role in future space tourism experiences if they become more routine or potentially commodified (Cohen, 2017).

Nostalgia A number of participants referred to space tourism as something which they had wanted to do since childhood. This might be categorized as a type of nostalgia, which leads the participant to yearn for space tourism, as a re-connection to youthful and cherished desires. As Leo mentioned:

> The whole adventure into space is a childhood dream. Most people have that dream or a lot of people I work with have that dream. You're sitting there, staring at the stars, going "What's out there? How much further can we go?"

He elaborated on this link with his youth:

> I think it was more the intrigue and the unknown about what was there, what could be there, and stuff like that. And a lot of the books I read as a child were very science fiction. Of course, I was born in the age of *Star Wars* so that does it too.

Sean also read science fiction, referring specifically to a series of space books written by Biggles' author Captain W. E. Johns, and remembers his attraction to space as "the unknown and somewhere interesting to go [...] what it would be like to be on different planets."

Emily referred to games she played as a child, mimicking "the Soviet Union putting dogs in space," where she would tie a matchbox filled with ladybugs to a helium balloon, "and send it out on my kite-string, and that was my space experiment!" She was also an "avid reader" of science fiction, referring to the writer Robert A. Heinlein as "the biggest influence in my life." She still recalls her frustration that developments in space tourism were not as fast as she would have believed possible, growing up in the 1960s:

> I call us the children of Apollo [...] we grew up in the late 60s fully believing that, just like the movie *2001*, there's going to be a regular shuttle service, passenger service to the Moon and back, or at least to orbit and back. And so I think a lot of us were disappointed when the year 2001 came and we're still not up there, we're just in low-Earth orbit.

Distinction The readiness of participants to admit egocentric motivations shows one of the beneficial outcomes of conducting qualitative research into human behavior. While a participant might be reluctant to acknowledge this in the context of a quantitative survey, they might open up and admit this during the course of a long interview, lasting upward of an hour. Thus, Leo saw part of the attraction of space tourism in its rarity: few have done it. This went beyond merely a desire for novelty, conferring on him a special status: "Everybody else has done the mundane. I don't think I should. Not when I have the ability not to." Evan expressed a similar view, referring to the kudos that this experience would bring: "I've always wanted to do it for the fun, for the record, for the money, for the glory." Further research could delve more deeply into this as a motivation for engaging in space tourism, as it is not much discussed in the current literature.

Interestingly, none of the participants used the language of "conquest," which is typically found among explorer-travelers, particularly mountaineers and polar trekkers, as a way of conceptualizing their experiences (Laing & Frost, 2014). It might be linked to a perception that early space tourism would be a relatively passive activity and potentially differentiates space tourists from other adventure travelers.

Pro-social Motivations While many motivations revealed in this study were intrinsically driven (such as challenge and spirituality), a few were extrinsic in nature, in that they were pulled by external rewards. One participant referred to pro-social motives, such as wanting to share information with others or promote a cause or a message through their experiences (Anderson & Shaw, 1999). Rather than focusing on environmental messages and the fragility of the Earth, which were found in the study of adventurous travelers, this study suggests that the participants saw themselves as advocates for space tourism. Emily stated that she wanted to be a role model for women in particular, but also to others as a non-professional who was going to take the leap into space:

> I think what's important is that people will relate to that […] I think once you get regular people, ordinary people, everyday people in space, the public will get more interested. It'll be more real to them.

She also liked the idea of being an inspiration to children in an era where boredom or ennui might be rife amongst youth:

> I'm going back to [thinking about] children again. I think space and the thrill of space and the unknown of space,

> I think it's psychologically healing to people at large because space is still the future […] it gives young people something to look forward to.

This may be a motivation that is only relevant in the early years of space tourism, until it becomes more ubiquitous and loses its ability to give passengers an example to be followed by others or to highlight causes dear to their heart.

CONCLUSION

While there is evidence of demand for space tourism, previous research shows that supply might outstrip it in the early years. A study of the motivations which might engage and attract people to become space tourists is thus crucial, to ensure the long-term survival of the market. An understanding of motivations thus complements earlier work on demand involving choice experiments. While there have been several nascent studies on motivations, limited qualitative research has been carried out to date, to fill in some of the gaps.

This chapter has attempted to do this, thus making a contribution to the small but growing literature on space tourism. It also demonstrates the value of conducting qualitative research that can elicit latent motives or elucidate those motives which the individual might be reluctant to admit to, but he/she reveals during the course of a long interview. This contribution is however limited in terms of the number of people interviewed and was essentially exploratory in nature, as part of a larger study of adventure travelers. A more comprehensive qualitative study of potential space tourists would provide the sector with more guidance about people's motivations for space tourism.

This study suggests that there may be at least nine potential motivations for engaging in space tourism include hedonic motivations such as thrill-seeking or risk-taking, a desire for freedom/escapism and novelty, along with more eudaimonic motivations such as challenge, curiosity, spirituality, and nostalgia and extrinsic motivations like craving distinction or seeking to motivate or assist others. This theory of motivations grounded in the data collected supplements preceding quantitative studies (Chang, 2017; Reddy et al., 2012) and reveal a greater complexity of motivations than might previously have been thought. It appears that deeper, more spiritual motivations are not necessarily antithetical to the quest for hedonic experiences. These findings are more in line with the "sublime" experiences reported by some professional astronauts after their travel in space (Cohen, 2017).

The early space tourist will need to accept high risks and substantial financial burdens (Crouch, 2001). This may be part of space tourism's appeal, given the comments made by some participants in this study about the desire for novelty and a level of insouciance about the risks they will be running. It could also be argued that seeking distinction from these experiences is linked to elements of risk and cost – status is derived from undertaking expensive and potentially perilous activities. The issue of risk is important, in that these space tourists will be engaged in activities over which they have little or no personal control, unlike those participating in other adventurous pursuits, such as trekking or climbing. For some individuals, this would make space tourism less attractive and paradoxically riskier, since they would have to place their trust in others, rather than in their own skills and abilities.

As the space touring experience changes over time and moves from an expensive and rarefied activity to one to which large numbers of people can aspire and engage in, these motivations may change. Like air travel, space travel may one day be viewed prosaically as simply a way to get to and from a destination. Alternatively, the more people engage in it, the less prestigious or novel it might become. Greater commodification of the experience might also lead to space tourism losing its spiritual qualities for some people or becoming a less influential platform for highlighting causes or disseminating social messages. These are all issues that warrant research in the future.

Prospective space tourists have to invest a great deal of time and money, as well as emotional energy, in their undertaking, since they have to endure a long period of training and preparation in order to make the vision a reality. This does not seem to be a problem for most of the participants in this study, and also apparently adds to the attractiveness of the undertaking, in terms of both its novelty value and the level of physical or mental challenge it poses.

Marketing space trips to potential tourists should emphasize the diverse aspects of the activity, in order to tap into the different motivations found in this study and hence increase the levels of demand. For example, merely concentrating on the hedonic, thrill-seeking aspects of space tourism may alienate those who are seeking more meaningful experiences in space, or who are motivated by nostalgia or a desire to trail-blaze. Different products could be developed to cater for various motivations, rather than trying to meet everyone's desires by standard programs. The fact that participants will be largely passive tourists in the early days of space tourism also needs to be explained, to avoid disappointment. Focusing on other aspects of the experience, such as spirituality or the challenge of training, might make up for the lack of personal control over the activity.

This page intentionally left blank

Chapter 7

CURRENT SPACE TOURISM DEVELOPMENTS

Derek Webber
Spaceport Associates, USA

Abstract: This chapter provides a status update as of 2018 on space tourism offerings either currently available or actively in the development process. The aim is to perform an evaluation of how the offerings respond to the aspirations described in the earlier chapters and also to provide a basis for the discussion on implications of space tourism described in subsequent chapters. In addition to analyzing suborbital, orbital, and lunar developments, the chapter discusses the state of the infrastructure supporting space tourism advances. This provides a perhaps subdued reality when compared with the heady initial hopes. **Keywords**: Space tourism; suborbital; space hotels; Gateway Earth; lunar tourism; spaceports

INTRODUCTION

This chapter provides an overall status update on those companies currently involved in bringing space tourism to fruition. We shall need some definitions. For instance, what is 'space'? There is no real boundary between the atmosphere and space: it is a gradual thinning. However, the international astronautical authorities, such as the Federation

Space Tourism: The Elusive Dream
Tourism Social Science Series, Volume 25, 163–175

ISSN: 1571-5043/doi:10.1108/S1571-504320190000025009

Aeronautique Internationale, generally stipulate 100 km as the demarcation line, so we shall use this definition in this chapter. Regarding aspirations, implications, and market demand, the author's contributions are captured in earlier works (Beard et al., 2002; Mihalic & Gartner 2013; Webber, 2010, 2013, 2016), and in Dubbs and Paat-Dahlstrom (2011).

Space tourism began either in 1990 or in 2001, depending on whether you start the clock with Akiyama, the Japanese journalist who flew to the Mir space station, or with the American Tito, who was the first person to spend his own money for a space tourism experience flying to the International Space Station, ISS (in the case of Akiyama, his newspaper funded the venture). This also brings to our attention the sometimes subtle differences between the synonyms used for space tourists. Are they "commercial space travelers"? In which case, Akiyama would qualify. Are they "space flight participants," which is a regulatory category used in US law for some purposes. What about "public space traveler," "private space adventurer," "private astronaut," "civilian astronaut," and "personal space traveler? For the purposes of this chapter, we shall simply use the term "space tourist," while recognizing that for some people, and some circumstances, that terminology would not be exact enough.

The contributors in earlier parts of this book have documented the aspirations for space tourism. Around the turn of the twentieth century, those aspirations had begun to be reflected in realities. By the end of 2009, seven people had spent tens of millions of dollars of their own money to become the first true space tourists. One of them (Simonyi) even flew twice. They all flew on Russian rockets and in Russian spacecraft and went into orbit around the Earth. In an attempt to bring down the ticket price for traveling to space, the Ansari XPrize had been introduced in 1996; the US $10M prize was won by SpaceShipOne in 2004, by flying twice above the 100-km space boundary within a two-week period. SpaceShipOne did not go into orbit. It flew a suborbital trajectory straight up above its home spaceport and landed back at the same place. This was a much less energetic flight profile than was needed for orbital missions and consequently brought the possibility of much cheaper ticket prices for potential space tourists. So, a new class of space tourism was born, and potential developers began to emerge.

That was almost 15 years ago. How well have the subsequent achievements lived up to the aspirations and expectations? We shall see in this chapter that it has been a mixed bag. In one sense, nothing has happened since then because there have been no new space tourists in this period, either for orbital or for suborbital flights. However, a great deal of real fundamental progress has been achieved, which we shall describe, and it would seem that the renaissance is finally about to take place. We shall consider the status of the potential providers of each of the various categories of space tourism in turn and assess their readiness to conduct space tourism operations.

CURRENT SPACE TOURISM DEVELOPMENT

Suborbital Developments

In this section of the chapter, we refer to space tourism which does *not* achieve the Earth orbit. In fact, there are some space tourism precursor activities which do not even allow participants to get on the top of a rocket at all. One example of such precursor offerings is a Zero-g flight in a specially adapted aircraft which flies along a parabolic trajectory. Zero-G Corporation has been successful in providing these offerings at a price point around $5,000. Some firms are developing balloon-launched experiences, such as Worldview and ZerotoInfinity. The balloon missions cannot get into space (if we use the internationally recognized definition of the beginning of space as the Karman Line, at 100 km above the surface) because balloons need an atmosphere in which to ascend, and thus cannot reach altitudes more than about 50 km. Worldview, even when it begins operations, cannot claim to have got its customers into space, despite their undoubtedly awesome experience. Other precursor space tourism experiences include spaceflight simulator training, such as that provided by the NASTAR Center, high-altitude jet flights provided by Incredible Adventures, and of course visits to space museums.

The key to understanding the whole field of space tourism is reusability. The potential market of space tourists is large enough so that economies of scale make sense. The price elasticity of demand for human payloads is so high that this produces the need for reusable, thereby lower-cost space access and hence the need for reusable rockets and spacecraft. This is the area in which a great deal of work has been done since the 2004 Ansari XPRIZE flights. The main companies which have been pushing this reusability paradigm for suborbital operations have been Virgin Galactic (VG) and Blue Origin (with SpaceX having made strides in the orbital category, discussed in the next section). Some other companies which had been hoping to operate in this sector, such as XCOR and Rocketplane, are now in suspended animation, having run out of operating capital before they could generate any revenues.

Perhaps the most visible of the potential suborbital space tourism operators is VG, which is one of the companies led by Sir Richard Branson. VG had a very good start, because in 2004 Branson bought out the technology for his spacecraft from Scaled Composites, builder of the winner of the Ansari XPRIZE, SpaceShipOne. He had already a working prototype which had been flown into space three times. However, SpaceShipOne could only carry two passengers at a time. The historic craft was sent as an exhibit to the National Air and Space Museum, the design was upgraded to allow six passengers, and the new class of spacecraft was called SpaceShipTwo.

Nearly 15 years later, it has still not flown into space, although it has conducted glide tests. SpaceShipTwo is part of a two-craft delivery system. The spacecraft is carried aloft up to 40,000 feet slung under its mother plane, known as WhiteKnightTwo. Then, it separates, fires up its rocket motor, and is intended to head up to the Karman line and beyond. The passengers on board will experience the blackness of the sky even in daytime, see the curvature of the Earth, observe the landscape far below for 1,000 km in all directions, and experience several minutes of weightlessness, before returning in the craft which has become a glider. The mother plane, WhiteNightTwo, also returns to base for refueling, ready for its next mission.

The problem of high-speed reentry into the Earth's atmosphere was solved by using a "feathering" mechanism to slow down the craft, before reconfiguring for a normal glider landing. This technique, developed for the Ansari XPRIZE-winning SpaceShipOne, involves altering the craft's aerodynamic properties by partially folding the wing upward, so that the craft descends somewhat like a shuttlecock, until low enough and slow enough that the wings can be straightened out again for a controlled runway landing. It has, however, proven to take much longer than expected to bring this combination of elements up to the required level of safety to allow passengers to fly on board. In fact, there have been a series of deaths in the development process related to both engine development and use of the "feather" technology, which have added to the problems and time frame of becoming operational. There have also been issues with the choice of fuel for the rocket motor, requiring some detailed design changes. However, the mother plane has now been thoroughly tested, and the spaceship itself has completed its glide tests and is now only awaiting its rocket testing-regime to complete its readiness for customer operations to begin.

There is a long line of potential passengers who have paid significant deposits on the $200,000 ticket price in order to become space tourists. The first among them will be Branson himself, with maybe some family members. He is determined that the venture will be a success and is still hopeful that the first passengers will fly by 2019; this remains to be seen. They have still to test the rocket motor on a series of test flights pushing the envelope to ever-higher altitudes. Meanwhile, funding is not an issue. The government of Saudi Arabia has recently invested $1 billion in VG (Berger, 2017).

Blue Origin is also owned by a billionaire: Jeff Bezos of Amazon. As if to underline the benefits of competition in a commercial marketplace, we note that VG and Blue Origin are developing totally different architectures to provide the suborbital space tourist with the experience of getting beyond the Karman Line. As already noted, the VG space tourist takes off horizontally in a spacecraft suspended below a mother plane. The spacecraft separates off at altitude and fires up its rocket motor, taking the passengers in a parabolic trajectory above the Karman Line, gliding back to base for a horizontal landing. With Blue Origin, the experience is more vertical. The Blue Origin space tourist will take off vertically in a capsule on the top of a rocket. The capsule then separates, and the tourists will descend to the Earth by parachute. Meanwhile, the rocket booster also returns to base to a vertical landing on its launch pad.

Since 2015, Blue Origin has demonstrated all stages of this operation, although we still await the first crewed test flights. Blue Origin has carried out its development test flights from its private spaceport at Corn Ranch, Van Horn, Texas. It named its reusable booster and spacecraft *New Shepard*, to recognize the fact that the mission parallels to some degree that of the first American in space, Alan Shepard, in a Mercury capsule on a Redstone rocket on May 5, 1961. Both craft fly on ballistic trajectories. Both exceed the Karman Line, returning by parachute. Both flights last about 15 minutes. What was a government effort is now a commercial money-earning venture. None of Commander Shepard's spacecraft or launcher were reusable and he needed the entire US Navy Atlantic Fleet to support his recovery.

There has been quite a litany of other companies that aspired to provide a suborbital space tourism experience, but they have all suffered from funding and other difficulties, and so no longer appear capable of delivering service. Among them were Rocketplane, XCOR, Armadillo, Swiss Space Systems, Masten, Eads/Astrium, Starchaser, and the Sierra Nevada. Although, in the case of the latter, the company is still proceeding, supported by NASA grants, but has changed its focus to providing orbital cargo delivery.

Low Earth Orbit Developments

It is perhaps ironical that space tourism began with the orbital category. It is certainly much more difficult to achieve, and therefore much more expensive for a ticket, than is the case for suborbital space tourism. Whereas suborbital prices are of the order of $200,000 or less, the space tourists who have been into orbit each paid at least $20M for their flights. The explanation is that these early orbital space tourism flights did not require a newly designed spacecraft. The Soviet Union decided to offer tourists a ride in empty seats in their Soyuz craft which was already being built to take astronauts and cosmonauts up to the space station. Soyuz can carry three persons, two of whom are generally governmental astronauts who command the spacecraft, take it to the space station, and return it to the Earth. Between April 2001 and September 2009, there were eight such trips with a spare seat for space tourists. Those first space tourists required great fortitude to undertake their flights. They spent months in remote Russian facilities for training and even had to learn Russian in order to be able to handle emergency procedures. Since then, there have been no available spaces for tourists, because all three seats were needed for government astronauts, since the Space Shuttle (the only other way to get crews to the ISS) was retired. The ISS, and its predecessor Mir, both operated in low earth orbit (LEO), which is at an altitude of about 250 miles. In LEO, the space tourists were weightless and experienced a complete revolution of the Earth every 90 minutes, and they typically remained at the space station for one to two weeks. According to Space Adventures, the firm that arranged for those first space tourism flights, there is still a list of wealthy clients who await an opportunity to have an orbital space tourism experience, once a spacecraft supply becomes available.

The Space Shuttle had its last flight in July 2011, and since that time the United States has been developing a replacement for getting NASA astronauts up into space. The new approach will use commercial space taxi firms to take the crews into space to do their work at the ISS. The commercial firms have demonstrated that they are capable of carrying cargoes to the ISS, and SpaceX and Orbital have now been successfully doing this starting in 2012. They are now almost ready to start delivering astronauts in the uprated versions.

SpaceX has developed the Dragon capsule which is totally reusable. They have received $2.6B from NASA for the first six flights carrying astronauts to the ISS. It is to be expected that SpaceX will start to offer LEO orbital space tourism opportunities using Dragon thereafter. The spacecraft takes off vertically on the top of a Falcon rocket. When its mission in LEO is completed, it returns to the Earth landing by parachute. The Orbital Corporation's cargo delivery capsule, Cygnus, is not capable of returning safely to the Earth, and so no crewed version is being proposed.

There is a Boeing contender, however, to provide some competition to SpaceX, and this craft, CST-100 Starliner, is also getting ready to demonstrate that it can safely transport humans into LEO and return them to the Earth. The Boeing spacecraft looks very much like the old Apollo command module; Boeing has received $4B from NASA for delivering six sets of astronauts to the ISS.

Two other potential offerings are less advanced. Blue Origin is proposing a New Glenn launcher and capsule which are intended for totally reusable access to LEO. Sierra Nevada Corporation has managed to get NASA contracts of $363M to use its DreamChaser winged spacecraft, originally conceived as a suborbital space tourism craft, to deliver supplies to the ISS. It remains to be seen whether a crewed version will also fly and be potentially capable of flying space tourists into orbit.

In the much more distant future, there is the possibility of a whole new class of hypersonic vehicle which could take off horizontally, reach orbital altitude, deploy cargoes or potentially passenger modules, and then continue to land on a conventional runway, perhaps halfway around the Earth. Reaction Engines is one firm proposing such a vehicle, called *Skylon*, and that vehicle could potentially be used to fly so-called point-to-point routes taking passengers to anywhere on the Earth in less than an hour. Planetspace and SpaceX have also proposed vehicles to perform that function. However, the business case for point-to-point services using spacecraft is far from being proven. The most progress to date has been made by Reaction Engines, who have managed to demonstrate part of the Sabre engine technology in ground tests.

Where do the orbital space tourists go once they have achieved LEO orbit? Up to now, they have been able to find some room in the ISS. But this is an orbiting laboratory and is not well-suited to the needs of tourists. Nor is it arguably a proper use of governmental funds and resources to make space available in ISS for space tourists to use. What is needed are true space hotels.

There have been various attempts to establish space tourism hotels in orbit, with Mircorp being an early example in 2000, when they purchased the ailing Russian space station Mir to reuse as a space hotel. That venture came to an end when Mir was deorbited as the ISS was launched to replace it. Bigelow Aerospace is the company that has since made all the running in this field. Being way ahead of the game, they launched two free-flying prototype inflatable habitation modules, called *Genesis*, in 2006 (two orbiting space tourism hotels without the means of having visitors arrive at their front porch). More recently, in 2016, they sent up a smaller version, called BEAM, which was attached to the ISS as part of a NASA-funded experiment to demonstrate its capabilities.

The details of what the inside of an orbiting space tourist hotel would look like, what facilities it would contain, what astronaut support staff would be needed, and how the tourists would occupy their time still remain to be thought through. One would suppose, they will need better zero-g washing/showering facilities than those currently on offer for government astronauts.

Although Bigelow has made most advances in terms of providing a space hotel facility for orbital space tourists, they are not the only potential provider. Other operators indicating their intention to provide LEO space hotel facilities include Space Island Project, Axiom, Final Frontier, and Galactic Suites, but these firms are much less advanced in their development status and have yet to launch any hardware into space.

Lunar Developments

Even though the Earth-based space tourism activities have been taking some time to get established, at least two companies have offered a space tourism experience to the vicinity of the Moon. The offering involves leaving the Earth orbit, taking a trajectory to the Moon, circling, and returning to the Earth. No lunar landing is included. This trip would in somewhat mirror the mission carried out by the Apollo 8 astronauts Frank Borman, James Lovell, and William Anders half a century ago, when they became the first humans to leave the vicinity of the Earth and visit our celestial neighbor the Moon. The journey would take about three days in each direction.

This trip was first offered by Space Adventures at a ticket price of \$150M back in 2007. The proposed spacecraft was going to be a Russian Soyuz, with one Russian Commander and two very rich space tourist passengers. At the time, it was reported that one of the lunar space tourists had signed up, but the mission did not take place. More recently, in 2018, SpaceX's Elon Musk has proposed the same mission but using his new BFR spacecraft instead of the Russian craft. Again, one of the potential passengers, a billionaire named Yusaku Maezawa, has signed up and is reported to be taking six creative artists with him on the journey.

Infrastructure Developments

For the space tourism sector to become established as a lasting part of the economy, there is a requirement for some associated ground infrastructure to support the operations. Future space tourists will need to have a place where they go to be trained for their flight, where their friends and family can come to witness the experience, and from where the space tourism adventure takes off and returns to. Such a place called a spaceport additionally needs to have the capability for storing rocket fuels, and to be able to connect with the Air Traffic Control system for takeoffs and landings. This is a new kind of facility, and it may bring about a new kind of architecture (Millard, 2014). To be a successful commercial venture in its own right, a spaceport will probably need to have restaurants, hotels, and entertainment facilities for visiting terrestrial tourists. A fairly thorough list of spaceport features is laid out in an early paper (Webber, 2005).

To have a spaceport in a region is considered as a potential source of business and tax revenue and a support for associated space businesses at the facility. Therefore, there has been a great deal of interest internationally in building spaceports. Some would just handle horizontal takeoffs and landings via a runway; others would operate using vertical takeoffs and parachute landings. There are currently proposals, in various stages of development, to build and operate space tourism spaceports in Sweden, the United Kingdom, Spain, the United Arab Emirates, Australia, and the United States. At present, the only truly operating space tourism spaceport is at Mojave in California. This is where the Ansari XPRIZE activities took place in 2004 and where VG currently executes its test flights. But VG will move from Mojave once it completes its development activities, to New Mexico, where Spaceport America is ready and waiting.

Spaceport America was designed from scratch as a facility for space tourism at a cost of around $200M, largely from local and State taxes. The citizenry around this desert area believes that they have built a facility which will guarantee employment for their children and grandchildren into the future. VG is their anchor tenant.

In the United States, in order to obtain regulatory approval to have a spaceport, it is necessary to provide the documentation to show that the facility does not present a danger to the uninvolved public. In practice, this usually means demonstrating that the area under the flight path does not have a dense population, which means selecting remote sites. If the intention is for the spaceport to conduct orbital missions, then that implies that the area to the east of the launch site for maybe 100 km be also relatively empty of population (because a launch trajectory goes to the east to take advantage of the rotation of the Earth). Alternatively, a spaceport could be positioned at a coastline, which would ensure that a flight path over the ocean does not bring any danger. SpaceX is developing Brownsville, on the south Texas coast, with orbital launches very much in mind.

What is the world market demand for spaceports? How many would be needed if point-to-point spaceflights became a possibility? Until this sector becomes established, there are no firm estimates. But, at present, there continues to be a competitive effort to have a local spaceport; in the United Kingdom, for instance, there have been about eight local authorities actively vying for the opportunity for a spaceport license. Figure 1 presents a chart of projected and existing world spaceports.

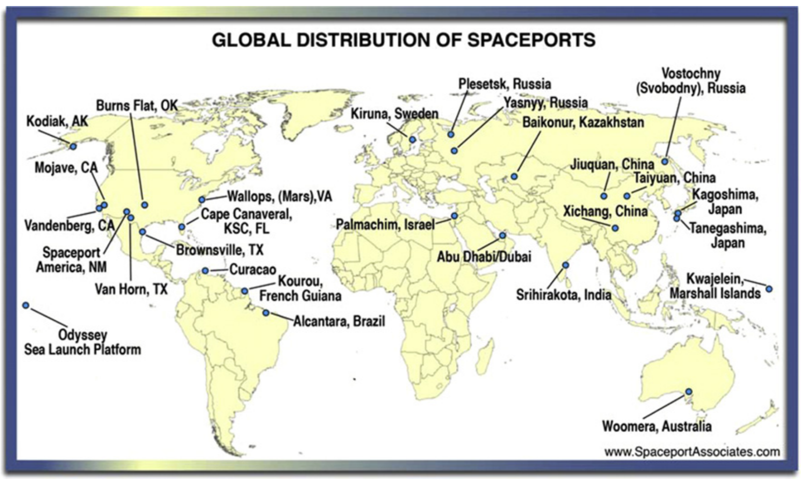

Figure 1. Global Coverage of Spaceports
Source: Spaceport Associates.

Some of the potential spaceports on the chart are existing military launch sites, hoping to take advantage of the opportunities being offered by space tourism. Others, such as Curacao, have suffered because their plans were linked to the provision of specific spacecraft offerings such as the XCOR Lynx spacecraft which, due to funding difficulties, is unfortunately no longer being developed. Kiruna is still awaiting the VG offering to justify its own development plans.

Geostationary Orbital Possibilities

The orbital space tourism that has taken place has so far been in LEO. There is no reason to suppose, however, that as governmental space activities head further out there will not be an interest among space tourists to follow suit. It is in this context that we consider a possible space tourism hotel being established in geostationary orbit (Gateway Earth proposal; Vidmar & Webber, 2017). The geostationary orbit, GEO, is at 36,000 km above the Earth. This is 100 times farther into space than has been the norm for all astronauts since the end of the Apollo era. At this distance, a spacecraft, or space hotel, would rotate around the Earth once every 24 hours and would appear to hover above the same spot on the Earth. From that altitude, an observer would be able to see almost an entire hemisphere of the Earth at the same time (Figure 2). At present, no market research has been carried out to see if this destination would be of interest to potential space tourists, and importantly, how much extra they would be willing to pay, over and above the high cost of getting to LEO, as a premium for getting to a GEO space tourism hotel. Nor has any operator proposed to build the facility, so it is premature to consider GEO as the next step for space tourism beyond LEO.

However, there could be distinct advantages to building a governmental space station there. If a tourist hotel was co-located at the outpost, there would be shared benefits to government and commerce. This is because the geostationary orbit is almost at the edge of the Earth's gravity well. Thus, Gateway Earth would become the perfect place for explorers both heading out to, and returning from, interplanetary destinations such as Mars. Space tourists vacationing at the Gateway Earth space tourism hotel would have a front-row seat at these historic future events. It would also be a good location for an orbiting commercial service station for ailing geostationary communications and broadcasting satellites needing life-extension support.

Figure 2. Gateway Earth
Source: Gateway Earth Development Group (Artist Phil Smith).

CONCLUSION

This chapter has presented a mixed record. The aspirations have not been forgotten, and the businesses still functioning in this sector continue toward providing the space tourism experiences that have been promised. Sometimes, however, even the strongest advocates, such as Sir Richard Branson himself, start to sound a little tired as they juggle with the balance between optimistic marketing and the realities of providing a space tourism operation. Back in 2004, at the time of the Ansari XPRIZE, it was generally thought that a suborbital space tourism experience derived from the prize-winning SpaceShipOne design architecture would be available to the public within about four years. Instead, it has been nearly 15 years, and we still await the first commercial space tourism flight aboard SpaceShipTwo. Certainly, this experience has been frustrating.

However, a great deal has been achieved, almost simultaneously between the suborbital and orbiting sectors of this new industry, so that we are likely to see emerging new offerings in both of them in the near future. What does make us relatively confident, even after these disappointments?

It is the steady work over the last decade toward making reusable spaceflight a practical and reliable new norm for the sector. Blue Origin has already demonstrated that all parts of its architecture will work for providing the suborbital space tourism experience. It would seem VG is also close to readiness. SpaceX has done the same thing for the orbital experience. Thus, we may hope for a relatively quick end to this long development process, with tourists finally being able to take to space. In the case of the suborbital sector, this will be for the first time. For orbital space tourists, this would be a new opportunity since Guy Laliberté (the last orbital tourist) had his flight in September 2009.

As we have seen, there are virtually no limitations as to where this new business will take us. The reusable nature of the technology opens up new possibilities for all kinds of future work in space. As discussed earlier, the implications are far-reaching, both positive and negative. We do not know how the onset of low-cost repeatable access to space, enabled by space tourism markets, will create new uses of space. It will certainly result in improved reliability and the transition of space transportation to a more airline-like *modus operandi*. There will be new business and economic opportunities centered around the spaceports, but we do not know how significant they will prove to be. Will space tourism remain an elitist activity or, like the airline and cruise businesses, eventually be the province of almost everyone? What about environmental impacts, such as sonic booms and the need to store rocket fuel in formerly pristine desert locations? Ultimately, of course, the onset of space tourism makes possible in the very long term the ability of humans from the planet Earth to find a back-up home when the need arises due to astronomical or other catastrophes. But, meanwhile, we can be sure that it will provide a great deal of fun, excitement, and indeed perspective for those who are its early participants.

This page intentionally left blank

Chapter 8

THE REGULATION OF SPACE TOURISM

Frans G. von der Dunk
University of Nebraska-Lincoln, United States

Abstract: Space tourism has to be regulated as a subset of private spaceflight activities, whereby humans are sent to outer space in a fundamentally private context. In addition to space law, air law would be relevant for addressing private spaceflight, but neither regime has at the international level regulated relevant activities to any appreciable extent. They provide little more than a set of guiding overarching principles. Much of the onus of future regulation will fall on the shoulders of individual states, most notably the United States. In the more distant future, this may result in a special international regime, using elements of both space and air law. **Keywords**: space law; air law; outer space; airspace; space object; aircraft

INTRODUCTION

There is little question that for the general public, space tourism is the most exciting development in the space sector since the Moon landings of half a century ago. The idea that anyone with some money could now actually enjoy a flight into space and back is of obvious appeal to many, whether because they think they have seen it all on Earth or simply because outer

Space Tourism: The Elusive Dream
Tourism Social Science Series, Volume 25, 177–199

ISSN: 1571-5043/doi:10.1108/S1571-504320190000025010

space represents the most fascinating experience ever. This is not to say that space tourism is the only exciting new phenomenon in space and space law. One category of initiatives that has recently attracted much attention concerns space mining, the plans to visit celestial bodies such as the Moon and asteroids to harvest their water deposits and/or mineral resources for commercial gain. Space mining, however, is far removed from space tourism even in a literal sense: it focuses not on low-earth orbits but on deep space missions; the technologies are very different; the operations have little in common; and both the public and the private stakeholders are totally different.

As a consequence, space mining and space tourism are, legally speaking, two entirely different sectors. Unlike in the case of space tourism, air law is totally irrelevant for ownership of celestial bodies and space resources, while key principles of space law such as non-appropriation, avoidance of harmful interference, and sharing of scientific discoveries take the place of such concerns as passenger liability (Tronchetti, 2015b). The same applies to even further-reaching projects such as the long-term settlement of humans in outer space. While private spaceflight in general may well turn out to be the starting point for developments allowing cheaper access to space, which somewhere down the line might support the establishment of human settlements in space, that does not make them into similar activities, whether from a political, economic, technical, operational, or legal perspective (Vaughan, 2017).

Another recent development in terms of space activities, which has received a lot of attention, concerns the US intention to create a national "Space Force." This initiative, however, entirely focuses on military and security considerations and so far does not have a significant impact on the legal discussions on space tourism. Contrary to the militarization issue, space tourism, or even "private spaceflight," is very much about the flight and not the destination and about the passengers rather than what they do (Tronchetti, 2015a).

This chapter seeks to clarify the role of law and regulation in the context of space tourism only. While the value judgement on the extent to which space tourism is a good thing is ultimately not a matter of the law (which merely tends to reflect relevant value judgements), the law is certainly an important tool for both promoting any beneficial aspects of space tourism and curbing any negative ones. The starting point is, of course, that space tourism is a fairly novel phenomenon. So far only seven individuals, who may be considered true space tourists, have flown into outer space; this happened during 2001–2009 (Brannen, 2010, pp. 642, 653; von der Dunk, 2015b, pp. 662–663). In 1990, a Japanese journalist flew to the Mir space station; he is generally considered the first non-professional astronaut but not a true space tourist (Negoda, 2003, pp. 90–91).

This contribution will first address the proper definitions of space tourism before moving into the legal analysis. Following this, it is argued that space tourism and the related broader notion of private commercial spaceflight, having much in common not only with space activities but also with certain types of aviation, would most obviously seem to fall within the scope of space and air law. In addition, the sector would obviously encompass characteristics of tourism and high-adventure sports as well. However, the legal aspects of these activities are essentially *national* in nature and not comparable to the profound *internationalization* of the law in the realms of space activities and aviation. The more mundane aspects (such as bookings, reservations, and cancellation and refund policies), which apply to tourism of any kind, will be largely taken for granted and by and large apply to space tourism as they would to other tourist activities. While this may be less true of high-adventure sports, the most important aspects thereof – notably, informed consent and liability issues – have been taken care of so far only in one particular case through national legislation as part of a space law approach. Liability issues are more extensively discussed in von der Dunk (2013, pp. 206–207) and Carminati's forthcoming thesis which addresses more fundamentally such activities as horse riding and downhill skiing and the attendant liability issues in the US legal context.

Therefore, international and national legal regimes will have to be addressed. As space tourist activities are inherently not national in character, they fall under international law. The legal analysis will turn to the handful of countries planning to be involved in the near future in space tourism projects, most notably the United States. We shall analyze how they have implemented the relevant international regimes on the national level. The chapter will then conclude with some more general remarks as to the wider context of space tourism and its potential importance for space activities in general, as well as some thoughts on the most likely future legal developments in these respects.

THE LEGAL FRAMEWORK FOR SPACE TOURISM

Space tourism would obviously constitute a subset of tourism, defined by the World Tourist Organization and the UN Statistical Committee in 1994 as "The activities of persons traveling to and staying in places outside their usual environment for not more than one consecutive year for leisure"

(Launius & Jenkins, 2006, p. 255). Unfortunately, the definition as given then actually adds for "business, and other purposes"; this seems to be a rather counterintuitive addition and has to be neglected, since it would effectively equate tourism with *all* travel and take away any distinctive traits. Launius and Jenkins, in their extended historical expose, do not refer to *all* travel but merely to what for purposes that everyone would agree constitute tourism properly speaking. This means that tourism requires the availability of three elements:

> (1) a discretionary income available for leisure travel; (2) ample leisure time to spend on both preparations for and taking the trips themselves; and (3) an infrastructure supporting tourism that offers accommodations, food and amenities, transportation systems, and attractions to see and do at the place visited. (Launius & Jenkins, 2006, p. 254; see also Loizou, 2006, p. 289; Smith & Hörl, 2004, p. 37)

Since space tourism is a novel phenomenon, so far no authoritative definition of it has been agreed upon (von der Dunk, 2008). It follows from the aforementioned WTO definition, however, that it would make most sense to simply define it as "the activities of persons traveling to, and staying in, outer space for leisure," as long as we interpret leisure in the broad sense as a notion complementary to and mutually exclusive of business and other professional activities.

Such a definition fundamentally refers to the *reason* for private individuals to undertake tourist activities, which upon closer look is not primarily a legally decisive criterion. To use the often-made comparison with aviation here, aircraft can carry tourists; persons taking a flight because they are crazy about flying or want to spend their holidays far away from home; and passengers who merely need to go to another place for business or professional reasons as safely, quickly, and/or cheaply as possible. Yet, legally speaking all of them are equal in terms of aviation law – whether it concerns the need to comply with applicable laws onboard, contractual liability, consumer rights, or the need to bring a valid passport.

The more distinctive criterion, therefore, is not the *reason* for undertaking certain activities but *who* offers and undertakes them. The legally more relevant concept is that of *private* (human) spaceflight, of which space tourism then forms a specific subset. Given the enormous sums that spaceflight still requires, it is for the time being very unlikely for governments to fund and operate such flights merely for purposes of tourism (for a discussion of why NASA started to strongly support private initiatives in commercial spaceflight, see Brannen, 2010, pp. 660–668).

"Private human spaceflight" has been defined as:

> flights of humans intended to enter outer space (a) at their own expense or that of another private person or private entity, (b) conducted by private entities, or (c) both. (von der Dunk, 2015b, p. 667)

In terms of both space tourism and private spaceflight, a further distinction then arises between orbital and suborbital activities. Since orbital is a rather straightforward operational/technical criterion, referring to the achievement of at least one full orbit around the Earth, it would make the most sense to define suborbital as the corollary to orbital, or a flight that does *not* achieve at least one full orbit around the Earth. Unfortunately, the actual use of the term suborbital has led to much confusion causing the above definition to require considerable further adjustment (von der Dunk, 2015b, pp. 667–672). However, for the purpose of discussing space tourism as the main subset of private spaceflight, that definition would still suffice.

This means that there are currently two relevant types of private spaceflight, giving rise to a similar dichotomy within space tourism. The first concerns private orbital spaceflight, whereby private spaceflights achieve (or at least intend to achieve) an orbit around the Earth. This comprises, first, the crewed flights soon to be flown by private operators carrying professional astronauts for NASA to the International Space Station (ISS) under the Commercial Crew Development program (a NASA concept for supporting and co-funding the development of private spaceflight capabilities to replace the role of the Space Shuttle, which was retired in 2010; see von der Dunk, 2015b, pp. 664–665 and pp. 702–705). Second, it includes the eight flights that have so far carried actual tourists to the ISS (von der Dunk, 2015b, p. 663; Sharpe & Tronchetti, 2015, pp. 646–652).

Commercial crew development has not yet been finalized, and it looks unlikely for the time being that there will be additional tourists willing and able to pay the price for a trip to the ISS, whereas the development of a private space hotel – a yet more futuristic element of orbital tourism – still seems some years away as well. Furthermore, these development plans are unique to the United States; there is no other country or area where substantial plans to develop private orbital spaceflight capabilities are currently under development. In the other major spacefaring countries, such as Russia, China, or India, there is no private space sector of note, whereas in other parts of the world where the private sector in general *does* play a role in space activities, such as Japan, Canada, Australia, and the major Western European countries, the interests generally lie elsewhere. For these reasons, the present contribution will focus on suborbital private spaceflight including suborbital private space tourism.

The category of private suborbital spaceflight can be defined as spaceflights *not* achieving or intended to achieve the Earth orbit. Within that category, the suborbital space tourism flights currently on the verge of being realized by the likes of Virgin Galactic and Blue Origin clearly dominate the discussion, although non-tourist activities, such as training flights for government astronauts or small scientific experiments, are also seriously contemplated. Developments here largely focus on the United States. Though several European countries are also working toward involvement in the future of private suborbital spaceflight, they so far still seem to depend exclusively on the US initiatives. That even more applies to countries outside of Europe, such as the United Arab Emirates, Japan, South Korea, and Singapore, where plans to become involved in such private US initiatives are at best in the stage of initial consideration. In practice, therefore, the analysis will focus very much on accompanying legal and regulatory developments in the United States and Europe.

Regulating Suborbital Space

Any analysis and discussion of which law and regulation already applies to suborbital private spaceflight and space tourism, respectively, and what law and regulation ought to be further developed, should start from the fundamental understanding that as a quite novel set of human activities these flights do not easily fit into any existing category, either within space activities and space law or within aviation and air law. Consequently, there does not exist a tailor-made legal regime developed exclusively for this new sector. The only thing which can be safely said at the outset is that the global character of both space activities and, generally, aviation means that any analysis of existing law and development of future regulation should preferably and primarily focus on international law as opposed to domestic law, limited to respective single nations. In fact, international space and air law serve to determine the scope for such national laws. Even if only as a baseline framework, the general rules and principles of existing international space law and international air law as a *lex generalis* would apply to private spaceflight in the absence precisely of such tailor-made *lex specialis*. Orbital private spaceflight and orbital space tourism are currently, and indeed should be exclusively and primarily regulated as space activities, presuming application of space law. By contrast, while those about to provide private spaceflight opportunities indeed sell them as *space*flights (notably, passengers are promised to become astronauts by reaching the altitude of some 110 km above the Earth's surface), air law is an issue for those flights for two main reasons.

On the one hand, any activities involving transporting vehicles into space and, if relevant, back to Earth, requires the transition of airspace on the way to outer space and on the way back. Safety reasons alone would require proper integration into existing rules of air law dictating the use of airspace. The ad hoc approach of creating launch windows for a limited time and a limited area may have worked for highly intermittent space launches in the past, but if private commercial spaceflight were to really take off such an approach would no longer be feasible.

On the other hand, the nature of the planned suborbital private flights shows much similarity with the early days of aviation in terms of the experimental and sensational character and the absence of real transportation. The customers of Virgin Galactic and Blue Origin will land on the same spot from where they took off, just like the old sightseeing flights comprising a major part of aviation activities in its infant stages a century ago. Beyond that, the ultimate aim of suborbital spaceflight operators is often to prepare the technology for later use in transporting passengers from one place on the Earth to another – which then resembles actual aviation (von der Dunk, 2008, pp. 403–408). Finally, much of the technology involved in those flights is either derived from aviation technology or, for instance in the case of Virgin Galactic, even uses aircraft for the first stage of the flight. All of this raises the more fundamental question whether air law should, would, and/or could be applied to the whole suborbital operation (whereas in the case of orbital operations obviously at least the orbital part would in principle also be subject to space law).

How fundamental the choice would be between space and air laws, how they allocate jurisdiction to states for the purpose of regulating and controlling activities, and how different the results of their respective application would be are illustrated here by focusing on four important aspects of private suborbital spaceflight operations, which would have to be taken care of by regulation: first, there is the issue of licensing operators (as space companies, airports, or airlines?); second, the issue of crew licensing (as astronauts or pilots?); third, there is a necessity to certify the vehicle (as a spacecraft or an aircraft?); and fourth, there must be a liability regime to address the occurrence of damage (damage caused by a spacecraft or an aircraft?). If one manages to regulate those in a proper and thorough manner, all other safety- and security-related environmental and other public concerns should be duly taken care of. When it comes to the issue of applying international space law *versus* international air law, with a view both to existing regulation and to future regulation, the application of either regime would be triggered by two major operational facts: the vehicles used and the areas where such usage takes place. Indeed, it will make a major difference whether we would apply international space law or international air law.

Space Law versus Air Law

As to the operation of the vehicles concerned, the application of much of space law's rules is premised on the involvement of a "space object." Unfortunately, this concept has not really been defined by international (space) law. The partially circular definition that a space object "includes [its] component parts […] as well as its launch vehicle and parts thereof" is not really helpful in this respect. Looking more closely at the way the terms "object (launched into outer space)" and "space object" have been used in the main space treaties of global scope, there is a growing consensus that a space object would best be defined as "any man-made artefact intended to be flown to an altitude generally considered outer space" (von der Dunk, 2015b, p. 679). This definition avoids a discussion on the altitude at which outer space is legally speaking considered to begin.

The applicability of national or international air law hinges on the involvement of an aircraft in the activities concerned. "Aircraft" in this context is defined quite precisely by international air law (a definition also applied in most national laws dealing with aviation as well) as "any machine that derive support in the atmosphere from the reactions of the air other than the reactions of the air against the earth's surface" (Convention on International Civil Aviation 1944, hereafter Chicago Convention, Chicago, 1944, Annex 7). In other words, anything with wings or rotors, as well as hot air balloons, qualifies as aircraft for the purposes of air law.

Looking at the current prototypes being developed for private suborbital spaceflight and assuming that the altitudes they aim for constitute outer space, *all* of them would qualify as space objects as defined earlier. However, in addition, vehicles under development such as the SpaceShipTwo, with wings used in the last phase of flight, would *also* qualify as aircraft under the International Civil Aviation Organization (ICAO) definition. Even more confusingly, in the case of Virgin Galactic the aircraft carrier WhiteKnightTwo, though itself not aiming for anywhere close to outer space (it is supposed to fly to altitudes of no more than some 15–20 km), by effectively being the launch vehicle for the SpaceShipTwo *also* qualifies as a space object.

In short, in several cases, a choice would have to be made between legally considering the vehicle at issue a space object, or alternatively an aircraft, since in principle both definitions might apply, but their simultaneous application would result in confusing and conflicting legal regimes (von der Dunk, 2015b, pp. 674–675, 678). This is so, because general international space law takes a rather light legal approach to regulating activities undertaken by or involving space objects, whereas, by contrast, air law consists of a very extended, well-weathered, and expansive set of rules detailing under which conditions aircraft can operate.

International space law is triggered by the involvement of a space object. The latter is made subject to such general legal requirements as registration (Convention on Registration of Objects Launched into Outer Space, 1975, hereafter "Registration Convention"), the rules on the object's return to the launching authority (Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies, 1967, hereafter "Outer Space Treaty," Art. V, Rescue Agreement, 1968), and compliance with the principle of absence of harmful interference to the extent provided for by Article IX of the Outer Space Treaty (Viikari, 2015).

As to the four main aspects of regulation to be taken care of, the licensing of operators of space objects would indeed be subject to some form of "authorization and continuing supervision" by "the appropriate State" (Outer Space Treaty, Art. VI), but no specific further details are provided. It is thus left to individual "appropriate states" how stringent or lenient such authorization would be (Marboe, 2015, pp. 131–132; Zannoni, 2013, pp. 349–353). Nothing is provided by way of licensing the crew; it is entirely left to individual states to determine who might be eligible (for instance, in terms of selection and training) to fly on a space object. International space law only provides for some general rights of astronauts in case of distress or emergencies (Outer Space Treaty, Art. V, Rescue Agreement, Arts. 1–4), but it is doubtful whether these would fully apply to either private crew flying suborbital craft or even more so the passengers on board (Chatzipanagiotis, 2011, pp. 29–38; Sharpe & Tronchetti, 2015, pp. 647–652). Likewise, international space law does not provide any requirements in terms of safety certification of space objects – it is again left entirely to individual states to impose such requirements by way of national space law.

The only one of the four main aspects that is addressed in any detail by international space law is that of liability, and it is indeed crucially tied to the concept of a "space object." Following Article VII of the Outer Space Treaty and the Liability Convention, liability for damage caused in the context of space activities is translated into damage caused by a space object, and this is elaborated in quite some detail. Thus, a distinction is made between absolute liability for damage caused on the Earth or to aircraft in flight and fault liability for damage caused to other space objects in outer space (Convention on International Liability for Damage Caused by Space Objects, London/Moscow/Washington, done on March 29, 1972, hereafter "Liability Convention," Arts. II & III). Compensation for liability is in principle without limits (Liability Convention, Art. XII). The extent of liability is detailed by several clauses (Liability Convention, Arts. I(a) & (c), IV–VI), the right to claim is specified (Liability Convention, Arts. VII, VIII & XII), and a set of procedures for actual claims is laid down (Liability Convention, Arts. IX–XX).

Crucially, with a view to private spaceflight, this whole regime applies to third-party liability only, that toward persons or entities not involved in the operations themselves. Since the space treaties were developed in an era when the only crewed spaceflight under consideration was a *public* crewed spaceflight, involving only government-employed astronauts and engineers whose potential harm would be covered by their employment contract and/or government regulation, nothing was included on liability toward other humans involved in the flights. The special status of astronauts as a unique, small set of government employees is further borne out by Article V of the Outer Space Treaty, which labels them "envoys of mankind" and requires them being treated with consequential special respect and by the Rescue Agreement which further elaborates the treatment that astronauts are entitled to in particular when in situations of distress or emergencies.

Under international air law, the situation is radically different. The Chicago Convention – like the space treaties – does provide for a range of general requirements pertaining to aircraft such as registration (Chicago Convention, Arts. 17, 18, & 21), documentation, and equipment to be carried on board (Chicago Convention, Arts. 29 & 30), and the rights and obligations aircraft have in the context of international aviation operations (Chicago Convention, Arts. 5, 7, 8, 11, & 12). These are often elaborated in great details by the Annexes to the Chicago Convention which provide for Standards and Recommended Practices (SARPs), of which the former constitutes binding law upon the member states (Chicago Convention, Art. 37).

As to operator licensing, the Chicago Convention – like the Outer Space Treaty – leaves it to states parties to use or not the specific tool of operator licensing. Due to the extended requirements that aircraft have to comply with, as per the Chicago Convention, it has become almost inevitable for states to also use operator licensing at a national level. Indeed, this has become standard practice in most states (Diederiks-Verschoor, 2012, pp. 254–259; Milde, 2016, pp. 89–95).

One major set of such requirements also concerns the second main aspect of crew licensing. According to the Chicago Convention (Art. 32(a)), the pilot of every aircraft and the other members of the operating crew of every aircraft engaged in international navigation shall be provided with certificates of competency and licenses issued or rendered valid by the State in which the aircraft is registered. Other states have the right, in principle, to refuse such licenses – which in practice translates into a general stimulus for national crew licensing regulation to be taken very seriously (Chicago Convention, Art. 32(b)). Similarly, the third main aspect, craft certification, is taken care of in broad terms by the Convention, as "[e]very aircraft engaged in international navigation shall be provided with a certificate of airworthiness issued or rendered valid by the State in which it is registered" (Chicago Convention, Art. 31). This is then further elaborated and updated in great detail through Annex 8 on "Airworthiness."

Finally, as to liability, international aviation law provides not only for third party but also for passenger liability, linking the occurrence of damage directly to the aircraft causing it. States party to the respective treaties then must implement such international law in their relevant national legislation. Third-party liability is covered by the 1952 Rome Convention on Damage Caused by Foreign Aircraft to Third Parties on the Surface, 1952 (hereafter "Rome Convention"), as later amended by the 1978 Montreal Protocol to Amend the Convention on Damage Caused by Foreign Aircraft to Third Parties on the Surface, 1978 (hereafter "Montreal Protocol"). A 2009 Convention (Convention on Compensation for Damage Caused by Aircraft to Third Parties, Montreal, 2009) has not yet entered into force. Since the number of states parties to the Rome Convention and the Montreal Protocol is limited, national law is still applicable in the majority of instances.

As for passenger liability, the international regime ranges from the 1929 Warsaw Convention (1929) to the 1999 Montreal Convention (2003). It effectively imposes upon states parties the obligation to harmonize relevant national law requiring aircraft operators to compensate damage caused to passengers and cargo on board of aircraft in accordance with whatever terms the relevant treaty regime prescribes. Which treaty is applicable precisely in which given case is not determined by the partisanship of the state in whose airspace a particular aircraft happens to be flying at the time of the incident, but rather by the partisanship of the states of departure and arrival of the flight at issue (Warsaw Convention, Art. 1(2); Montreal Convention, Art. 1(2)).

The above analysis shows that it is of crucial importance for private suborbital spaceflight, including space tourism, whether the vehicles planned to be used were to be defined and viewed as space objects or aircraft. Looking at the design and operational features of the current drawing board prototypes, all of them would qualify as space objects, yet most of them would also qualify as aircraft (Hughes & Rosenberg, 2005; van Fenema, 2005, pp. 400−403; Vissepó, 2005, pp. 79−84). Within Europe, this situation even gave rise to semiofficial efforts by the European Aviation Safety Agency to develop an appropriately specific certification regime for the craft to engage in suborbital flights (at least to the extent that these qualify as aircraft) and, once that regime was sufficiently developed, to start addressing attendant safety issues such as those related to crew and passenger licensing and certification (Marciacq, Morier, Tomasello, Erdelyi, & Gerhard, 2010).

Outer Space versus Airspace

As to the areas of operation, the difference between the status of outer space and the underlying airspace starts already with the fundamentally different international legal status of the two realms, raising the problem of how individual states could exercise jurisdiction over relevant activities out there. One consequence of this very fundamental difference is that, at least in principle, a boundary line should be acknowledged where the sovereignty of the underlying state gives way to the freedom of outer space. While currently no international (legal) agreement exists on a specific altitude at which such a boundary would be set − or even about the need for such a specific boundary − a consensus is gradually emerging that the most agreeable altitude would be 100 km (von der Dunk, 2015b).

Outer space is generally conceived to be a global commons: an area outside of the territorial jurisdiction of *any* state (Outer Space Treaty, Art. II) and an area where freedom of exploration and use (Outer Space Treaty, Art. I) is the baseline legal principle. Limitations to that freedom can only be agreed upon at the international level by such treaties as the Outer Space Treaty itself or customary international law. This means that activities in that realm can only be legally controlled by states, which are also responsible and liable for private activities out there (Outer Space Treaty, Arts. VI, VII).

First, to the extent that such activities are remote-controlled, that is with the key actor located somewhere on Earth, normally territorial jurisdiction can still be applied *to actors on national territory even if the activities themselves take place in outer space* (Boas, 2012, pp. 251–255; Wallace, 1997, pp. 112–117). Second, states can (continue to) exercise jurisdiction based on the nationality of the actors, whether natural or legal persons (Boas, 2012, pp. 255–258; Wallace, 1997, pp. 114–115). While there may be issues with enforcing jurisdiction if such nationals are physically outside the country, in principle nationality-based jurisdiction can be exercised *vis-à-vis* their activities regardless of where they would be undertaken (including in outer space). Third, following the provisions of Article VIII of the Outer Space Treaty and the Registration Convention, states can exercise quasi-territorial jurisdiction over space objects registered by them as well as over "any personnel thereof" (Outer Space Treaty, Art. VIII). However, for instance, in terms of traffic management, the only feasible solution would be an international regime, even if specific tasks within a space traffic management regime for a special area might be allocated to a single state. This resembles air traffic management over international waters being allocated to specific nations (von der Dunk, 2016, p. 385). In other areas an international regime would also clearly be preferable over a hodgepodge of national laws, each applicable to only some pieces of the puzzle. Operator licensing, the only aspect of private spaceflight where space law does provide some potential legal tools, has already been discussed as being linked to the operation of a space object. At the same time, however, the scope of Article VI of the Outer Space Treaty is also defined by the area of activities: pursuant to it, international responsibility applies for "national activities *in outer space*" (emphasis added).

A major part of the regime of space law providing limitations to the baseline freedom of exploration and use of outer space (Outer Space Treaty, Arts. I & II) also applies to the geographical realm of outer space as such. That goes for instance for the fallback clause requiring compliance with general international law (Outer Space Treaty, Art. III), the prohibitions to orbit or station weapons of mass destruction in outer space (Outer Space Treaty, Art. IV), the principles regarding harmful interference with other states' activities (Outer Space Treaty, Art. IX), and the need to inform the United Nations and the scientific community about activities conducted in that realm (Outer Space Treaty, Art. XI).

In contrast to the global commons of outer space, the airspace around the globe is partitioned in sovereign airspaces belonging to the underlying states (Chicago Convention, Art. 1, also Arts. 2, 5–16) the remainder being international airspace (Chicago Convention, Art. 12). This means that each individual state can legally control or even completely prohibit access to its own airspace, whether for safety of aviation, national security, or economic reasons. Contrary to the situation in outer space, territorial sovereignty can be exercised comprehensively by the underlying state over its air space and in principle even overrides any exercise of jurisdiction over nationals or quasi-territorial jurisdiction over aircraft.

Air law was originally developed at the national level. But the international character of aviation gave rise to a body of *international* air law, the ultimate role of which is to harmonize or at least align as much as possible national legislation for the purpose of enhancing the safety of international aviation. This means that, once such treaties have achieved widespread acceptance by the respective states, their national sovereignty to legislate became subjugated to the international legal standards agreed to under the treaty. Hence, many rules of international air law will then apply to the realm of national airspace and the activities taking place therein, in accordance with the Chicago Convention, which imposes upon the states obligations to ensure that their national legislation is in conformity with international rules. For instance, the clause on scheduled services, which forms the baseline for global commercial operations, requires consent by the sovereign state for any aviation operations in its airspace (Article 6 of the Chicago Convention on the basis of which the world-wide bilateral system of air services agreements allowing reciprocal access to national airspace has been developed [Milde, 2016, pp. 107–127]). Conversely, states retain full responsibility for the safety of aviation in their national airspace (Chicago Convention, Art. 28); they must allow non-scheduled flight in national airspace, subject to certain conditions (Chicago Convention, Art. 5), and are required to apply the rules of the air as elaborated by Annex 2 to the Chicago Convention (Art. 12).

The international conventions of global scope, addressing the application of criminal law, fundamentally hinge on national airspace and on the underlying territory. Thus, the first treaty to address such issues, the 1963 Tokyo Convention, provided that the state, in whose airspace an aircraft registered with another state is flying, is the primary state entitled to exercise its "criminal jurisdiction over an offence committed on board" (Convention on Offences and Certain Other Acts Committed on Board Aircraft, 1963, "hereafter Tokyo Convention," Arts. 1[2], 4). In addition to the vehicle used being a major trigger of space law and air law, the area where a certain activity takes place constitutes the other major trigger of space law or air law, sometimes in combination and sometimes potentially in conflict. Therefore, the choice in either case is obviously of great importance in practice, and so is the as-of-yet undecided question at what altitude airspace ends and outer space begins.

The US Domestic Approach

The only state that has so far taken substantive steps to address private spaceflight, including private suborbital spaceflight and space tourism, is the United States. Once the race for the XPRIZE was won in 2004 by Scaled Composites, it was clear that private suborbital flight was around the corner and that the United States needed to develop a proper legal and regulatory framework to quickly address it.

The main choice which had to be made was between an approach primarily addressing private suborbital flight as a peculiar kind of space activities and one primarily addressing it as a special branch of aviation. The United States circumvented the outer space *versus* airspace conundrum by defining and addressing suborbital vehicles as a single category, regardless of where they operate, and thereby avoided the need to take a formal position on any boundary line at any altitude, which also allowed it to create a single legal regime for the whole suborbital flight. Beyond that, the United States essentially opted for the space law approach. It did this by going back to the Commercial Space Launch Act (1984) which had allowed private involvement in the launch service sector. So far, that had concerned uncrewed launches only, either undertaken from US territory or undertaken by US operators elsewhere. Amendments in 1988 fine-tuned the liability regime, so far, however, still only for unmanned private launches.

As a first step toward addressing private manned launches, in 1998 the Commercial Space Act was purportedly amended "to address liability and government indemnification concerns and to address licensing authority for RLVs [reusable launch vehicles]" (Hughes & Rosenberg, 2005, p. 4).

This gave the FAA the competence to license reentry operations of any object in outer space in addition to launches sending those objects there. Second, the requirement to:

> "encourage private sector launches, reentries, and associated services and, only to the extent necessary, regulate those launches, reentries, and services to ensure compliance with international obligations of the United States and to protect the public health and safety, safety of property, and national security and foreign policy interests of the United States" (51 U.S.C., § 50901(a)(7))

resulted in further amendments, now formally incorporating crewed launches into the regime. This was done in 2004, in the Commercial Space Launch Amendments Act amending the 1984/1988 Act, and in 2015 in some further refinements as per Title I of the US Commercial Space Launch Competitiveness Act (2015). Yet further details were (to be) provided by the Code of Federal Regulations.

Thereby, the obligation to obtain a license from the Office of the Associate Administrator for Commercial Space Transportation within the FAA now also pertained to each launch and/or reentry of a vehicle intended for suborbital spaceflight, and the option of obtaining an experimental permit for test flights was created for any private company with US nationality or launching from US territory. Conditions for the grant of a license addressed safety, national security, and compliance with international law. However, there was no certification of the spacecraft used for the launches – the safety considerations were taken care of through the licensing of the launch itself. Effectively, further-reaching safety-related measures such as developing standards for certification are by law currently excluded until October 2023.

With regard to liability, under the original 1984/1988 Act licenses were to include specific obligations to cover third-party liability or liability for the use of governmental launch facilities resulting from accidents; but, as no crewed launches had been foreseen at the time, contractual (passenger) liability was not provided for. Following the 2004 amendments, the existing third-party and interparty (*vis-à-vis* the US government) liability regimes continued to apply.

Operators were allowed to fly spaceflight participants without any statutory obligation to accept liability for damage caused to them, as long as all had signed an informed consent clause indicating they were aware of probable accidents and "that the United States Government has not certified the launch vehicle as safe for carrying […] space flight participants" (51 U.S.C., § 50905(b)(5)(B)). This "informed consent regime, however, resulted in considerable uncertainty as to whether this also would amount to a waiver of contractual liability *vis-à-vis* spaceflight participants (Knutson, 2007). So, in 2015 the Commercial Space Launch Competitiveness Act redressed this omission and ensured that spaceflight participants are included in the cross-waiver. This means there is effectively no statutory obligation to accept contractual liability on the part of the spaceflight operators – quite contrary to common aviation practice. This regime is also temporary in nature, as a sunset clause currently refers to September 30, 2025 as the date at which a more aviation-like regime could come to be implemented (Commercial Space Launch Competitiveness Act, Sec. 10).

As to the crew, which was also included in the legal regime by the 2004 amendments, operators essentially had to comply with an "informed consent-light regime." This means that crew can also be flown, if duly informed "that the United States Government has not certified the launch vehicle as safe for carrying crew" (51 U.S.C., § 50905(b)(4)(B)), and if it was ensured that "the crew has received training and has satisfied medical or other standards specified in the license or permit in accordance with regulations promulgated by the Secretary" (51 U.S.C., § 50905(b)(4)(A)). This meant that it is largely up to the operator to determine training and other standards.

If by 2025 (for contractual liability) and 2023 (for certification) the spaceflight industry still has not yet taken off in any substantive manner, the aforementioned sunset clauses might be expected to be once again extended. Only once private commercial spaceflight will be considered a mature industry would it become appropriate to start developing statutory and mandatory approaches to passenger liability and safety certification along the lines of the aviation industry.

A final development of note concerns the possibility of government astronauts flying on such private vehicles (von der Dunk, 2015b, pp. 703–705). The hybridization of private flights carrying public employees into outer space gave rise to discussion on the extent to which NASA would accept its astronauts and any foreign guest astronauts to fly on vehicles "not certified […] as safe for carrying crew or space flight participants" (51 USC, § 50905 (b)(4)(B) & (5)(B)). Section 112 of the Commercial Space Launch Competitiveness Act, by creating a third category next to crew and space flight participants of government astronauts, has now opened the door to develop special procedures and rules for private commercial spaceflights with such astronauts on board (Mirmina, 2015, pp. 669–678).

A European Approach

Outside of the United States, the main region where substantive progress has been made toward suborbital private spaceflight, including space tourism is Europe; various projects intended to offer such flights have been developed in Sweden, the Netherlands (albeit for a non-European part of the country, the Caribbean island of Curaçao), England and Scotland, France and Spain, in particular the autonomous region of Catalonia. The largest European aerospace consortium, EADS/Airbus, has announced its plans to develop a vehicle for such purposes.

Following the lead of the United States, it would make most sense for any regulation of space tourism in Europe (whether at the national level or at an EU level) to agree with the US approach of addressing space tourism activities as *space*flight activities. As will be shown below, this was also initially the approach taken. However, later developments cast considerable doubt on its legitimacy and caused considerable problems in establishing any regulation.

In Sweden, where efforts focus on using the Kiruna launch site for space tourism, since 1982 an Act on Space Activities regulates the legal aspects of the whole range of space activities conducted by the private sector. Pursuant to it, a license is required for such activities conducted from Sweden by any operator as well as conducted elsewhere by Swedish operators, with attendant obligations phrased in very broad and abstract terms. The Act, however, was never specifically elaborated for space tourism. Therefore, it contained no provisions relevant for crew licensing or vehicle certification. As to liability, only international third-party liability, not passenger liability, was dealt with. The licensee was required to provide full reimbursement of international claims to be paid by Sweden "unless special reasons tell against this" (Act on Space Activities, 1982, hereafter "Swedish Act on Space Activities"). More recently, as a consequence of European developments addressed further below, discussions on the possible alternative application of national and international air law arose, with the basic result that so far no clear-cut regime seems to exist in Sweden.

As for Curaçao, part of the Kingdom of the Netherlands, it should be noted that the latter has a national space law in place since 2007, requiring a license for launch, flight operation, or guidance of space objects in outer space if undertaken from Dutch territory, ships, or aircraft. Its scope could under circumstances be extended to Dutch operators active elsewhere. While the license will include safety, security, and other related conditions and also require the licensee to fully reimburse Dutch government for any international third-party liability claims, this law has not been adapted to private spaceflight or space tourism. There is no requirement for passenger liability, crew licensing, or vehicle certification.

While no directly relevant specifics are provided, the licensing requirement could be made to apply to space activities organized from the Netherlands, which would possibly enable the application of the law to such activities, undertaken from Curaçao. However, for political reasons, the Dutch law has *not* been applied to the non-European territory of the country (von der Dunk, 2011, pp. 351–354). As a consequence, regional space regulation is currently under development for Curaçao only, which will likely follow the US approach by addressing space tourism as part of private commercial spaceflight. To the extent these flights would be conducted by US operators, who are closest to market, they would anyway require a license under US law.

In England and Scotland, both (still) part of the United Kingdom, the various projects hatched there would originally have been ruled by the 1986 Outer Space Act, which required a license from UK operators interested in launching, procurement or operation of a space object, or undertaking any other activity in outer space – hence, in principle also for tourist activities (Outer Space Act, 1986, hereafter "UK Outer Space Act," chapter 38, Secs. 1, 2). However, once again these were neither specifically mentioned nor addressed by that Act, and there were no crew or vehicle certification clauses. While the licensee was subject to a liability regime, this only pertained to reimbursing the UK government for international third-party liability claims.

When, however, the projects for private suborbital flights recently became more serious and were focusing on flying from the United Kingdom and even inviting non-UK operators to come to the country to do so, it was recognized that such space activities would not be comprehensively covered by the Outer Space Act. The Space Industry Act was adopted to remedy that situation (Space Industry Act, 2018, hereafter "UK Space Industry Act"). Applying to activities conducted from UK territory, this Act addressed private spaceflight in particular *à la* the United States; no crew licensing or vehicle certification clauses were included, but the Act did include a requirement of "informed consent" waiving any liability toward passengers (UK Space Industry Act, Secs. 17, 34(3)). However, the legal regime became slightly hybridized in that the UK Civil Aviation Authority is now the licensing authority, taking over from the UK *Space* Agency, which had this authority under the Outer Space Act.

In France, a domestic Law on Space Operations is in place since 2008; it requires an authorization for launching or returning space objects from French operators and (as for launch and return only) for activities undertaken by any operator from this country (*Loi relative aux opérations spatiales*, hereafter "French Law on Space Operations," Arts. 1, 2). The French Law on Space Operations does not include any conditions regarding crew licensing or vehicle certification, but it does include the standard provisions on international third-party liability.

This so far suggests that the law, like the other national laws of European countries discussed here, does not specifically address, and perhaps was even not intended to address, private spaceflight. However, the French Law on Space Operations also contains clauses providing for a cross-waiver of liability between "persons having taken part in the space operation or in the production of the space object which caused the damage," unless "willful misconduct" would be at issue. It also provides for such a cross-waiver in case of damage "caused by a space operation [...] to a person taking part in this space operation," unless the contract specifies otherwise (French Law on Space Operations, Art. 19). Without any further guidance or jurisprudence, this could well apply to passengers on private spaceflights, making France the third country (after the United States and the United Kingdom) having addressed the specific legal aspects of space tourism.

Catalonia, the last region of Europe where space tourism flights are seriously considered, is of course a part of Spain; here, the basic problem is that Spain does not have a national space law nor does it look like it will have one anytime soon. This may not exclude the possibility, given a certain level of autonomy to Catalonia, of the creation of a regional space regulation for Catalonia alone. However, it also does not prejudge any possible application of national Spanish aviation legislation, which would likely bring with it crew licensing, vehicle certification, and liability toward spaceflight passengers.

Finally, a major part of the confusion in several countries as to the correct approach to spaceflight regulation derives from the efforts of the European Union to become involved in this sector. The 2007 Treaty of Lisbon provided for an "EU space competence" by creating a clause stating: "the European Parliament and the Council, acting in accordance with the ordinary legislative procedure, shall establish the necessary measures, which may take the form of a European space program, excluding any harmonization of the laws and regulations of the Member States (Treaty establishing the European Community as amended by the Treaty of Lisbon amending the Treaty on European Union and the Treaty establishing the European Community, 2007, hereafter "Treaty on the Functioning of the European Union," Art. 189(2)).

The last phrase in this clause casts major doubts as to the competence of the EU institutions to address, at a European level, the licensing of private spaceflight including space tourism operators. While arguably only France (since 2008) and more unequivocally the United Kingdom (with the enactment of the 2018 Space Industry Act) have addressed private spaceflight, seven more among the EU member states have national space legislation in force addressing the licensing of private space activities as such in general terms.

Therefore, the Commission considered the possibility of rather using its *aviation*-related competences to work for an EU-wide spaceflight regime. As indicated earlier, the European Aviation Safety Agency (EASA) for a few years explored the options to use the EU-wide competence to address the safety aspects of aviation, including those addressing certification of aircraft to apply to suborbital flight (Marciacq et al., 2010, pp. 187–212; Van Fenema, 2005, pp. 400–401). Apart from the fact that the EASA competence, as part of the EU transport competence, does *not* extend outside Europe and would thus not apply to Curaçao, it quickly became clear that such an approach – essentially addressing private suborbital spaceflight as a special kind of aviation rather than of space activities – would not square well with the US approach and might by that token result in stifling any European efforts rather than stimulating them. It was no accident that Virgin Galactic, originally a UK company, also in a legal sense moved its operations to the United States and that the efforts in Curaçao, driven originally by a Dutch business initiative but using US technology (von der Dunk, 2011, pp. 349–350), were effectively taken over by the US partner, XCOR (until that company went bankrupt). In any event, the EU efforts were shelved in 2011, leaving uncertainty as to whether any EU regime in this area was considered desirable and feasible or whether individual states could choose their own approach – which some have started to do.

CONCLUSION

Whether addressing private commercial spaceflight as the more appropriate legal category or space tourism as the currently more visible and attention-attracting subset thereof, regulation at this stage remains, at best, embryonic. The sector is a very international, or indeed global, one. However, while the general rights, obligations, rules, and principles of public international law would indeed apply to this sector, this is far from sufficient to speak of any proper regulation.

Beyond a few very general and broad principles, such as State sovereignty over national airspace, the absence thereof over outer space, and State jurisdiction over craft registered domestically, there is no international agreement to what extent suborbital private spaceflight should be addressed as a space activity, as aviation, or as both – and, if so, where the exact boundaries between application of international space law respectively international air law would have to be drawn. The existing definitions of space objects and aircraft and the existing interpretations of outer space and airspace as geographical realms, the two main sets of triggers of application of the respective regimes, still allow for far too much uncertainty in this respect.

Because of being the country most involved in serious projects developing private commercial spaceflight, including space tourism, and to a considerable extent actually promoting them for more general industrial and space policy purposes, the United States faced a substantial need to step into the gaps left open at the international legal level. The result was new national legislation and regulation primarily treating private commercial spaceflight as *space*flight, even as the door was left open to, over time, insert more aviation-law aspects and elements into the regime.

Europe is really the only other major area in the world where private commercial spaceflight, and to some extent also space tourism, is seriously contemplated and projects have been initiated to develop the necessary technologies and infrastructure. However, while the European Union at least originally tended to opt for a much more aviation- and air law-guided approach, owing partly to the threatening divergence from the US approach the relevant regulatory initiatives have been shelved, if not indeed silently cancelled. As a result, the few European states still interested in private commercial spaceflight are currently developing their own, idiosyncratic approaches, to more or lesser extents following the US approach.

From a theoretical perspective, both space law and air law being very much international in character (albeit from the opposite starting points of absence of territorial sovereignty and presence thereof respectively), it would of course make most sense to address private commercial spaceflight (and perhaps to a lesser degree also space tourism) at a global level as one coherent sector and determine at that same global level the extent to which the regulation thereof should be taken care of principally by space law, air law, or a mix thereof. Equally, from this perspective, it would be desirable to have such regulation enshrined in an international treaty of some sort.

However, the reality is that since the mid-seventies it has not been possible for the international community to agree on space treaties of general scope. Instead of the top-down approach of an internationally agreed treaty, most likely a bottom-up approach will arise, whereby those individual countries (or in the case of Europe, maybe the European Union after all) seriously interested in private commercial spaceflight will develop their own particular legislative and regulatory initiatives, where it may be hoped that those countries will look to existing legislation in other countries in order to not entirely fall out of line with general developments. The United States being first in this realm, its law would set the baseline model for national domestic regulation of the sector – hopefully ultimately to such an extent that a more or less uniform regime of customary international law regarding private commercial spaceflight would arise. Fundamental space law principles such as state responsibility and state liability, including for private space activities, would then provide some guarantees that the essentially individual approaches of various countries would not result in a race to the bottom, and make sure that ultimately "[t]he exploration and use of outer space, including the Moon and other celestial bodies, shall be carried out for the benefit and in the interests of all countries, irrespective of their degree of economic or scientific development, and shall be the province of all mankind [sic]" (Outer Space Treaty, Art. I).

This page intentionally left blank

PART IV
IMPLICATIONS

This page intentionally left blank

Chapter 9

SOCIAL RELATIONS, SPACE TRAVEL, AND THE BODY OF THE ASTRONAUT

Peter Dickens
University of Cambridge, United Kingdom

Abstract: Space tourism is often represented as an extended version of tourism on the Earth, with tourists experiencing relaxed and trouble-free experiences. But parallels between travel on the Earth and in outer space are misleading. The latter raises major issues concerning power-relations between passengers, pilots, and ground control. Who has the power in space tourism and how is this power exercised? The literature underestimates potential dangers to the human body. These include short- and long-term risks stemming from microgravity, exposure to radiation, and rapidly changing switches between day and night. These problems further undermine the popular image of space tourism as a wholesome and joyous practice. Space tourism may well be a very expensive way of achieving ill health. **Keywords**: space tourism; the body; power; human health

INTRODUCTION

In a recent paper to a conference hosted by the National Aeronautics and Space Administration (NASA) in 2007, M. G. Lord spoke of a

Space Tourism: The Elusive Dream
Tourism Social Science Series, Volume 25, 203–222

ISSN: 1571-5043/doi:10.1108/S1571-504320190000025019

contradiction lying at the heart of the American space effort. "What interests me," she writes:

> is the disparity between who we are in our imaginations and who we are in real life. In fiction, we have mastered extra terrestrial flight, our technology enables to, quote a classic split infinitive, "boldly go" anywhere. In reality, however, we are fragile creatures that do not thrive outside Mother Earth's atmosphere, gravity, and magnetic field. (Lord, 2000, n.p.)

Picking up Lord's theme, this chapter focuses first on the astronaut's fragile body and its changing relations to society and the risky conditions of outer space. How are these three items connected? So far, speculations about "brave astronauts" or "space tourists" floating about in outer space have remained dominant in fiction, but they have largely eluded the sociological literature. Yet, there are some important issues of power and knowledge involved here, and the intention of this chapter is to develop a conceptual framework which offers better forms of understanding. The chapter first deals with issues including modern space tourism and the theoretical insights which throw light on this process. It proceeds to develop these insights and applies them to further understand contemporary relations among society, outer space, the body, and space tourism.

As regards space tourism in particular, attention tends to be paid to the experiences of the tourist or the economics of the tourism industry. But rarely is attention paid to the experience of laboring in the outer space "industry" itself (Ladkin, 2011). This omission is getting repeated in the current discourse about space tourism. Yet, the popular image of the spaceman and woman makes it all too easy to forget that space tourism requires manual and mental labor on the part of the tourist and/or crew. Therefore, beneath the heroic image of "the right stuff," very little is known about the experiences of astronauts as embodied laborers.

How can the notion of "laboring in outer space" be specified in theoretical terms? This chapter turns, in the first instance, to Marx (1975). As a result of their long evolutionary history, humans have developed what Marx called their "species being," one which requires, *inter alia*, regular sleep, eating, and social interaction. Over millions of years, humans' "species being" has developed not only in the context of many social systems but of the Earth's gravity. It is convenient to imagine that this "species being" is highly flexible and easily be accommodated by the management of space flight. Marx himself argued that humans are "more universal than animals" (1975, p. 327). But such an assumption, as asserted later, does not of course mean that human beings are indefinitely "universal." In practice, the human body in outer space is constantly threatened and, in some cases, even destroyed. Managing the body in outer space entails constant monitoring and, as this chapter will elaborate, struggle between astronauts and those in power.

To take this argument further, we first need to critically assess the predominant, supposedly "objective," way of understanding the human body in outer space – a supposedly objective perspective with a long history called "space medicine."

POWER, RISK, AND THE BODY OF THE ASTRONAUT

Space Medicine

"Space medicine" has dominated work on the relations between the body and outer space. But this growing and supposedly "objective" science ignores all questions of social power and treats the astronaut's body as an object, one which can be readily experimented on. Space medicine claims to be objective and "scientific." Yet, it is a highly problematic discipline. As to the origins of space medicine, it is a discipline initially derived from Nazi doctors' experiments on how human bodies respond when exposed to extreme cold. This supposedly "objective" science was again really the direct product of power, a form of torture of people de-humanized by the Nazi Party. This included Jews, gypsies, the mentally and physically sick, and very young children (Jacobsen, 2014). Yet, under the notorious Paperclip program, the Nazi scientists involved, including Herbert Strughold (usually considered the father of the discipline), were spirited away from Germany by the American military at the end of World War II. They were quickly given influential positions in NASA. Strughold and his colleagues later used animals as a prelude to sending astronauts into outer space. Little if anything is known about the effects on these objects of sending them into the nearby cosmos.

Space medicine, as later practiced during the space race between the United States and the Soviet Union, again applies a scientistic, supposedly "objective" view of medicine, one that recognized and allowed only a one-way relation between the subject (the dominant experimenting scientist) and object (the human or animal body). More than half a century after the Cold War height of space travel, the "science" of projecting bodies (including living animals such as dogs, apes, and now human beings) into outer space is still portrayed as eventually bringing an unalloyed "good" both to the bodies concerned and to society (Clement, 2011). This attitude largely continues into the present day; yet there are now countervailing arguments which recognize to a much greater extent the autonomy and agency of the body, particularly the body in relation to social and political power and the always suspect claims of space medicine to neutrality, objectivity, and rationality. Launching an animal or a human being into outer space remains a process governed by those with economic and political power. But space medicine and its Earthbound practitioners again represent astronauts as possessing a high degree of agency and autonomy. Yet, this view is misleading. Astronauts are usually allowed only a very low degree of agency and autonomy. Such is the main lesson to be drawn from the earliest stage of the Apollo project and from the 1986 Challenger crash in which seven astronauts died. These episodes show how the power-relations surrounding a space project can affect, and on occasions even destroy, the body of the astronaut. But further rationality entails the management of a whole labor process undertaken by the astronaut.

Capital, Labor, Outer Space Crises, and Rationalization

The early days of NASA saw the successful Apollo project which, despite a major setback in 1967 when three astronauts died in a ground-based test, succeeded in landing astronauts on the Moon. But the realities and tensions surrounding the early US Space project were exposed with the failure of the Challenger flight in 1986 (Vaughan, 2016). Its diagnosis exposed the frailties and false assumptions surrounding the Challenger program.

Yet, the diagnosis by the US Presidential Commission which examined the disaster eventually concluded that it was only a "small" and hence "acceptable" risk of the Challenger program. This approach is what Vaughan (2016, p. 65) aptly called "the normalization of deviance." In the end, the putty sealing the solid rocket boosters had hardened and failed under freezing conditions. As a result, the Challenger flight blew up a few seconds after the rocket was launched, with the death of its seven astronauts. But it is still difficult to avoid asking the question why was the Challenger project disastrous? The answer in large part lay in the failure of NASA and the private Morton Thiokol company to adequately recognize the risk in a linked-up manner. NASA's reputation and Morton's share price suffered for a short period after the disaster, but in the end these reputations seem to have counted for more than the lives of the astronauts.

As to the private sector, how it has responded to such disasters and how it has ascended to its now powerful position. There are a number of competing companies here, one of the most prominent being SpaceX. A way of comparing SpaceX (the company owned by Elon Musk) with NASA would be to contrast them in relation to our particular concerns with outer space and the human body. NASA remains highly sensitive to the risks exposed by the Challenger accident and it now runs a large number of research projects concerned with the body in outer space. Musk's SpaceX spacecraft are designed and constructed in its Californian headquarters. This concentration of design and production presumably helps the company to underpin reliability and minimize risk. But this risk will now be further decreased as the Big Falcon Rocket will not only be designed and constructed in Los Angeles but actually flown from disused docklands in the same area. An organized labor-process is in place.

Presently, it is too early to say how Musk's program will affect the human body. At the time of writing, he has not flown any spacecraft containing human beings. His project remains "safe" in that very limited sense. Other private sector projects have also remained "safe" in a similar limited way. The main current exception is, of course, Richard Branson's Virgin Galactic project in which one of two test pilots died in October 2014. According to a report by the National Transportation Safety Board, the cause of this crash was a combination of human error on the part of one of the pilots and inadequate safety procedures. At this time, the future of this particular project seems to be in some doubt, though other outer space tourism projects are still projected by Virgin Galactic.

But public and private space missions alike still confront a range of "unknowns" when it comes to projecting the human body into the cosmos. This makes it difficult to assess whether privately financed missions are substantially safer than those financed and built by NASA. But one thing seems clear. Accidents such as that of the Challenger mission presumably led Musk and other private promoters of space travel to not only tighten up their safety procedures but to learn from NASA's earlier disasters and to start with a range of projects which does not incorporate the human body. Musk has delayed incorporating an astronaut into his plans for some time, perhaps because he does not want to prematurely expose his astronauts to the kinds of risk involved.

The astronaut's body actually remains something of a "black box" when it comes to understanding how he or she copes with the varying experiences of, and exposures to, outer space and to the managers back at mission control. Recent research is beginning to expose the many complexities involved (Houston & Heflin, 2015; Johnson, 2010).

Toward a Conceptualization

This chapter now introduces some of the theory required for gaining an adequate understanding of what is taking place. As discussed earlier, we are using and developing here a conceptual framework first introduced by the young Karl Marx (1975). He argued that as human beings change or interact with external nature, they change their own internal nature. Marx applied this dialectical approach to understanding the plight of the industrial worker at the dawn of industrial capitalism. But, as suggested earlier, his perspective can be extended to consider the circumstances of astronauts as they confront both the demands of their controllers and the dangers presented by outer space. With this in mind, the work of the neo-Marxist sociologist, Henri Lefebvre can guide this discussion. At the heart of his analysis was an abiding concern with how society was being "spatialized" or, as this chapter would argue, now "*outer*-spatialized." Mirroring Marx and Engels, Lefebvre (2004, p. 40) insisted that "social practices" presuppose the use of the body, the application and use of the hands, members and sensory organs. Again like, the young Marx, Lefebvre was also centrally concerned with the body throughout the whole of his work. This focus on the astronaut's body is also central to our concerns. Lefebvre's original perspective is summarized in Figure 1. This describes in diagrammatic form the two-way interactions between "outer spatial practices" (these receiving the most attention in this chapter), "representations of outer space," and "representational outer space."

Lefebvre's perspective can be used to understand society's relations to outer space. Outer spatial practices have so far been given limited attention by the social sciences. But, as outlined earlier, they should be of interest to any discussion of the relations between society and outer space.

The outer spatial practices here are those of astronauts' bodies as they are projected into outer space and required to carry out a number of tasks and experiments. But here is the main stumbling block for the social sciences: astronauts are also likely to experience a large number of the so-called side effects resulting from such spaceflight. These include, as mentioned earlier, suffering from the rhythms consisting of irregular days and nights. Similarly, astronauts experience further "side effects" resulting from the body being exposed to low gravity and radiation. The latter, and its

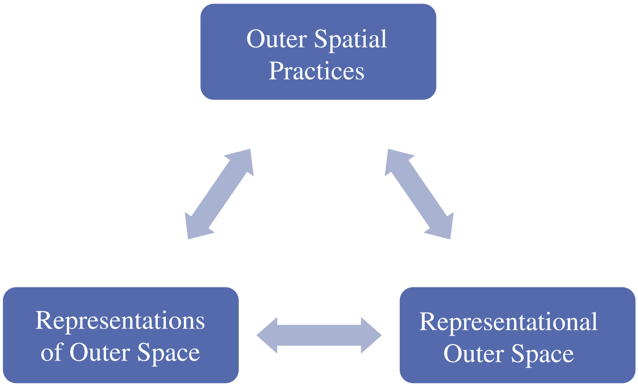

Figure 1. Lefebvre's Original Conceptualization
Source: Adapted from Lefebvre (1991[1974]).

effects on the body, cannot be simply ignored or assumed away as is very often the case. In 1961, when Yuri Gagarin was fired into orbit, his body was relatively well-protected from cosmic rays. During this very early era of space travel, the Sun's magnetic field was particularly active, deflecting away many of the incoming dangerous particles. But now the rise of this cosmic radiation is increasingly recognized as a major threat to the body, one very likely to adversely affect spaceflight safety and mission planning of "outer spatial practices" (Dorrian & Whittaker, 2018a, 2018b).

The science of outer space is "representations" in Lefebvre's terms, those which can now begin to quite accurately describe the workings of the cosmos (Figure 1). The discussion now considers other aspects of Lefebvre's work, those which can also be usefully extended to the study of the outer spatial body. The space medicine described earlier remains one form of *representation*, albeit often a poor one because it fails to take sufficient account of power-relations and of the body as a real, vulnerable entity. Representations of outer space, and of the body in outer space, can of course take many and varied forms. They can also, for example, include those in film, "comics," or in literature such as space and science fiction. These often portray the astronaut as encountering seemingly impossible conditions but remaining "tough" or "heroic" and usually overcoming these hazards.

However, this kind of representation, ultimately perhaps misleading, has actually been influential in the making of *real* space programs. They have been influential in, for example, the representation of astronauts in their spacesuits as half human and half machine "cyborgs" (deMonchaux, 2011). But such representations, though certainly pervasive in popular literature and space fiction, are eventually very problematic in the sense that they under-recognize the real threats, biologies, and vulnerabilities of astronauts as they enter the outer space. This should remain central to the understanding of the body in outer space.

Returning to Figure 1, "Representational Space" or in our case "Representational *Outer* Space" refers to visions and utopian ideals informing the humanization of outer space. As Lord (2007) and many others have documented, copious dreams and visions have of course been posited by science fiction writers such as Robert Heinlein and Olaf Stapledon. As Figure 1 indicates, such visions have on occasion actually informed and influenced the forms of real, material projects, including the American space program. It is easy to dismiss these visions and utopias as merely fanciful, but of course they can often describe accomplishments and ways of life toward which human beings may aspire and on occasion actually accomplish. For example, Chesley Bonestell's paintings of a humanized cosmos made in the 1950s directly helped (particularly via the mass readership of *Collier's* magazine and Walt Disney movies) to shape and enhance popular support for the real "material practices" of the American space program from the 1950s onward (Dickens, 2015; Sage, 2014).

As Figure 1 suggests, material practices, forms of knowledge, and alternative worlds constantly interact with one another, often in complex ways. But here the human body is infused into *all* aspects of Lefebvre's conceptual thinking. Thus, while not mentioned in Figure 1, the body is similarly incorporated into outer spatial practices, representations of outer space, and representational outer spaces. This helps to stress Lefebvre's abiding concern, and indeed our own abiding concern, with the human body in relation to *all* aspects of social life, including the human body's life in outer space.

Now combining a Lefebvrian perspective with recent more empirical work on the astronaut's body, the discussion returns to the question posed earlier: How, as humans are projected into outer space, are they themselves changed?

Lefebvre, Rhythmanalysis, and Outer Space

With the aid of Lefebvre and the early Marx, the two-way, reciprocal, interactions between bodies and the rhythms and threats of outer space can be explored. This interaction is not of course only between individuals and outer space. As mentioned earlier, an astronaut is necessarily part of a socially and collectively planned project, such as the American Apollo program or a project that now being planned and made by SpaceX (Sage, 2014).

First, transformations of the body take place within the context of the rhythms and cycles of the human body and its complex relationships with the rhythms and cycles of the Earth, the Moon, and perhaps other spatial entities such as Mars. Again, the human body has, of course, evolved on the Earth and it has obviously not been exposed to, for example, the new and changing periods of day and night like those experienced in outer space. This raises a question: What are the outcomes of launching human bodies into new, extraterrestrial rhythms, and cycles which do not match those experienced by the human body on the Earth? Lefebvre's (2004) work on "rhythmanalysis" is very suggestive for "the outer spatial body." This is, first, due to his continuing and abiding focus on social and political power.

The clashes between the rhythms of outer space and the rhythms of the human body cannot be considered as simply "natural." This is again because the rhythms of the human body, which have developed over millennia of evolution, are now being overridden by projecting human beings into outer space. They are simply *allowed* to clash by elites such as scientific advisers and mission controllers and those engaged in space science as discussed earlier. Astronauts, while sometimes receiving widespread popular adulation, are clearly taking (or being obliged to take) enormous short- and long-term risks with their health. But they, and indeed society, at large, obviously need to know about these risks and to reflect upon them.

Hazards of Long-distance Missions

With Lefebvre's conceptualizations in mind, we can now start considering in more detail the outer spatial practices of astronauts under the management of mission control. Earthly control centers are nowadays less concerned with catastrophic accidents and explosions. They are much more concerned with the emerging challenges to the body during long-distance missions around the Earth and eventually, if Musk's longer-term plans are successful, to Mars (Daniels, 2017).

Somewhat ironically for the romanticized futuristic image of spaceflight, astronauts in practice appear to "age" during their exposure to outer space.

Calcium drains out through their urine and bones dwindle at about 1% per month. Eyeballs lose their shape and vision becomes blurry. Astronauts undertake exercise as a means of restoring lost muscle mass and declining eyesight, but for some astronauts, a complete recovery never takes place (Fong, 2014a, 2014b). The implication is that their strength may well be permanently reduced as a result of space travel. Yet restoring muscle mass and eyesight must surely be priorities for those undertaking long-term missions.

Further contradictions and dangers stem from the exposure of the astronaut's body to radiation, especially during long-distance missions (Moreno-Villanueva, Wong, Lu, Zhang, & Honglu, 2017). "Free radicals" are atoms or groups of them that start a chain reaction in the body, causing damage to cells and DNA. Astronauts, like others, have evolved strategies to confront such damage on the Earth. But in outer space, free radicals can start a chain reaction within the body. The chief danger comes from the damage they can do when they react with important cellular components such as DNA. This in turn can result in cancer. Of course, such damage will almost certainly not become evident until well after the astronaut's flight, this being the kind of issue hardly confronted at all by space science (Moreno-Villanueva et al., 2017; Phillips, 2012). Nevertheless, young astronauts and the wider public need to know about these risks. The hero status projected on to them by adoring publics (a status already in decline as space travel becomes more common) may well have been acquired at considerable cost to astronauts' later lives.

An even more catastrophic threat to the astronaut's body arises if the protection offered by a spacesuit or spaceship for some reason fails. Phillips stresses that the space environment is very unfriendly:

> It is an almost complete vacuum that would cause you to essentially explode if exposed without the protective atmosphere inside a space suit or spaceship […] All of your body fluids would begin to boil due atmospheric pressure, and you are mostly made of water. This would be a rapid and unpleasant end. (2012, p. 56)

A still more immediate threat facing the outer spatial body stems from the low level of gravity. Again, the human body has evolved in an unchanging gravitational field on the Earth; its form, structure, and physiology have indeed been defined by terrestrial gravity. But, as Fong puts it, "take gravity away, and our bodies become virtual strangers to us" (2014a, pp. 229–230).

Once removed from gravity for a protracted length of time, the muscle groups of the human body start to deteriorate even to the extent astronauts are unable to walk when they return to the Earth (hence the somewhat demeaning image of returning astronauts being carried away from the landing sites in large soft chairs). This muscle-weakness persists until astronauts have sufficiently exercised their limbs while back on the Earth. Ethically questionable experiments with rats in outer space show a third of their muscle bulk is lost within nine days. Is it acceptable that astronauts (and for that matter, rats) should be exposed to such experiments?

The issue of changing gravity levels has, like the exposure to radiation, become all the more pressing with the advent of long-distance spaceflight. It has recently been found, for example, that the astronaut's body can be considerably stretched during a prolonged mission, a result of the spine straightening out when no longer compressed by the weight of gravity. This is just one of the many contradictions between outer space and evolved human body as it is transported into outer space. As early as 1923, Hermann Oberth devised a solution to the problem of maintaining long-term gravity in outer space. It consisted of a vehicle attached to a counterweight that would "spin end over end like a twirling baton, subjecting the occupants to artificial gravitation load" (Fong 2014a, p. 230). Subsequent research programs have developed yet more supposed "solutions" to the problem. But the scientist and television presenter Kevin Fong, who has himself been subjected to artificial gravity experiments, makes clear that it will not be easy to incorporate gravity devices, which he calls "compact torture chambers or giant twirling batons," into future spacecraft. "There's a lot of work to be done before that can happen," Fong (2014b, p. 234) notes. This consists of inventing gravity-making devices small and efficient enough to fit into already crowded spacecraft. So far such innovations are proving very difficult to achieve.

The gravity problem is therefore yet another threat to the astronaut's body, a threat which has still not been adequately understood. NASA's Artificial Pilot Project, designed to find ways to protect muscles from low levels of gravity in outer space, has reportedly been shelved due to budget cuts.

Rhythms, Managers, and Astronauts' Bodies

Research on state agencies and on private businesses engaged in space runs the constant risk of conceiving such programs as technical problems to be solved. They thereby remain trapped in the scientistic paradigm of space medicine. Again the work of Henri Lefebvre is uniquely helpful for understanding the astronaut's body and outer space in dialectical, relational terms. His concept of "rhythmanalysis" can again be used to start describing the undeniable, intersecting, and often contradictory relations between the rhythms of the universe, the rhythms of the body, and the rhythms or regimes imposed by the socially and politically powerful.

But Lefebvre's work also reminds us that the rhythms of the body in outer space are not only a simple product of power hierarchies in the space industry. As mentioned earlier, they also arise directly from the rhythms of the universe itself, from the regular orbits and rotations that structure days and nights, weeks, and years, here on the Earth. The tensions between the evolved human body and the conditions of outer space are again prominent here and potentially dangerous. Recognizing the complexities of these different forms of rhythm has so far been largely unrecognized, especially by space science. But they will have to be recognized if astronauts or space tourists are to be successfully projected into outer space over long periods of time. The science of bodies in outer space has still not taken these tensions and conflicting rhythms on board, but they will have to be dealt with if human bodies in the cosmos are to remain relatively safe.

Conflicting Rhythms

The attempt to micromanage astronauts raises still more important issues, many of which can also start to be recognized and envisaged by adapting Lefebvre's focus on rhythms. Human beings' bodily rhythms are to a large degree coordinated with each other. These rhythms are clearly linked to cyclical movements such as day and night, but they also have their own internal cadences, determined by millennia of physiological evolution. But what happens when the astronaut's body is exposed by managers at Mission Control to different, and changing, rhythms? For example, what happens when the astronaut's body is completely separated from the familiar alternating phases of light and dark to which we are accustomed? The rhythms of the body will, in these circumstances, almost certainly not combine well with those of the cosmos. These issues again surely need understanding if heroic visions of travel through the cosmos are seriously envisaged.

In fact, recent empirical research shows that the real interactions between bodily rhythms and outer spatial rhythms are far more complex and far-reaching than simulations and convenient assumptions regarding the body in outer space would suggest (Barger et al., 2014). Already in the case of space shuttle missions and the months spent on the International Space Station (ISS), astronauts have been left struggling to get adequate sleep and rest, since the Sun "rises" into view every 90 minutes. Can the human body adequately withstand these kinds of treatment? There are complexities here which space science has again still not adequately addressed.

Such clashes of rhythms make it very difficult for astronauts to remain alert and efficient. Furthermore, recent studies of 64 astronauts on 80 shuttle missions and 21 astronauts on ISS missions have shown that "sleep deficiency is pervasive among crew members" (Barger et al., 2014, p. 910). Shuttle astronauts slept for just six hours per night on average, when mission controllers advised 8.5 hours. Astronauts very often turn to sleeping pills to compensate for such rhythmic imbalances. About 78% of shuttle-mission astronauts used sleeping pills on 52% of flights (Barger et al., 2014). But sleeping pills are hardly a viable solution, especially for longer missions, since astronauts can only get a few hours of sleep at a time and the sleeping pills solution would adversely affect their performance and potentially endanger their health. Complex conflicts between the rhythms of the cosmos and the internal rhythms of the body are thus real and must be examined in detail before real space flight, including the future forms of space tourism, can be assumed to be practical and safe.

Much of the work concerning the rhythms of the body is conducted in the United States and China and in some instances published by military journals. In fact, the whole issue of the conflicting rhythms experienced by the astronaut now looms quite large in specialist journals such as *Military Medical Research*. The concern here is presumably that surveillance of the Earth or even "manned" hostilities in or from outer space could prove highly problematic if military astronauts are badly disoriented by punishing combinations of their bodies' rhythms with the rhythms of the cosmos. Ingestion of sleeping pills to compensate for such clashes might not combine well with accurate surveillance or warfare from, or even within, outer space. But the concern with the clashes between human and universe rhythms are not merely a critical matter for military analysts. As outlined earlier, the clashes between artificial night and day and the bodily rhythms of the astronaut outlined above will necessarily affect all forms of manned missions into outer space, these including the missions of space tourists. These realities and their inflictions might eventually take a good degree of the glamour out of space travel.

Appropriated Time: Missions Control

The management of astronauts' bodies by mission controllers is almost totally neglected by the social sciences. In theory, as already outlined, the managers and controllers could, with the aid of the relevant scientists, take account of the multiple clashes between the rhythms of the body and the changing rhythms of the universe. Earthbound simulations of these clashes might be possible, yet in practice such simulations would be difficult to carry out. Astronauts are now made by controllers to yield to their quite crude and simplistic ideas and demands. This is especially the case as controllers' priorities are often, as further documented shortly, to make astronauts work harder and for longer periods of time. These power-relations involved in space-flight are disturbingly similar to the management of factory laborers during the early stages of industrial capitalism.

Lefebvre's notion of "appropriated time" refers to the management of time and flows of people in urban space. But, according to Fishman, it can also be made to refer to mission controllers trying to make crews obey a preset timetable, monitoring their movements, and issuing new commands. The cyclical rhythms of the body in outer space are closely monitored and, with the aid of medications, managed by mission control. But ground controllers are usually attempting to impose a "linear" regime on the astronauts, one in which standardized tasks must be undertaken as part of a regular sequence over time (2015, p. 14). This often causes tensions between the mission controllers and astronauts, since the latter are usually looking for a high degree of autonomy and flexibility.

Astronauts frequently comment on this type of rigid linear order imposed on them by their superiors, this resistance again resonating disturbingly with the early stages of industrial capitalism. But astronauts can also resist the labor processes imposed by their managers. One astronaut aboard the ISS complains of being given "only 30 minutes (scheduled) to execute a 55-step procedure that required collecting 21 items. It took 3 or 4 hours." According to another astronaut's journal notes:

> It has been a pretty tedious week with tasks that were clearly allotted too little time on the schedule. Talking to [a Mission Control staff member] today, I realized he just doesn't understand how we work up here. (Fishman, 2015, p. 16)

Astronauts on Strike

Yet astronauts have also found ways to resist or evade the controllers' authority. All this further adds to the parallels between the management of astronauts' bodies by mission controllers and the control of laborers' bodies by managers back on the Earth. A recent study of astronaut–management relations for the ISS documents, for example, covers some of the harsh realities of these relations. It again resonates with the power-relations of industrial capitalism rather than glamorous representations of space fiction or indeed representations offered by proponents of space tourism.

Astronauts are now being reduced to little more than automated technicians. The pace and rhythm of the day are unequivocally set by mission control. Life on the station is managed via a spreadsheet: every minute of each astronaut's workday is mapped out in blocks devoted to specific tasks. When an astronaut clicks on a time block, it expands to present all the steps necessary to perform the task at hand – whether it is conducting an hours-long experiment on the behavior of fire in zero-G or stowing supplies from a cargo ship (Fishman, 2015, pp. 15–16).

Perhaps the most extreme, if not well-publicized, example of mission controllers over-working astronauts arose with the 1973 launch of Skylab 4 (Hiltzik, 2015). It is also a case of how the reporting of a political struggle can be influenced by the times in which the reporting takes place. This was the last of the Skylab missions, and astronauts in previous stages of this program had been unable to collect all the scientific data required for their mission. As a result, the mission controllers of Skylab 4 demanded that this final Skylab mission should consist of a fairly remorseless 16-hour day. An extended speeding-up of labor-processes for the program was needed for the whole Skylab program to be deemed a success. The work of this last mission was therefore made highly intensive for the whole Skylab program to be regarded successful. But this proved to be far too much for the SkyLab4 astronauts. Productive in their work but falling behind an over-ambitious seven-day-a-week schedule, Commander Jerry Carr requested Sundays "off." This was another example of rationality being failed or at least temporarily subverted. The astronauts effectively went on strike, refusing all communications with mission control. The astronauts used the time, however, not to entirely stop working but to catch up on work left undone. But punishment came later, with none of the astronauts being later selected for a mission.

Here, we are witnessing no less than an early form of class struggle between managers and workers, one first conceptualized by Marx a century and a half ago and now transposed to outer space. Today, the whole episode is rubbished by press accounts as minutely small scale. But this misses the point. Seen in the context of the times, even a very small strike by astronauts was suggestive of much wider possibilities (Loomis, 2017). The astronauts' strike took place in an era when workers' control over the means of production was being seriously considered by those in, and those against, the labor movement. The 1970s, the period of the astronauts' strike, was one of the most important decades in the history of the labor movement. A small-scale strike against an overbearing management was then, and to some extent still is, suggestive of much wider struggles and possibilities. Besides, what more spectacular place could there have been for a strike, one taking place 36,000 kilometers above the Earth's surface and watched by a helpless management left on the Earth.

Returning to the Earth

Conflicts and contradictions between the controllers and the body in outer space do not necessarily end even when the astronaut returns to the Earth. The process of reentry may well collide with the "species being" of astronauts, bringing severe crises, these often deeply affecting the astronauts' mental as well as physical well-being. But at the same time, the homecoming can also bring some more positive perspectives on the nature of the human condition.

Smith's (2005) study of the nine then surviving lunar astronauts is very suggestive here. All the Moonwalkers struggled to adjust to the social regimes and rhythms they faced when returning to the Earth. This was partly due to the "overview effect" of perceiving the Earth and humanity from such a literal and figurative distance (White, 1998). These effects often resulted in the epiphanies that many of the astronauts had experienced in outer space. For instance, Marc Garneau, the first Canadian to enter outer space, reported, "there are wars going on, there's pollution down there, but these are not visible from up above. It just looks like a very beautiful planet" (cited in the study by White, 1998).

The experience of circling Earth has resulted in many astronauts developing new conceptions of both the cosmos and their relation to the universe, and even to society on the Earth. This overview effect has now even been given physical recognition in the design of the ISS. A special "cupola" designed by the European Space Agency has been created in the spacecraft, offering space for meditation while flying through the cosmos. The cupola is by all accounts regularly used by ISS astronauts (Durrani, 2016). Such viewing facilities are also likely to appeal to paying space tourists.

But serious problems can emerge when such experiences are replaced by the humdrum routines experienced by the astronauts as they return to the Earth. For example, Neil Armstrong, the first astronaut to walk on the Moon from Apollo 11, virtually disappeared from social life on his return. In fact, he became somewhat notorious for his absence. As Smith writes of Alan Bean:

> When I review my travels among astronauts, my mind's eye goes first to the Houston Shopping Mall where Alan Bean sat for hours after returning from space, just eating ice cream and watch the people swirl around him, enraptured by the simple but miraculous fact that they were there and alive in that moment and so was he. (2005, p. 347)

Bean seems to be mesmerized by the clash of rhythms between the crowd and his own rhythm as a now-landed astronaut, but note again the apparent absence of official concern for the returning astronaut. The space medicine offered by NASA largely lost interest in the outer spatial body once the astronaut's job is done and he or she is decommissioned. Many astronauts, especially in the early days of space travel, have been largely neglected, indeed left to look after themselves once they have reentered society on the Earth. This is another instance of the objectification of the astronaut's body. It is another case of the astronaut's body being treated as an inert object.

Yet, we must also recognize here that Lefebvre's notion of "appropriated time" is intended as a positive concept, and one with special significance when experienced by the outer spatial body. It is, in Lefebvre's words, "time that forgets time, during which time no longer counts (and is no longer counted)" (2004, p. 85). The reflections of Marc Garneau, quoted earlier, offer an example of "appropriated time," a cosmic version of "time out," one opposed to the highly organized "linear" control over time as directed by the managers from the Earth and an opportunity to just reflect through the spacecraft's window. Here lies a form of escape from the pressures imposed by mission control, but at the same time an opportunity to imagine different and better social relations back on the Earth.

CONCLUSION

Applying Marxian political economy to the study of people in outer space at first sounds like a peculiarly masochistic undertaking. Yet Marx and Lefebvre's work demonstrates the essential need to remember the power-relations made in and through the outer space. These very often go missing in the social science literature on outer space. "Power-relations" in this context particularly applies to the relations between astronauts and their controllers. These too are often forgotten in the literature on outer space.

Some long-distance engagement with activities on the Earth will probably be available to astronauts and future space tourists as they proceed deeper into outer space. A recent account of such practices in contemporary space travel suggests, for example, that "a microcosm of home life" will be made available to astronauts (Johnson, 2010). Special occasions drawn from everyday life on the Earth, such as holidays and family birthdays, will be shared between astronauts and their families. Selected football or baseball games will be beamed up to spacecraft via satellite for spacefarers to enjoy or otherwise. NASA managers now actively encourage these kinds of celebrations and practices, hoping that such events may help to relieve the monotony and sustain morale.

With space travel now defined by longer missions, relations between astronauts and their controllers may be changing. Crews on extended missions have generally not found their experience boring and monotonous, but their activity nevertheless remains intensively managed by NASA mission control. The aim is to keep the astronauts busy. When, for instance, one Skylab crew recently appeared insufficiently occupied by their assigned working hours, Ground Control quickly found more tasks for them (Peldszus, Dalke, Pretlove, & Weld, 2014).

Future astronauts, and maybe some space tourists, will have to undergo a period of training on the Earth. But, even so, their movements and decisions in outer space will have to remain closely monitored by mission control even when their internal body clocks no longer coincide with the rhythms of other celestial bodies. As discussed in this chapter, the clocks represented by the circuits of the Earth, the Sun, the Moon, and Mars may have to be imposed upon the rhythms of the astronaut's body. But to what extent can the body really be assumed to simply adjust to the demands of their controllers or to the changing rhythms of external nature? Again, some heroic assumptions are being made by the inventors and administrators associated with space travel about the flexibility of the astronauts' body as it combines with the changing rhythms of the universe.

This links to a key issue of this chapter: the often problematic relations between mission control and the astronauts. As already discussed, these relations can be very fraught, with mission control having access to extensive knowledge and information which is not available to astronauts. Knowledge available to mission control, of course, lends them power, including power over astronauts. The issue of power surely remains here. Emancipation for astronauts will remain unrealized so long as their bodily rhythms and practices are made subject to the "appropriated time" and "conflicting rhythms" imposed by mission control. Unrealistic but convenient assumptions about the bodies of astronauts, and indeed of space tourists, being flexible and capable of overcoming or endlessly adapting to the rhythms and dangers of outer space will no longer suffice. Much better understandings, based on the experience of real human beings in the cosmos (for increasingly long periods), will have to be made accessible to space travelers of all kinds (Rowen, 2017).

These kinds of transformation challenge the underlying issue, that of social and political (with a small "p") power. The problem here is the familiar one; the division between mental or intellectual labor, on the one hand, and manual labor, on the other (Braverman, 1974). So far, power over spaceflight has been largely held and exercised almost entirely by elites, these strongly influencing, and represented by mission control and spacecraft manufacturers. But for space travel, as for many other forms of social activity, this division of mental and manual labor could take more progressive forms. In the case of space travel, the division of labor between the astronauts and the elite controllers based at mission control could be curtailed and reallocated back to practitioners, especially to astronauts. In this way the power and control over the astronauts' bodies could be transferred back to, used and transformed by, astronauts themselves rather than by dominant elites back at mission control. In terms of politics, this is perhaps the key political conclusion of this essay.

The start of this chapter cited M. G. Lord and her hope that "our flesh does not forever curtail our dreams." This is clearly a laudable enough goal but more clarity is surely needed. In a class society such as ours, who exactly are the "we" in Lord's hopes? Are powerful elites still thinking up and imposing new, long, and dangerous missions for astronauts and space tourists alike? The answer is quite varied, but elites of different kinds are certainly involved in this kind of magical thinking.

On the one hand, Elon Musk is competing with NASA to service the ISS. More ambitiously, his company is planning to launch a spacecraft to the Moon (originally planned for 2018 or earlier, but it has been delayed) and to Mars as early as 2023. Meanwhile, Musk's attentions have been turning back to the Earth. More "mundane" projects include using his spacecraft to reduce travel times between cities on the Earth. He is claiming that a London-to-New York trip could be reduced to 29 minutes (Grady, 2017; Titcomb, 2017). The plans of Richard Branson and Virgin Galactic remain quite modest by comparison. A jet aircraft flies to about twice the height of a regular aircraft and releases a smaller rocket-powered spacecraft (SpaceShip Two) offering tourists a very brief encounter with the edge of outer space (Grady, 2017).

A radical alternative would, of course, be to remove elites from decision-making over outer space. The whole process of space-humanization (including even the militarization of the cosmos) should be democratized, with the use of outer space being made subject to popular democratic control. Cosmic humanization would be determined not by powerful elites but by the great mass of people left down here on the Earth.

Acknowledgments – This is an extended version of an article that first appeared in *Monthly Review* in March of 2017 (Volume 68, Issue 10). The author thanks *Monthly Review* for giving permission to reprint some of the material in this periodical. He also thanks James Ormrod and the editors of this volume for their patience and assistance.

Chapter 10

SPACE TOURISM, CAPITAL, AND IDENTITY

James Ormrod
University of Brighton, United Kingdom

Peter Dickens
University of Cambridge, United Kingdom

Abstract: Space tourism is a rapidly growing sector of capital accumulation. As virtually all space on the Earth has been humanized and populated, outer space is being made by elite groups into the new exotic destination of choice. But the humanization of outer space also reinforces an ancient and powerful worldview concerning society's relations with the cosmos. It relies on the idea that outer space is an apparently pure and serene "other" place offering a profound sense of awe, wonder, and renewed identity. This hegemonic view of the cosmos and society is a product of a new dominant social bloc, one incorporating pro-space activists, the aerospace industry, the tourism industry, and governments. **Keywords**: capital accumulation; government; elites; space activism; self-identity

Space Tourism: The Elusive Dream
Tourism Social Science Series, Volume 25, 223–244

ISSN: 1571-5043/doi:10.1108/S1571-504320190000025020

INTRODUCTION

Paradoxically, early space tourism was a result of the Russian state:

> embracing the capitalist mantra as they seek to make money from their orbital ventures. They have the only space program to date that has made millions of dollars by selling seats on their rockets to private companies and private citizens. (Spencer & Rugg, 2004, p. 23)

Perhaps, the most dramatic point is that the Russians have embraced capitalist tourism in space much more than the National Aeronautics and Space Administration (NASA). As Spencer and Rugg put it, "The Russians have become the 'cowboys' of Earth orbit" (2004, p. 23). After a number of abortive attempts by American and Russian conglomerates, American company Space Adventures sold flights on board a Russian Soyuz rocket to the Russian part of the International Space Station (ISS) to multimillionaire business people. Each flight cost about US $20 million, the first being that of Dennis Tito. There has been no shortage of applicants, most famously including *NSync singer Lance Bass.

However, contemporary tourism entrepreneurs have their sights set on opening up space to more and more people and not just a few elite individuals. Space Adventures, at the time of writing, has "curated a suite of private spaceflight experiences to suit all interest levels and budgets" (2018, n.p.) and are offering zero-gravity flights, "atmospheric" flights, and orbital spaceflights, with the option to participate in a spacewalk. They have taken deposits for the latter experiences, even though these services are not yet operational.

As of 2007, a number of companies were competing in the space tourism business, including SpaceX, XCOR, Blue Origin, Virgin Galactic, Armadillo, SpaceDev, and Scaled Composites. Following the familiar pattern of competitive capitalism, some of these companies are to succeed while others go out of business (Dickens & Ormrod, 2007). This has indeed proved the case. XCOR, a company specializing in rocket engine development, filed by bankruptcy in 2017. Armadillo, a specialist in the rapid building and testing of spacecraft was taken over by EXOS Aerospace in 2014. SpaceDev, which worked closely with NASA in the building of a new spaceship, was taken over by the Sierra Nevada corporation and turned to work on the production of micro-satellites.

Virgin Galactic has been one of the largest companies selling vacations in space. This was a collaborative effort between Sir Richard Branson (head of the Virgin group of companies), Paul Allen (Microsoft cofounder), Burt Rutan (a developer of spacecraft), and Philippe Starck (a design guru). Allen contributed $25 million toward the successful attempt by Rutan's company Scaled Composites to win the $10 million Ansari XPRIZE. This company won the prize for developing a reusable suborbital vehicle, flying SpaceShipOne to the edge of space twice in five days. Virgin Galactic spent over $100 million on White Knight Two, a jet-powered cargo aircraft used to lift the smaller SpaceShipTwo designed to fly a small number of passengers to the edge of outer space. Charging $200,000 per person, the company had by late 2006 collected $13 million in deposits for future spaceflights. However, Virgin's plans suffered a serious setback (or what they termed an "anomaly") in 2014 when a SpaceShipTwo crashed into the California desert during a test flight. This resulted in the death of one pilot and serious injuries to the other. But, despite this major setback, Virgin Galactic now appears to be recovering: they have successfully tested a slightly modified rocket (see Chapters 1, 2, and 7 for further discussion).

Projections for the future of privately financed space tourism are ambitious. Spencer and Rugg (2004) made the analogy between the growth of luxury cruising on the oceans and potential growth in space tourism. They argued that Tito's flight was a "pioneering phase." They predicted that by 2020 the ISS will have been converted into the first "private orbital yacht" and around one thousand private citizens will have traveled "off world." In the next "exclusive" phase, wealthy individuals and corporations will be engaging in orbital yacht racing and celebrities will be making outer space their preferred venue for weddings. The "mature phase" will be one in which cruiseships seating one hundred persons and offering a range of recreational facilities will be available. By 2050, one million people will be touring off-world and "the year 2075 could see 3000 to 5000 tourists and sports fans going every day" (Spencer & Rugg, 2004, p. 52). In 2002, Ashford suggested the market for $100,000 flights was 10,000 per year and reported that some estimates were that the sector might be worth $20 billion a year by the time this book was published. Virgin Galactic's own market research suggested that there were 650,000 people willing and able to pay for suborbital flights (Reddy et al., 2012).

In more concrete terms, it has been reported that Virgin Galactic have already sold 650 tickets for suborbital flights at $250,000 each (Pomerantz & Isakowitz, 2013, cited by Cohen, 2017). What this means for longer term demand is highly uncertain. But the excessive optimism regarding the possibilities of space tourism during the twentieth and early twenty-first centuries has in fact proved to be unjustified (Cohen, 2017). By the time of writing, space tourism has still not emerged as a viable sector, one operating on a mass scale.

There were even greater promises made for when orbital tourism is finally mature (see Chapters 1, 2, and 7). This includes, as mentioned earlier, the creation of orbital "hotels" – destinations in orbit more geared to the tourist experience than ISS. The idea was first mentioned by Barron Hilton, the president of Hilton Hotels, as long ago as 1967 (Spencer & Rugg, 2004, p. 160). In addressing the American Astronautical Society, he assured them that "when space scientists make it physically feasible to establish hotels in space, the hotel sector will meet the challenge" (Billings, 2006, p. 162). A Hilton hotel, as well as a PanAm orbital flight, featured in Stanley Kubrick's *2001: A Space Odyssey* (1968). Designs for hotels incorporate large viewing windows, and in an extended weightless stay, the space tourism visionaries imagined ever more fantastic leisure pursuits and games to be enjoyed in zero gravity. Collins and Graham (1984) presented ideas on how orbital hotels will allow tourists to fly with wings and play in cylindrical zero-gravity swimming pools. Collins, Fukuoka, and Nishimura (2000) have also produced a design for an orbital sports stadium. These fantastic orbital facilities sound like something of the distant future. Yet, the inflatable "Bigelow Expandable Activity Module" has been attached to ISS for two years as part of the development of Bigelow Aerospace's commercial operations and has been used by astronauts for experiments and storage (NASA, 2017a, 2017b).

A SOCIOLOGY OF SPACE TOURISM

How should we understand space tourism from a sociological point of view? Inevitably any such understanding must be somewhat speculative; but, through a focus on historical materialism and forms of subjectivity, we can begin to offer some understanding. It should be noted that the approach we are offering here about capital and identity in space tourism is somewhat different from those arguably more fashionable approaches in the sociology of tourism (Cohen & Cohen, 2012a, 2012b). For example, recent studies, such as Johnson and Martin (2016), have explored space tourism through the mobilities paradigm.

We divide our discussion into three sections, although all are in their own way related to the dynamics of late capitalism. The first brief section looks at space tourism from the perspective of industry's interest in developing new circuits of capital. The question here is why people have come forward to invest in the fledging space tourism business despite the obvious financial risks involved in so doing.

The second focus is on the likely future consumers of space tourism and how it might be related to questions of identity. A number of studies, largely conducted as market research, have attempted to tap the "motivations" of potential space tourists (Chang, 2017; Reddy et al., 2012; see also Chapter 6). While interesting, such studies are limited in their focus on motivations as articulated by consumers in response to direct questions. Our aim is to utilize sociological theory to understand the relationship between space tourism, capital(s), and identity in ways that go beyond this surface level. We wish to understand why space tourism has a special appeal without resorting to notions of genetic predisposition to thrill seeking (Reddy et al., 2012).

Third, we discuss the relationship between the journey to outer space and the "inner space" of the psyche. We briefly discuss those activists who are campaigning in support of the space tourism sector. These form a more-or-less distinct part of the pro-space movement studied in our previous work (Ormrod, 2006). We argue that a slightly different account needs to be given of activism in support of space tourism from that given by its consumers. Following these three sections, we conclude with a brief account of findings from research into the public's attitude toward space tourism

Circuits of the Earth and Capital

Elsewhere (Dickens & Ormrod 2007, 2009; Dickens, 2016), we have given an account of how investment in outer space can be explained on the basis of interacting circuits of capital (following Harvey, 2003). Extending Harvey's work to the scale of outer space, the "outer spatial fix" refers first to the intrinsic need for capital to spread out over space as a means of overcoming crises of over-accumulation in a particular place and time. Capital, however, has attempted to adapt to such crises. The provisional solution to the problem is using investment in a particular zone at a particular time. A crisis of over-accumulation is one in which capital accumulation declines in one region but is hopefully, from the viewpoint of owners of capital, relieved by moving capital investment to a different territory and initiating new rounds of production and capital accumulation. This "solution" therefore relieves declines in profitability by moving investment into a new region, such as a new "fix" in outer space. Examples in our case might be investment in new space stations or, perhaps even more important, new regions of outer space such as parts of the Moon, Mars, or some other entity. In these ways, capital restlessly seeks out new markets and, perhaps, via collaborations with national governments, new outer spatial fixes, but the success of these efforts is never assured.

Getting the industry off the ground, quite literally, has meant considerable risk in developing the infrastructure for space tourism. This includes investment in space vehicles. According to some accounts, Burt Rutan invested over \$100 million in order to win the \$10 million XPRIZE. This was done in the hope that the vehicle would go on to far outstrip this investment in terms of revenue generated. It also includes investment in terrestrial and orbital facilities, as Bob Bigelow's hotel developments demonstrate (see Chapter 7). These are examples of money being siphoned off from primary circuits by previously successful businessmen and reinvested in a speculative new arena for the production of surplus value.

The feats of outstanding private entrepreneurship rely, however, on government support. This tertiary circuit investment occurs in order to stimulate the development of new primary circuits. The government of the state of New Mexico, for example, has financed the new \$225 million Spaceport America. This in turn has attracted major investors to the area, including their "anchor tenant," Virgin Galactic.

A number of bills have been introduced to US Congress with the hope of incentivizing the space tourism business through tax legislation. This includes the Invest in Space Now Act (2003) which excluded space-related income from tax; the Spaceport Equality Act (2006) which permits the issuance of tax-exempt bonds to those developing spaceports; and the Zero Gravity, Zero Tax Act (2008) which gives a tax-free window on profits made from outer space enterprises. In these ways, the US government, it was hoped, could encourage renewed investment without any immediate calculable cost. Perhaps, unsurprisingly, all these initiatives received active support from the pro-space movement, though none were passed.

If plans are extended to actually landing and accommodating tourists on the Moon or Mars, a system of legalized private property rights beyond the Earth will be required to protect investments. Legalized commodification will be needed for this kind of imperialization of outer space. This might well put into question some UN Declarations and Treaties, such as the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space (1967), which declared that "the exploration and use of outer space [...] shall be the province of all mankind" (n.p.; see Chapter 8 for further discussion of legal aspects of space tourism).

Space Tourism and Identity

The making of "outer spatial fixes" as outlined at the start of this chapter expresses a certain kind of capitalistic "logic." But this should not imply that those making such investments – largely high-profile, charismatic billionaires – are acting on the basis of entirely rational economic calculations. They themselves would not pretend this was the case as most are open about their (emotional and financial) over-investment in space tourism, and even trace this back to childhood fascination, as do pro-space activists. It is important to consider that financial success itself has an emotional, and not simply material, significance for entrepreneurs.

The sociological literature is as much concerned with the meaning of tourism for the tourist as it is with the economics of the tourism industry. In what follows we outline how three well-known theories of tourism, consumption, and identity might be extended to space tourism.

Tourism and Conspicuous Consumption

One long tradition of sociological analysis of leisure time has focused on the way in which leisure time creates and maintains social distinctions and identities, rather than on the sensuous experience of leisure. In his 1899 *Theory of the Leisure Class*, Veblen (1973) examined the forms of "conspicuous leisure" practiced by an eighteenth-century leisure class who were freed from labor. It was argued that extravagant forms of leisure incompatible with the daily toil of the rest of society helped to maintain class distinction. For Veblen, the lower strata of society strove to emulate the conspicuous consumption, leisure, and waste of higher classes. Once the middle classes caught up with the latest fashions and pastimes of the leisure class, the latter evolved new forms of leisure and consumption to set them apart yet again. Space tourism might be one way in which future wealthy elites will, perhaps only provisionally, set themselves "above" future middle classes.

Tourism has since been subjected to the pressures and changes affecting most other industries. Principles of rationalization have, at least since the 1920s, been extended to the production of a mass tourism. The original result, in the British case, was a "Fordist" holiday, typically represented by the "holiday camp." It was a form of mass holiday production consisting of standard holiday experiences undertaken at fixed times of the year. Some year later, Weaver (2005) explored the development of cruiseliner tourism using George Ritzer's concept of "McDonaldization." Space tourism, with its attendant risks, may well be one way in which the wealthy can now attempt to distinguish themselves from "other" classes.

Tourism and Self-identity in Late Modernity

Like many other industries since the 1960s era, tourism has seen the continuing rise of "postfordist," variant types of vacation experience being targeted at particular niches or sectors of the tourism industry (Williams, 2006). In particular, the production of holidays has been fused with esthetic and cultural appeal to particular sectors of the middle classes, the aim being to make possible the expression of distinctive lifestyles and tastes in tourism to exotic places and throughout the year. Holiday is therefore no longer merely "industrial." It promises distinctive lifestyles and adventures to people with different tastes and incomes. "Adventure" holidays are one such niche. The American company Incredible Adventures offers space exploration as one of a number of potentially dangerous yet thrilling exploits being created by a postfordist tourism industry, including swimming with sharks, skydiving, and even "fighting terrorists" (Virgin, 2018). The embrace and negotiation of such "risk" is now understood as a key factor in creating forms of identity through leisure-practices (Lupton & Tulloch, 2002; for further discussion in relation to space tourism see Reddy et al., 2012).

Whichever kind of tourism is consumed and participated in, the chances are that it will help make and reinforce a particular kind of social identity. People do not simply "consume" holidays and their images offered by brochures, but they actively *use* certain kinds of vacation to literally recreate their very "selves" (Britton, 1991; Crang, 2006; Crouch, 2006). Space tourism promises to give tourists a new, infinitely more fulfilled, self; one which looks forward to a tomorrow in outer space which will be wholly better than a today left on the Earth (see Chapter 4 for discussion of how the desire for renewal and transcendence is reflected in space tourism films and games).

Tourism, Capital(s) and Class Distinction

Class, identity, and tourism are also brought together by Bourdieu (1984). Tourism of all kinds can be analyzed using what he termed "cultural capital." People, especially the middle classes, are able to exchange economic capital, or money, for cultural capital. The latter includes holidays offering not just sand, sea, and shelter, but nowadays a broadening of the mind, an uplifting of the spirit, perhaps an extreme experience and a confirmation of life's meaning (Goss, 2006).

For some, particularly those middle classes with relatively high levels of education and cultural capital, vacations might be taken to historic sites at home and abroad (Savage, Barlow, Dickens, & Fielding, 1992). But classes with much higher levels of economic capital typically engage in both adventure holidays *and* the more "cultural" type of tour. Indeed, their social dominance stems largely from their ability to sample any number of lifestyles and cultures. On the one hand, they are indulging in "cultural" holidays, while on the other hand they are also engaging in relatively dangerous "adventure" holidays (Savage et al., 1992). We might now add some "dangerous" missions into the cosmos.

Yet "enlightening" sights and experiences are also now being incorporated into mass tourism, a form of holiday which has become one of the biggest industries on the Earth (Urry, 2000, 2002). Fear and experience have now been democratized and tamed to appeal to those without substantial funds or a serious desire to risk their lives. Over the past 200 years, railways, ships, and budget airlines have opened up sites of "unspoiled" nature and peoples for the previously "lower" classes. Expanded selves are again being made in the process of touring the world but now on a mass scale. Making a new, or recovered, self by long-distance travel is now becoming ordinary, even if the "unspoiled" destinations are now themselves being "spoilt" through mass incursions by moneyed tourists.

Once there is no awe and mystery left on the Earth, outer space could be made into the new Caribbean. Outer space is therefore the next, even final, stage in the game of social leapfrog: elites identifying themselves as elites by traveling somewhere no one else has been. As Phillippe Starck, cofounder of Virgin Galactic and designer of SpaceShipTwo, puts it when talking about the possibility he would build space hotels, "There is nothing new to see at the moment, and it will be replaced by something more conceptual like this" (Baker, 2006, p. 27). Baker says that Starck feels the Earth tourism has "lost its mystery and cachet" (2006, p. 27).

It should, however, be noted that there are contradictions to space tourism in relation to Romantic and adventure tourism, insofar as space tourism could in practice turn out to be a passive, and even rather mundane or alienating experience (Cohen, 2017; Johnson & Martin, 2016; see also Chapter 9). Furthermore, there seems to be some evidence from market research studies that potential tourists actually emphasize the fun and novelty of the experience above its transformative potential (Chang, 2017; Cohen, 2017).

Representations

The visions of space tourism currently on offer by Richard Branson, Elon Musk, and others are an example of what Lefebvre (1991) calls "abstract representations," those being made by dominant elites. People's perceptions and plans for outer space tourism are obviously very dependent on such images since very few of us have had the benefit of direct experience of living and working in outer space. Such living and working could be mundane and tough rather than relaxing. How people actually perceive and behave in relation to an "outer spatial fix" will of course ultimately depend not just on these representations but on space tourism as experienced, shared, and remembered. But until then powerful ideas and myths, Lefebvre's "abstract representations," about society's relations with the cosmos continue to be advanced by dominant elites when describing the future experience of space tourism. This brings us back to question of hegemony (Gramsci, 1971; Jones, 2006).

Hegemony might appear to be a contemporary set of beliefs, but it can in practice be shot through with much older ideas, traditions, and ideologies. Indeed, reversion to old and familiar ideas helps to gain widespread popular support of space tourism. As regards society's past and future relations with the cosmos, dominant forms of hegemony use depend on and reinforce a very ancient and very powerful myth about what the universe actually is and how human society relates to it. It is a myth encountered in a number of theologies, in which the cosmos is a zone of peace and God, one separate from that of everyday existence with its pain, insecurity, and suffering. What we have called "cosmic elites" (Dickens & Ormrod, 2007) claimed privileged positions as intermediaries between the cosmos and the Earth. For example, Ancient Greek philosophy (particularly that represented by Plato and Aristotle) placed a special premium on abstract and detached reasoning as distinct from the knowledge gained by first-hand practical experience. This scheme thereby lent premium significance to the understandings offered by the majority of philosophers rather than, for example, the understandings made by slaves.

As we have demonstrated in some detail elsewhere, similar kinds of schemes prevailed in later societies such as the Italian Renaissance and indeed our own era. Although there have been some notable exceptions to this rule, a special premium has continued to be placed on more abstract forms of reasoning and understanding used by scientists. Although there are, of course, resistances and exceptions, it is abstract, scientific, "detached" forms of knowledge that have prevailed over- and above knowledge gained by practice and observation. The key point is that more abstract forms of knowledge of the universe have, like other forms of understanding, been intimately connected to the acquisition and maintenance of social and political power (Dickens & Ormrod, 2007; see also Chapter 9).

The form of hegemony surrounding space tourism today is uncomfortable, even contradictory. On the one hand, it is recognizing an essential difference, that between ourselves and an external, literally universal, "Other" of the Universe, one containing "life's great secrets." On the other hand, these qualities and secrets are to be understood by penetrating, humanizing, and even despoiling this "Other." The Enlightenment instigated the removal of God from the heavens. Now humanity, combined with the active marketing of the outer space "experience," is slowly starting to take His place. Yet a dominant notion of the perfection of the heavens persists. Promoters of space tourism continue to rely on this notion as part of their sales-pitch, while outer space tourists must hope their funds will allow them first-hand experience of such perfection.

Space Tourists as Pilgrims

The emergent hegemonic "common sense" of society's relation with the cosmos can be illustrated with an analogy often used in the sociology of tourism. The parallel made is between a tourist trip and a religious pilgrimage (Shields, 1991; Turner & Turner, 1978; Urry, 1990, 2002). The analogy becomes even more acute when we turn to tourism in the cosmos. Here, people will be touring no less than the realm of harmony and even of God as described earlier. There are three phases involved in the space pilgrimage. These can be read into the advertising of such trips by space tourism companies and the testimonies of tourists themselves.

(1) People separate themselves socially and spatially from the Earth. Everyday life is, for many, relatively unhappy and alienated. People are estranged from one another and they lack a sense of connection with one another and with external nature (Dickens, 2004). Their work is so

rationalized and bureaucratized that they have little or no sense of mystery or spirituality left in their lives. They find the world to be, using a word employed by Weber, "disenchanted." Future space tourists hear, via different kinds of media or perhaps even from previous space tourists, of the seemingly positive experiences of those who have returned. Leaving Earthly society for the unknown entails danger and a removal from social relations and a remaking of the self. Yet, the representation of space tourism as a life-transforming, incredible trip is sufficient for space tourists to also risk undertaking the trip themselves. Capitalism, while generating disenchantment and alienation, also offers "cures" to these very same conditions.

(2) With the tour in outer space, we encounter a dominant, hegemonic view of the cosmos. In outer space, the individual is detached from everyday life, removed from time, place, and social structure (Urry, 1992, 2002; also Boorstin, 1964; Turner & Ash, 1976). It is a zone of "liminality," one in which "people are in transition from one station of life to another" (Shields, 1991, p. 83). It is "the experience of a lifetime," the opposite to the Earthly unhappiness and chaos from whence they came. The tourist has escaped from the rationality and alienation of everyday life to enjoy a spiritual or quasi-religious experience. He or she is "re-enchanting" her/his life with a sense of awe and mystery (note that Dennis Tito meditated to opera while watching the Earth from the ISS). Space tourists have found something apparently authentic which was missing in their daily lives. Other extraordinary adventures will apparently be on offer in the future as space tourists can swim or even fly with the aid of various kinds of artificial wings in a space hotel. These activities are feted as changing the tourist's relationship to the universe and the self.

(3) Coming home also entails major danger and further "excitements." But on return the space tourist is likely to be celebrated as a charismatic hero, as was Dennis Tito. He or she will acquire "celebrity status" and, according to Space Adventures publicity, "the respect and admiration" of friends and relatives (more later). Having engaged with this liminal zone beyond society and detached from time and place, the tourist will not be exactly the same person. He or she has been transformed in some way. Having enjoyed something genuinely authentic, something playful and/or non-serious, something dangerous, and something with real or quasi-real religious significance, the space tourist is a new, "improved" person (Heelas, 1996). The "next generation" of space tourists will, it is presumably hoped by the industry, be inspired to take similar "adventurous" holidays and society's deteriorated and impure state will be improved.

While the transformative potential of such a pilgrimage seems greatest when considering the kind of orbital trips taken by the first few space tourists, it might be argued that the same general idea underpins, albeit less explicitly, even more modest potential suborbital trips. It should be noted that elite individuals, such as Dennis Tito, are much less likely to lead the kind of alienated existence that might generate a mass market for space tourism "pilgrimages." The analogy to a pilgrimage is only one way of making sense of how space tourism is narrated. But it provides a basic structure that resonates with other accounts of the impact space tourism has.

The Overview Effect

Frank White (1987), in his book charting the experiences of astronauts, *The Overview Effect*, reports on astronauts' experiences of being in space. His concern is with the effect that looking back on the Earth from space has on one's perspective on the planet and on the self. The overview effect rests on a new appreciation of how small and precious the planet is and on observing a world without political boundaries. The experience of traveling into space has apparently profoundly positive effects on the self. A video produced to celebrate the 25th anniversary of *The Overview Effect* emphasizes the sense of spiritual unity with the rest of humanity that is experienced by tourists in space (Planetary Collective, 2012).

There is a real tension in White's writing, one which most probably reflects contradictions within the experiences of astronauts. On the one hand, he presents these new insights as steps toward humility. This can be seen as part of a long-term historical decentering of the planet, humanity, and the self. It is now often recognized that Copernicus and Galileo, who were of course the early contributors to the scientific revolution predating the Enlightenment era, contributed to this progressive decentering (Freudenthal, 1986; Koestler, 1989). These scientists showed that the Earth is actually not the center of the universe. Darwin further decentered humanity by showing that Homo sapiens, along with all organic beings, is probably descended from one primordial form or creature. Freud demonstrated that humans were not even masters of their own psyche (Freud, 1973; also Best & Kellner, 2001; Craib, 1998; for a slightly different account, Tarnas, 2006).

However, White seems more than well aware of the ways in which visiting outer space provides a sense of empowerment. MacDonald (2009) understands space tourism precisely as a reaction against the progressive decentering described earlier. Although rejecting the idea that space tourism is inherently a spiritual experience, White acknowledges the power of the myth of the heavens as the dwelling place of God and refers to the "demi-god" status of astronauts and cosmonauts based on their ability to travel to the heavens. Arguably, they have been made the new intermediaries in the Great Chain of Being (Dickens & Ormrod, 2007, pp. 23–24). White talks about the trip being like a death and rebirth, marking a transition of the self. His desire to write the book came from his own feelings when flying over Washington DC and thinking how preposterous it was that the tiny beings down there were making decisions for him. It was "like ants making laws for humans!" (White, 1987, p. 3). Clearly, he envisages the overview effect not just as humbling, but also as aggrandizing the self. This is clearly the motive for taking trips as spelt out by Space Adventures' advertising campaign. As reasons for enrolling on one of their programs, they say:

> Live the experience of a lifetime and create memories that you will always cherish; Invest in the future of spaceflight; Earn the respect and admiration of your colleagues and home nation; Conduct experiments aboard the most advanced and unique laboratory ever constructed; Be one of the first 500 people ever to go into space; Achieve worldwide celebrity status; Inspire the next generation of space explorers. (Space Adventures, 2007, n.p.)

White most definitely sees space tourism as a promising chance for the self and for society, but in order to understand what is going on, these two very different elements need to be reconciled. There has been some debate in recent years about whether the sense of awe and wonder experienced by the "sublime" nature of space tourism potentially challenges our disenchanted conceptualization of outer space (Kilbryde, 2015) or in opening up new ways of thinking more generally (Cohen, 2017; Sage, 2014). The alternative interpretation (more later) is that it manifests a form of what Kilbryde calls "spiritual narcissism" in which the sense of unity engendered is felt to be possessed by the space tourist as a form of self-enhancement. This then encourages fantasies that the tourist might be able to "save" the Earth on their return (see Ormrod, 2016, on such "mock reparative" fantasies). Former astronauts have spoken about this fantasy and the depression that has followed when people have not been receptive to their message.

Journeys into Outer and Inner Space

While sociological theories of tourism provide important historical context for understanding how the industry has become so intimately connected to issues of capital and identity, these only take us so far. In attempting to understand how these social structures connect with deeper psychological dynamics, we turn to the field of psychosocial studies.

Jungian Archetypes. One possible lens through which the journey into space and back could be understood is Jung's (1968) myth of the hero (see Chapter 4 for how this myth has played out in films and games). This is certainly compatible with the tourist's pilgrimage metaphor, and it may help explain some of its appeal. It is impossible to conclude for the moment, however, precisely what significance the trip has for those able to make it, since presently there is no space tourism. This remains a speculation on the way in which the journey into outer space could be read as a parallel to an internal, psychic journey. For Jung, myths were particular cultural manifestations of underlying universal "archetypes": shared representations of the unconscious. For him, all hero myths seek to express the human psychic journey, charting the emergence of ego consciousness in adolescence and eventually death and a return to the womb to be reborn in immortal form. The passage often involves a period of separation and wandering, symbolizing a longing for the lost object (classically the mother from whom the infant must separate) that cannot be possessed.

This archetype could be used to describe what many advocates assume is the "universal" appeal of space tourism. The Earth is often referred to in mythology as a "mother" and is nearly always female, as it is in Lovelock's concept of Gaia. In this sense, a journey away from the Earth into space represents a universal need to break away from the mother. White agrees with the use of the mother metaphor for the Earth and provides a striking example of it from the astronaut Russell Schweickart. "I viewed my mother quite differently when I was in the womb than I did after birth. Afterward, I was able to take more responsibility for her" (1987, p. 113). This seems express the theme that travel to space symbolizes a process of individuation whereby the infant is able to recognize the mother as a separate entity. The psychic significance of individuation is arguably greater in Western modernity and among men in particular (Keller, 1986).

Return to the Earth then becomes a much desired return to the womb, a "reentry" to use the space terminology. But, as White's book demonstrates, it is also a rebirth of a very changed person with a different, more complete perspective (note that White himself refers to the moment of take-off and the fear associated with it as a death and rebirth in space – a slightly different interpretation). Furthermore, as the Space Adventures publicity stresses, this new self becomes celebrity, one way in which immortality can be achieved according to Jung.

Jung's concepts of archetype and myth explain popular and recurrent stories as expressing, what he considers, certain universal psychic processes. A positive view is often taken of them. They are less able to explain why in particular societies some people are driven to pursue fantasies to the exclusion of other needs and wants, and possibly to the destruction of the self. Freudian (and Kleinian) psychoanalytic theory, in contrast, has been taken up by psychosocial scholars looking to understand the dialectic relationship between the psyche and social conditions. Central to much of this work, discussed next, has been Freud's concept of narcissism.

Pro-space Activism and Narcissism. Future tourists may go to space because it is sold as a realization of a myth, a way of constructing a new and improved self or a hero's journey. They may even go simply as a demonstration that they can afford the latest "exotic" extravagance. In the pro-space movement, however, we encounter a group of people, mostly members of the American technocratic middle class, who have been consumed by the fantasy of space tourism from an early age and who are far from casual consumers. We have the benefit here of being able to draw on more extensive empirical work of our own (Ormrod, 2007, 2009, 2016). In the twenty-first century, there has been a much more open statement from pro-space activists that they want to go into space themselves. Earlier groups rarely expressed that wish openly. The pioneering activist Barbara Marx Hubbard (1989) admits she found herself quite shocked when, after several years of advocacy, she realized that she had wanted to go into space personally the whole time. But there were exceptions. In 1984, the World Space Foundation adopted the slogan "I want to GO" (Michaud, 1986, p. 103). From the early 2000s onward, pro-space groups have become even more explicit about their ambitions. The Artemis Society supports a privately funded lunar colonization project, the Artemis Project, which advertises that "you can come too!" (ASI, 2007). More recent private colonization projects, such as Mars One, have also attracted pro-space support.

The feasibility of this desire has been bolstered by the burgeoning private space tourism business, which offers customers the chance to visit outer space as a paying tourist. Sections of the pro-space movement have turned their focus so much toward commercial space tourism that a distinct "space tourism movement" has been identified (Ashford, 2002). Spencer and Rugg (2004) chart the rise of this movement. It was inspired by visionaries like Kraft Ericke and G. Harry Stine, and centers around the Space Tourism Society and a small band of entrepreneurs and engineers. This development of the movement can be seen as part of what is often now called the "NewSpace movement."

We have argued that the economic interests and value commitments of pro-space activists are insufficient to explain their involvement in the movement (Ormrod, 2007). We have suggested instead that members of the pro-space movement exhibit a form of adult narcissism. In the absence of any other socially imposed sense of self, they are in pursuit of the kind of self-experienced during the stage of primary narcissism identified by Freud. This is a position of subjective omnipotence in which the whole universe is experienced as an extension of the baby's self, orienting around it and meeting its every need. Fantasies about life in a spacefaring civilization can be read, according to this, as manifestations of unconscious narcissistic conflicts surrounding the desire to return to such a state (Ormrod, 2016). Various theorists have identified a culture of narcissism pervading the late-modern developed world (Lasch, 1979), a trend which, we argue, is capable of explaining the timing of the movement's emergence and the type of people drawn to it (Ormrod, 2007, 2009, 2016).

There is clearly a theme of transcendence in pro-space fantasies (Ormrod, 2007). Traveling to space does, as previously suggested, entail a separation from social life and "mother" Earth. It also aggrandizes the self, reflecting the omnipotence experienced in the stage of primary narcissism identified by Freud. Abercrombie and Longhurst (1998, p. 82) have suggested that the tourist's gaze commodifies and consumes its object – it places the seer in a position of power over the seen. Activists interviewed in previous research (Ormrod, 2007) also referred explicitly to their wish to see the Earth so small that it could be covered by their thumb. Activists' fantasies oriented toward objects in outer space, rather than those directed back toward the Earth, seem to manifest even more directly a quest for omnipotence and power as they involve strivings to bring distant objects under control to be tamed and put to human use in colonial projects (Ormrod, 2016).

Yet, fantasies about being in the Earth orbit also retain strong themes related to another, earlier feature of primary narcissism. Being weightless in space, a common fantasy encountered in research (Ormrod, 2007), is often said to be a regressive fantasy related to the feeling of unity experienced not just in the first few years of life, but in the womb (Bainbridge, 1976, p. 255; White, 1987, p. 23). The fantasy of having "zero-gravity sex" combines this weightlessness with the fantasy of sexual union or reunion with the mother. More than this, many activists anticipated a new sense of unity with the Earth, not only upon returning to it, but while still in space, observing it as a whole of which they feel part.

Traveling to space and looking back at the Earth might thus seem like a journey of transcendence and separation, but it also denies the break from primary narcissism. The object is at once lost, even discarded, and at the same time consumed and brought back into one unified being with the self. As we have argued more recently (Ormrod, 2016), this is a fundamental feature of all forms of fantasy. What sets these activists apart, however, is that these fantasies are set in outer space and also these fantasies are actively pursued in what we have called a "narcissistic mode."

But a new kind of cosmic society and its emergent hegemony is not made by enthusiasts alone. The new kind of hegemonic "New Space" bloc combines the somewhat eccentric dreams of space activists and tourists with the multimillion-dollar aerospace and tourism businesses as well as, perhaps most importantly, the major financial interests funding the outer spatial fix. Governments themselves are at the center of this bloc. They will not be directly paying for large-scale tourism into outer space but they will be providing legal frameworks and guarantees of profitability, not least via the militarization of the supposedly "private" aerospace industry. Awards of military contracts to the supposed New Space companies are a somewhat ironic case in point (Erwin, 2019). NewSpace still claims, however, to be centrally focused on the existence of a significant market for space tourism – but public attitude is something else.

The Public and Space Tourism

In the following section, we use data taken from research conducted in association with the Mass Observation Archive at the University of Sussex. A non-representative panel of respondents are regularly asked by MO to write at length on topics related to everyday life and current affairs. In one of the 2005 Mass Observation directives, these respondents were asked a number of questions about how they related to outer space, including the possibility of becoming a space tourist (Dickens & Ormrod, 2007).

The most obvious finding from our MO data is that, contrary to some market studies for space tourism, and correcting the picture received from studying pro-space activists, the majority of the MO writers did not want to go into space. Gender and age had some bearing on their responses, though it certainly did not determine them. Perhaps unsurprisingly, the older respondents were less likely to want to take a trip into space, although it was almost as unappealing to the young. Occupational class does not seem to have a significant impact, though those higher degrees were more likely to say they welcome the opportunity than those in the lower classes. The results here suggest that those least favorably inclined toward a trip into space are the old, women, and those in working-class jobs. Those most likely to say they would enjoy such a trip are the middle-aged, men, and those in professional occupations. This seems to support the idea that the fantasy of taking a trip to space probably appeals most to those who are more likely to belong to the culture of narcissism as identified by Lasch (1979). There has in fact been a great deal of debate about his work and whether it applies universally or more specifically to certain social groups. It is to those people most used to being able to control and consume that a visit to outer space promises most. Those MO respondents who would like to go into space offered three main reasons for wanting to do so. The first is the experience of weightlessness. As one man said, it would be fun simply to "float around." As mentioned earlier, this motive is also common among pro-space activists. The second is the desire to see the Earth from far away. The third reason, not given as frequently by activists, is to look out into outer space and wonder at it. Female MO respondents in particular wrote about the desire to see the blackness of space outside the Earth's atmosphere, of being able to see stars undisturbed by light pollution as well as nebulae, galaxies, etc. Probably in contrast to the majority of pro-space activists, there was a general intent among the MO respondents to observe space rather than do anything while there. However, one elderly male writer, who had been on an aerobatic flight for his 84th birthday, did give one rather narcissistic-sounding reason why the new perspective was appealing, suggesting the pleasure comes from again becoming the center of things:

> I've noticed a similar sense of being at the center of things when sailing; look at a small yacht from the cliffs and it looks like a lonely speck on a vast sea. Be on that yacht and it is your world – everything across the water is "other." I feel sure that is how I should feel if I was in a spacecraft.

The fantastical aspect of taking a trip into space was mentioned by other respondents, who importantly recognized that this was a fantasy associated with their childhood. One man admitted, "I did fantasize about this when I was young, but not now." Another middle-aged man, a local authority town planner, said that to do so would be the "realization of the dream of a small boy in Gloucester in 1962." This childish fantasy has been balanced by a strong sense of reality by many of these respondents. As one man says, "as much as I like the idea of going into space, my fantasies are tempered with the knowledge of the realities." This tempering to reality is arguably absent in most pro-space activists (Ormrod, 2007, 2009, 2016).

One of the realities acknowledged by those who were not keen to take the trip was of the dangers involved and the bravery needed to overcome them. Though most obvious in the accounts of older women, this was even present in the accounts of young male respondents:

> I personally would not like to go into space. I think it would be extremely exciting but I'd be worried about the risks and I don't really like change; I don't think I could stomach such a different experience.

The problem of not having "the right stuff" deterred a lot of respondents, even those who would in principle have liked to have gone into space.

Those who did not admit to being too frightened by the thought often mentioned the conditions of the flight as being too uncomfortable to make it enjoyable. Several mentioned the claustrophobia of being in a spaceship, others the boredom of the flight. One man joked:

> I hope it will be better run than our present transport systems – no one will go to Mars if you have to spend six hours on the Moon, your luggage goes to Andromeda and a small child throws up in your helmet.

There were also many who believed the experience of being in space itself would be boring. Asked if he would like to go, one older man said humorously, "No. There's nothing to do out there. That's why they call it space." One woman also doubted she would get much out of the trip, saying she would not have anything useful to say when she got home, except "it's big," though part of this seemed to stem from her feeling that she was not personally equipped to make the most of the experience.

Some respondents justified their devaluation of the experience by contrasting it to the more beautiful landscape they could enjoy on the Earth:

> Why would anyone want to live in outer space, no beautiful countryside. And all the other delights I can savor living in Britain[…] No, I wouldn't go into space, not for a million pounds, what can be better than walking on the South

> Downs or in Wharfendale, or a visit to the Bluebell Railway; not much.

There was only one respondent in the sample who objected to *personal* space tourism as being the wrong thing for humanity, in contrast to the more common ethical complaints about space development and settlement. There were just a couple of respondents who discussed religious objections to it. For example:

> Perhaps it's because my mind links the wonders of space with the thoughts of God's kingdom. That is what I was taught to believe as a child, that only God was in heaven.

This woman demonstrates, in contrast to the materialistic conceptions of the universe that abound among pro-space activists, a pre-Copernican understanding of a universe in which God is literally located in "the heavens" of outer space, and objects to this contamination of the heavens by humans rising above their estate.

Another woman said that she would enjoy going into space to look down on the Earth from a different perspective, but that she would do that anyway one day, "from Heaven," also suggesting some parallel between the two experiences. Some have suggested that many pro-space advocates wish to achieve a God-like position. Extending our argument about narcissism, it could be argued that the omnipotent fantasy of entering into God's realm is a manifestation of the psychoanalyst Ernest Jones' (1913) "God complex." Fulda has argued that pro-space groups confuse outer space and heaven (cited in Bell, 1985, p. 98). Among our respondents, however, this is the basis of an objection to mankind ascending into space.

It is interesting to note that, for all that was under way with humanity's humanization of the universe, the majority of MO respondents had no burning desire to travel into space, the very idea being for some one of their worst nightmares. The majority of people seemed to be happier to leave this to those braver than themselves and were content to appreciate the wonders of this world.

CONCLUSION

Daydreaming and the search for pleasure in some kind of "Other" world are central not just to tourism but to modern consumerist capitalism as a whole. Daydreaming about space, and indeed actually achieving these dreams in reality, can be seen as just another feature of consumerism infecting the whole of our lives. Daydreaming and space tourism are, on the one hand, an "escape attempt" one in which people are proverbially or actually jetting away from social monotony and from themselves (Cohen & Taylor, 1992). But they simultaneously entail being drawn toward something that promises a revived sense of self and relationship with the universe.

Space tourism offers this reconnection as part of an "outer spatial fix." As Urry argued, "to gaze as a tourist is to insert oneself within a historical process and to consume signs or markers of particular histories" (2000, p. 184). The nature of the gaze back to the Earth of the space tourist will depend on whose gaze it is. For the foreseeable future, this is likely to be the gaze of those who are economically, socially, culturally, and politically the most powerful.

Acknowledgments – This chapter is based on a previous work, Chapter 5 *Cosmic Society: Towards a Sociology of the Universe* (Dickens & Ormrod, 2007). It is reproduced with the kind permission of Taylor & Francis. The authors would like to thank the editors for their comments on an earlier draft.

Chapter 11

SPACE TOURISM, THE ANTHROPOCENE, AND SUSTAINABILITY

Sam Spector
University of Canterbury, New Zealand

James E. S. Higham
University of Otago, New Zealand

Abstract: Conceptualizations of sustainability and the Anthropocene are expressed in static terms, with the Earth's biosphere viewed as imposing immutable limits. Yet, increased access to outer space, with tourism as an important facilitator, challenges past limitations. This chapter examines the implications of advances in space tourism for the concepts of sustainability and the Anthropocene. The former is complicated by access to outer space, which may bring about a raft of calamities but also potentially immense resources and even the possibility of ensuring our species' long-term survival by settling the cosmos. This chapter also analyzes problems incurred by the Anthropocene's emphasis on terrestrial geology in an era of increasing ability to leave the Earth. **Keywords**: space tourism; Anthropocene; sustainability; mobility; limits to growth

Space Tourism: The Elusive Dream
Tourism Social Science Series, Volume 25, 245−262

ISSN: 1571-5043/doi:10.1108/S1571-504320190000025021

INTRODUCTION

> [...]bourgeois relations are then quietly smuggled in as the inviolable natural laws on which society in the abstract is founded. (Karl Marx, 1973, p. 87)

In an event that is instructive of the relationship between outer space and capitalism, in February of 2018, the company SpaceX used its Falcon Heavy rocket (which is twice as powerful as any rocket ever built) to launch a Tesla Roadster vehicle into outer space (Griffin, 2018). The idea of for-profit businesses engaging in such stunts might seem absurd, but in "NewSpace" activities beyond the Earth are increasingly dictated by a small cadre of companies led by enthusiastic entrepreneurs such as Elon Musk (SpaceX), Richard Branson (Virgin Galactic), Jeff Bezos (Blue Origin), and Robert T. Bigelow (Bigelow Aerospace). The National Aeronautics and Space Administration (NASA) recently announced they will end government investment in the International Space Station (ISS) by 2025 (Foust, 2018). Buyers from the private sector will potentially purchase the ISS, and it may partially be used to host tourists (Foust, 2018). What was formerly the exclusive realm of governments – whose interests lay primarily in scientific progress, technological advancement, and nationalism – is now a developing market eyed by for-profit companies, venture capitalists, and ultra-wealthy individuals.

Our species is becoming acutely aware of its impacts on the Earth. Simultaneously, we are increasingly able to venture beyond our terrestrial habitat. However, conceptualizations of sustainability and the Anthropocene are predominantly predicated on the assumption that we will remain Earthbound. The availability of advanced space-tourism technologies necessitates reevaluating those spatial boundaries. What does that reevaluation imply for manifestations of sustainability, and what are the effects of humankind's role as a geological force being emphasized at the same time as we begin to realize our ability to leave the Earth?

Central to answering such questions are the social, political, and economic systems through which space-related developments come to fruition. Outer space constitutes a near-infinite realm for expansion and a near-infinite supply of resources (Hawking, 2001). Yet, we continue to be confronted with discourses of finite resources, planetary limits, and the inability to sustain continued consumption (Ehrlich & Ehrlich, 1990; Meadows, Randers, & Meadows, 2004). These rationales are swiftly becoming obsolete, highlighting the importance of analyzing the implications of unprecedented advances in our ability to access outer space occurring via capitalist economies. As has been the case on the Earth, this will dictate the types of developments that occur, how resources are accessed and apportioned, who benefits, and who is disadvantaged.

Discourses that formulate sustainability in terms of planetary limits no longer adequately portray the actual realm of human influence. The Anthropocene does not capture the reality of a species whose future will, at least to some extent, involve outer space. As we are currently on the brink of exponentially increasing human involvement in space, tourism scholars must begin to address these topics. This chapter analyzes the effects of spacefaring capabilities on conceptualizations of sustainability and the Anthropocene and, in doing so, draws attention to the socio-politico-economic arrangements that underlie the development of outer space.

SUSTAINABILITY AND THE ANTHROPOCENE IN NEWSPACE

The Anthropocene

Crutzen and Stoermer's article "The Anthropocene" was published in the newsletter of the International Geosphere–Biosphere Program (2000). In this short article, they argued that humans have become a geological force, and we should thus mark the end of the Holocene and usher in a new epoch. In support of their thesis, Crutzen and Stoermer cited population growth, urbanization, use of fossil fuels and the corresponding climatic impacts, exploitation of fresh water resources, human-induced species extinction, emission of pollutants, and depletion of wetland habitats and fisheries. The article, barely over a page in length, revolutionized thinking about the relationship between humans and the Earth.

Whether or not humankind's geological influence is substantial enough to mark a new epoch has been heavily debated, but there is growing support for the idea from a wide range of fields (Ruddiman, Ellis, Kaplan, & Fuller, 2015). Geologists have used data from rock strata to defend the Anthropocene's existence (Zalasiewicz et al., 2017). A new type of "stone" was found in Hawai'i – a "plastiglomerate" that "formed through intermingling of melted plastic, beach sediment, basaltic lava fragments, and organic debris" (Corcoran, Moore, & Jazvac, 2014, p. 4). Atmospheric scientists have weighed in, citing climate change as evidence for the new epoch (Steffen et al., 2011). The social sciences and humanities have also taken up the fight, emphasizing the Anthropocene as instrumental in highlighting our society's impacts on the planet (Alberts, 2011; Cohen, 2012; Lorimer, 2012; Rose et al., 2012). Among those who endorse the Anthropocene argument, there is disagreement about when the epoch began; but many place its origins as lying in the Industrial Revolution, precipitated by James Watt's steam engine and more intensive coal extraction (Moore, 2015). Others argue that humans have been visibly and substantively transforming the Earth for thousands of years, and the epoch actually began long ago (Ruddiman et al., 2015).

The concept of the Anthropocene has become prominent in tourism studies, even resulting in an edited volume on the topic (Huijbens & Gren, 2015). Its proponents argue that the Anthropocene has significant implications for tourism. If humans are a geological force, tourism's impacts are also geophysical in scope (Gren & Huijbens, 2014; Huijbens & Gren, 2015). This, it is argued, substantially raises the ethical considerations associated with tourism.

While there are numerous criticisms to be waged against the Anthropocene, two are particularly relevant for the purposes of this chapter. First, the Anthropocene encourages an ahistorical and abstract view of humanity (Hartley, 2016; Head, 2014; Malm & Hornborg, 2014; Moore, 2016). As stated by Hartley:

> At the heart of the Anthropocene lies the Anthropos: the human. But what or who is this Anthropos? No clear definition is ever given […] To speak of the "human enterprise" is to make of humanity an abstract corporation in which "we're all in this together" (the David Cameron maxim of 2009), thus belying the reality of class struggle, exploitation, and oppression. (2016, pp. 155–156)

Moore likewise argues:

> It [the dominant Anthropocene narrative] says that the origins of modern world are to be found in England, right around the dawn of the nineteenth century. The motive force behind this epochal shift? Coal and steam. The driving force behind coal and steam? Not class. Not capital. Not imperialism. Not even culture. But […] you guessed it, the Anthropos: humanity as an undifferentiated whole. (2016, p. 81)

Climate change (one of the key contemporary drivers of the Anthropocene) illustrates why it is problematic to conceive of humanity as an undifferentiated whole. Developing countries are the source of less than a quarter of historic emissions (Mattia, Rydge, & Stern, 2012; OECD, 2008). An average citizen of the United States emits as much as 500 people in countries such as Ethiopia and Cambodia (Roberts & Parks, 2007). Further, a list of less than 100 investor- and state-owned entities is responsible for almost two-thirds of cumulative, historic CO_2 emissions (Heede, 2014). In the context of tourism, the industry's substantial (and previously underestimated) contribution to climate change is driven largely by the increasing affluence of certain segments of society (Lenzen et al., 2018). Like climate change, population growth is a common theme in the Anthropocene argument, but emissions have grown far faster than populations, and more importantly, population growth has largely stemmed from locations that had comparatively low growth in emissions (Malm & Hornborg, 2014).

Climate change is thus a "sociogenic" phenomenon in that it is not a species-wide attribute but rather primarily results from specific countries, socioeconomic classes, and companies (Malm & Hornborg, 2014). Positioning climate change as an *anthro*pogenic phenomenon conveniently erases the underlying mechanisms of inequality and exploitation that are an inexorable part of the problem. Proponents of the Anthropocene often fail to address these structures (Moore, 2015). Depicting humanity as a unified whole can do much to conceal pernicious social issues.

There is an interesting parallel to this dynamic in pro-space discourses. The experience of the "overview effect" – caused by seeing the Earth from the outside – reportedly causes space tourists to recognize human connectedness and the planet's fragility (White, 2014). Astronaut Gene Cernan said, "You don't see the barriers of color and religion and politics that divide this world" (cited in White, 2014, p. 37). Edgar Mitchell stated that he felt an "overwhelming sense of oneness and connectedness" (cited in Hunt, 2015, p. 73). Yuri Artyushkin said:

> The feeling of unity is not simply an observation. With it comes a strong sense of compassion and concern for the state of our planet and the effect humans are having on it. It isn't important in which sea or lake you observe a slick of pollution or in the forests of which country a fire breaks out, or on which continent a hurricane arises. You are standing guard over the whole of our Earth. (cited in Jaffe, 2011, p. 9)

Indeed, the overview effect is asserted as one of the main benefits of human spaceflight, a transformative experience for the tourist (White, 2014).

Yet, in their portrayal of "humankind," these narratives conveniently erase the state of inequality and discord that is the actual condition of our societies (Cosgrove, 1994; Ormrod & Dickens, 2017). Such narratives are thus at odds with those who want to draw attention to "the barriers of color and religion and politics" that Gene Cernan could not see from space. Those who live in abject poverty may well not share the feeling of unity that Edgar Mitchell attained from his privileged vantage point. It arguably matters a great deal exactly which of the seas and lakes Yuri Artyushkin saw have been polluted. While astronauts gaze down on the northern and southern hemispheres of the Earth, they do not see the "Brandt Line" which divides the regions of the world into the Global North and Global South (Williams, 2016). The harmonious and unified Earth seen by astronauts is the same one that is also characterized by increasing alienation and entrenched geographies of unequal development.

A second key criticism of the Anthropocene is that it propagates a deterministic view of history. The current state of the world is traced back to particular technological (rather than economic, social, and political) developments, principally – the ability to combust fossil fuels (Moore, 2014a, 2014b). This nullifies endeavors to identify humanity's impacts as resulting more from relations of power than from resource usage. It allows the advantaged to envision the current state of affairs as a "technological imperative," thus diminishing their role in the accompanying processes of disempowerment, dissonance, and disaster (Malm & Hornborg, 2014). The Anthropocene obfuscates the underlying conditions that made the Industrial Revolution possible, the switch from water to steam power preferable, and the extraction of fossil fuels attractive (Moore, 2014a, 2014b, 2015, 2016). As stated by Moore:

> Coal is coal. Only in specific historical relations does it become fossil fuel. Yes, the fossil boom transformed the conditions of capitalist civilization. But did these new conditions imply a fundamental rupture with the territorialist and capitalist relations—and historical-geographical patterns—of early modernity? This is precisely the line of questioning that has been ruled out by the dominant Anthropocene argument. (2014b, p. 14)

In the Anthropocene, it appears easier to blame the coal rather than the coal baron.

An alternative perspective, the Capitalocene, is particularly relevant for underscoring the shortcomings of the Anthropocene. Rather than identifying resources and technologies as the root causes of our impacts, the Capitalocene argument instead focuses on the emergence of capital and the historical relations that made certain forms of exploitation desirable. As argued by Moore (2014a, 2014b, 2015), a leading figure in the development of the concept, the Industrial Revolution is *a*, but not *the*, milestone event in this history. Moore argues that attention should instead be on capitalism becoming "a way of organizing nature" (2016, p. 6). While exploitation of course occurred in various forms before the advent of capitalism, only under capitalism have the impacts become extensive enough to even consider debating whether our species is a geological force (Altvater, 2016).

Consider that electric vehicles require various rare metals, such as lithium for their batteries and neodymium for the magnets in their engines. Is it so far-fetched to posit that future generations may one day bemoan reaching "peak lithium" or "peak neodymium"; and what then? On to the next technology as we transition past dirty lithium! The Capitalocene encourages asking what systemic factors led to the overexploitation of fossil fuels in the first place and what is there to suggest that those same factors will not likewise result in a similar eventuality if we merely replace one resource or technology with another? Certainly, it matters which resources are used, as Moore (2014a) himself explicates, but the systems under which resources are accessed, used, and overused cannot simply be ignored.

Our stance is not against classifying the current epoch as the Anthropocene; indeed, the geological evidence is convincing. However, reticence is required when transposing the concept to other fields. According to Hartley:

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

Propagators of the Anthropocene, if the concept is to be applied outside geology, must critique that which is implicitly embedded in the concept.

The debate between which term best captures humanity's relationship with its geophysical environs is important because, as Moore argues:

> The difference [between the Anthropocene and Capitalocene] speaks to divergent historical interpretations—and also to differences in political strategy. To locate modernity's origins through the steam engine and the coal pit is to prioritize shutting down the steam engines and the coal pits, and their twenty-first century incarnations. To locate the origins of the modern world with the rise of capitalism after 1450, with its audacious strategies of global conquest, endless commodification, and relentless rationalization, is to prioritize a much different politics—one that pursues the fundamental transformation of the relations of power, knowledge, and capital that have made the modern world. (2016, p. 94)

The Anthropocene, the Capitalocene, and Outer Space

The two aforementioned criticisms (the Anthropocene's portrayal of a unified humanity and its focus on technologies and resources at the expense of social relations) are not necessarily fatal blows to the Anthropocene. Such criticisms can be addressed within the concept, and a new term (such as the Capitalocene) may not be required. More problematic is our increasing impact beyond the biosphere. Emphasizing the discourse of planetary boundaries that underlines the Anthropocene argument, contributors to Gren and Huijbens's (2014) volume state that the "Anthropocene implies that humanity has 'come up against a greater force, the Earth itself'" (Hamilton, 2010, pp. 30–31) and that humans now have to "view themselves as members of a forced commune that no longer permits any escape" (Elden, 2012, p. 171). Indeed, proponents of the Anthropocene often emphasize planetary boundaries (Steffen, Grinevald, Crutzen, & McNeill, 2011) and "the coupling of human society and earth systems" (Palsson, Szerszynski, & Sörlin, 2013, p. 6).

Yet, these discourses are emerging at precisely the point in history when humans are on the brink of having a much more extensive presence in outer space. Historically viewed as science fiction rather than science reality, numerous recent events have established the arrival of space tourism. Companies such as Virgin Galactic, Scaled Composites, and XCOR Aerospace have successfully test-flown suborbital spacecraft for tourist flights and are now selling tickets for future trips. In 2016, an inflatable module that can be used as a "space hotel" for tourists was designed and built by a private company (Bigelow Aerospace) and flown to the ISS by another private company (SpaceX). While currently focused on building ever more powerful rockets, SpaceX intends to operate touristic missions in the future and hopes to eventually develop a permanent human settlement on Mars.

The human species is becoming increasingly capable of moving beyond its terrestrial environment. This expansionary process does not necessarily negate classifying the current geological epoch as the Anthropocene, but it does call into question the value of applying the concept in fields outside geology. Humans may well be a geological force – perhaps that is best left to geologists to debate – but we are also an extraterrestrial force. Focusing attention on humans' geological impact may come at the expense of addressing the actual spatial and temporal extent of our influence. Indeed, regardless of to what extent space tourism comes to fruition, it is erroneous to conceptualize the Earth as separate from outer space – satellites have influenced our daily lives since the 1960s, crewed and un-crewed space probes have already affected other celestial bodies (for instance, the Roadster vehicle that SpaceX launched earlier this year did not undergo the standard cleaning procedures usually required by NASA's Office of Planetary Protection and likely hosts the largest collection of microbes ever launched into space), and life of course relies on an entity almost 150 million kilometers away: the sun (Olson & Messeri, 2015; Zacharias, 2018).

The Capitalocene offers a useful lens for understanding the effects of human forays into space. Some scholars have argued capitalism will exhaust itself due to its inability to continue to create meaningfully distinct alternatives for consumers and because the system will run out of "outsides" from which it can attain resources and seek future opportunities for expansion (see Chapter 10; also Deleuze & Guattari, 1980; Hardt & Negri, 2000). However, outer space constitutes what is perhaps the ultimate "outside," a near endless realm for capitalist expansion (Dickens, 2009). Arguments that critique capitalism on the grounds of limited resources and the inability of our species to continue its historic rate of expansion stand to be nullified by the development of improved access to outer space. Other rationales will become necessary to refute capitalism. The Capitalocene thus elucidates aspects of the human relationship with both the Earth and outer space that the Anthropocene conceals.

The amount of resources present in the Universe, even only in the Milky Way Galaxy, is immense. One estimate found that the asteroid belt between Jupiter and Mars contains minerals and metals worth US $100 billion *per person* on the Earth (Lewis, 1997). Zero-gravity manufacturing promises to overcome many of the inefficiencies of traditional manufacturing (OECD, 2004). In addition to doing away with the need for machines to surmount the forces of gravity, zero-g manufacturing means resources mined in space do not have to be transported to the Earth, and dangerous operations can be conducted far away, minimizing the risk of negatively impacting humans or the Earth's ecosystem. Space-based solar power could offer enough clean energy to meet our current usage more than 6,000 times over (Bernasconi & Bernasconi, 2004; Yarris, 2010). As can likely be inferred from these brief examples, space advocates position such developments as capitalism and ecology "fixes" (Dickens, 2009).

The Capitalocene contributes to understanding the "resource boom" in outer space. As capitalism has increasingly been confronted with terrestrial limitations, it is now looking skyward. While some have argued that there is likely other intelligent life in the Universe (Hawking, 2001), as far as we are currently aware this is not the case for the locations suggested for near-future developments (the Moon, Mars, asteroids, and the Earth's orbit). There is thus no process of colonization, and this reduces the barriers to utilizing space for human benefit. Contrary to the fragile, "blue dot," teeming-with-life image of Earth, space is presently seen as a barren wasteland (see Chapter 3). This abets those who seek to deliberately and substantively transform such areas by mining and settling them. Outer space is set to greatly further the cause of capitalist expansion. The Capitalocene framework encourages analyzing the implications of free markets driving that expansion, emphasizing that humans are not an undifferentiated whole and that only particular socio-politico-economic groups are likely to benefit from the emergence of space-related capital.

Sustainability in NewSpace

Outer space has long played an important role in the sustainability movement. The "blue marble" image of the Earth taken during the Apollo 17 mission proved instrumental in communicating our planet's fragility (Klein, 2014). Satellites allow the close monitoring of climate-related environmental change (such as seasonal sea ice and glacial retreat), deforestation rates, light pollution, and urban sprawl. Ironically, the process of escaping the confines of the biosphere has thus helped reinforced the notion of planetary boundaries and limits (Spector et al., 2017). But, in a similar manner to the discovery of climate change requiring shifting from a local to global perspective of sustainability, increased access beyond the Earth requires further expanding the spatial scale currently associated with sustainability (Spector et al., 2017). Humans exert an ever-increasing influence on the Earth's ecosystem. Yet, our galaxy contains approximately 100 billion other planets, and the Milky Way is but one of the 100 billion galaxies in the Universe (Johnson, 2012; Villard & Sahu, 2012). As humans extend further into the reaches of space, our perspective of planetary limits will change; and sustainability discourses that fail to pre-empt those changes will be rendered myopic.

Tourism plays a central role in this process because space tourism – and its concomitant need for affordable, reusable launch vehicles – presents an important impetus for reducing launch costs and improving technologies (Johnson & Martin, 2016; Lappas, 2006; Launius, 2006; Ormrod & Dickens, 2017; Peeters, 2010; Penn & Lindley, 2003; Reddy et al., 2012; Spector et al., 2017, van Pelt, 2005). Increased private and commercial access to outer space has substantial effects both within and beyond our biosphere. In "NewSpace" outer space is no longer solely (or even primarily) the realm of governments.

Tourism scholars have all but ignored this *laissez-faire*, neoliberal approach to outer space and the fact that tourism is very much a protagonist in that story (Spector et al., 2017).

Suborbital spaceflight, being developed by companies such as Virgin Galactic, Scaled Composites, and XCOR Aerospace may revolutionize point-to-point travel. Flying from New York to Tokyo would take 83 minutes rather than 13 hours (Peeters, 2010). However, due to particularly potent "black carbon" being emitted at very high altitudes, 1,000 suborbital spaceflight launches per year would result in emissions equal to those of the entire aviation industry (Ross, Mills, & Toohey, 2010). On the Earth, increased affluence has incited tourism growth, and carbon emissions have correspondingly risen (Lenzen et al., 2018). Suborbital spaceflight now stands to become a further mechanism through which the affluent disproportionately contribute to climate change.

Critics might find it hard to envision a thriving suborbital industry in the near future, but the same doubts were expressed about aviation in the early days of its development. For instance, in 1895 Lord Kelvin said, "Heavier-than-air flying machines are impossible" (quoted in Marshall, 2008, n.p.). In October of 1903, an article in the *New York Times* stated that "the flying machine which will really fly might be evolved by the combined and continuous efforts of mathematicians and mechanicians in from one million to ten million years" (quoted in Hallion, 2003, p. 152) – the Wright Brothers' *Flyer* took to the skies two months later. While currently in a nascent stage, a rapidly growing suborbital spaceflight industry would substantively affect the climate, an eventuality that conflicts with the emissions reductions targets outlined in the Paris Agreement (United Nations Framework Convention on Climate Change, 2015).

Advances in spacefaring capabilities – which, again, are considerably motivated by space tourism – may also allow activities further from the Earth, such as mining celestial bodies for resources (International Space Exploration Coordination Group, 2013; OECD, 2004; United Nations, 2010). In addition to affecting the environs of such entities, the amount of wealth available will likely result in increased surveillance and militarization in space, and some countries are positioned to be stronger players than others in the new military-industrial-space complex (Dickens, 2009; Dickens & Ormrod, 2007; MacDonald, 2007; Ormrod & Dickens, 2017). Space tourism has implications far beyond offering touristic joy rides. Space tourism – with its rhetoric of settling other planets, manufacturing climates and ecosystems, and mining celestial bodies – is at odds with the strands of sustainability that advocate getting back to nature, buying local and organic, and reducing consumption.

However, outer space may also contribute to environmental, economic, and social sustainability. For instance, 100,000 terawatts of solar energy hit the Earth each year; humans use less than 15 terawatts (Bernasconi & Bernasconi, 2004; Yarris, 2010). Space-based solar power offers a clean energy source of unparalleled capacity and longevity. Additionally, as discussed earlier, potentially dangerous experiments and manufacturing processes can be conducted safely away from fragile ecosystems and species (OECD, 2004). If the vast quantities of resources available in space were to somehow be distributed equitably, humankind could benefit from a substantially higher standard of living and fewer resource wars (Collins & Autino, 2010).

Outer space is also cited as integral for achieving sustainability due to the "survival imperative" (Burrows, 2006). Groups such as the Centre for the Study of Existential Risk at the University of Cambridge and the Future of Humanity Institute at the University of Oxford study existential risks that threaten the continued viability of our species. Threats such as a global pandemic, solar flares, super-volcanoes, runaway climate change, asteroids, and comets could destroy human life (Bostrom, 2013; Bostrom & Ćirković, 2008; Burrows, 2006). As noted by those who view extending life into space as a necessity, the vast majority of species that have existed on the Earth have become extinct, and *homo sapiens* will ultimately experience the same fate if permanently confined to the Earth (Bostrom & Ćirković, 2008).

Prominent thinkers such as cosmologist Stephen Hawking (2012), physicist Paul Davies (2010), astronaut Buzz Aldrin (2013), and physicist and mathematician Freeman Dyson (1997) have argued in favor of developing human settlements in space to avoid the eventual extinction of our species. Those who support this rationale see outer space as essential for development – an expanded version of America's "manifest destiny" in which outer space is the new frontier that will not only support population growth and address resource scarcity but also allow continued survival (Sherwood, 2011; Siddiqi, 2010). Additionally, the survival imperative offers one of the few plausible rationales for a human, rather than robotic, presence in space.

Sustainable development is typically formulated as development that "meets the needs of the present without compromising the needs of future generations to meet their own needs" (World Commission on Environment and Development, 1987, p. 43). The advent of increased access to outer space substantially complicates this concept. Is outer space the next logical (even necessary) stage in sustainable development? Or does it greatly exacerbate the destruction of both Earthly and extraterrestrial environments, economies, and social relations? The answers to such questions very much hinge on the structures under which space-related developments occur. Capitalism is in the captain's chair, and the implications of the path dependency currently being established remain largely unchallenged.

Pro-space discourses claim species-wide benefits, as seen, for instance, in Collins and Autino's (2010) article, "What the growth of a space tourism industry could contribute to employment, economic growth, environmental protection, education, culture and world peace." Yet there is little evidence to suggest that space-related capital will be distributed any more equitably than has been the case on the Earth. Impoverished countries do not generally have thriving space programs. The economic, political, and legal systems of dominant countries dictate how outer space develops. In addition to attaining resources, powerful countries will be further advantaged by their increasing ability to utilize space for surveillance and weaponization (Dickens & Ormrod, 2006). Space is primed to accentuate rather than ameliorate global inequality. Achieving a different eventuality would require significant changes, such as global agreements ensuring the fair distribution of benefits and stringent legal requirements limiting the power of corporations. The fact that humans have failed to achieve this on the Earth (Piketty, 2015) does not bode well for the prospects of doing so in space.

Outer space will also shape how humans view their place in the Universe. Many in favor of settling space advocate "terraforming" other planets to create permanent, viable habitats (Davies, 2010). Transforming the environment of a planet then becomes not only acceptable but also necessary for survival. Involvement in outer space will shift how humans view themselves in relation to both Earthly and extraterrestrial environments. How will we conceptualize "nature" on other celestial bodies? Will we aim to preserve, conserve, or exploit such natures? How will outer space shape our relationship with the Earth's ecosystem?

Research on the human–environment interaction now needs to consider the implications of our species' cosmological impacts. Outer space is negating the limits to growth and planetary boundaries asserted by many sustainability advocates (Ehrlich & Ehrlich, 1990; Meadows et al., 2004). It is impossible to accurately conceptualize sustainability without considering the associated spatial and temporal scales. Far from undermining the concept of sustainability, this requires addressing sustainable development with a more nuanced and deeper understanding of our species' trajectory (Bostrom, 2013). As has been argued throughout this chapter, the notion of the Capitalocene offers insights into the likely effects of space tourism, elucidating whose agenda will be served by outer space and who will benefit from space-related capital.

Globalization and Its Discontents

Globalization has allowed interactions between people to occur over much greater distances than was formerly feasible. As discussed in Stiglitz's (2002) work, globalization has also brought with it a raft of issues, particularly for the developing countries and due to the rapid liberalization of markets. Space advocates position outer space as a means of overcoming the shortcomings of globalization, but there are reasons to suggest that which has plagued globalization will likewise afflict the development of space (Veda, 2009). Chief among these reasons is the fact that the main players – governments and large corporations – remain unchanged (Veda, 2009). The tension between the global and local is now developing into a triadic conflict of local–global–celestial.

As one of the section headings in Latour reads, "Even a longer network remains local at all points" (1991, p. 117). All places, Mars' Cassini crater and Moon's Mare Tranquillitatis not excepted, are local. As we have seen both with the overview effect and with the Anthropocene, a wide-angle lens can obscure much. How are we to balance the localness of far-away places with the fact that they are, at least for now, far away? How are we to understand the effects of space tourism on globalization? First, this latter question should be turned on its head: globalization has significantly impacted space tourism. That which was achieved under protectionist governments, such as during the Space Race, pales in comparison with the advances accomplished under privatization and globalization. For instance, according to NASA (2011) estimates, SpaceX developed the Falcon 9 rocket for approximately one-third what it would have cost NASA to complete a similar project.

The same mechanisms that cause citizens of a country to be affected by occurrences at the far corners of the Earth mean that activities in space have flow-on affects throughout the reaches of the planet. As demonstrated by communications and Earth-monitoring satellites, this situation has been the case for some time (MacDonald, 2007). But if space-related activities expand, we would expect to see greater conflict, and possibly greater resistance, among the local, global, and celestial levels. Indeed, entities such as the Institute for Security and Cooperation in Outer Space, as well as the Global Network Against Weapons and Nuclear Power in Space, have already begun raising concerns regarding the current trajectory of space development. The sense of disempowerment that accompanies being influenced by distant and uncontrollable events may grow as those events occur increasingly further away and are increasingly incontestable. If it is challenging for an individual in rural sub-Saharan Africa to rectify their daily life with images of affluent societies, what will happen when they see immense wealth generated by mining space resources flowing into those already-affluent societies (this predominant conceptualization of affluence is of course contested; see Sahlins (1998) for a stimulatingly different perspective)? When they see fellow humans living permanently on the terraformed surface of the Moon or Mars? It is difficult to imagine a more striking juxtaposition than that of the space tourist and the subsistence-farmer.

Technological advancement is not apolitical. Consumers are encouraged to support space technologies but are not necessarily made aware of the more sinister potential uses of those technologies. For instance, the same satellite-enabled global positioning systems that help you navigate a busy city center can also be used to track how and where you spend your time (MacDonald, 2007). Indeed, activities in outer space have long been justified on the grounds of scientific and technological development, but those same technologies have been used by the military-industrial complex for surveillance and weaponization (Lin, 2006; MacDonald, 2007). Space tourism is likewise not apolitical. While guised as simply fulfilling consumers' desires, the technologies that enable space tourism are also useful for geo- and astro-political purposes.

Humans have pursued a number of frontiers, but outer space is often portrayed as the "final" one. As stated on Virgin Glactic's website, "The exploration of space is the ultimate expression of the human desire to push boundaries and stands at the pinnacle of our species' achievements." Yet what is the likelihood that outer space, even if explored and settled, will remain the final frontier, the "ultimate expression"? Just as globalization may in a thousand years be merely a small step in a long expansionist march, the "final frontier" of space could be superseded (or even preemptively replaced) by another frontier. Some of these, such as artificial intelligence, parallel dimensions, and downloading human consciousness are theorized about. Others may be beyond the reaches of contemporary imaginations. Outer space is no more the final frontier, nor a permanent fix for capitalism, than was the colonization of the "New World" or the globalization of countries' economies.

CONCLUSION

The human body, at its present evolutionary stage, has not adapted to function well outside the biosphere. Further, humans do not need to leave the Earth in order to reap many of the benefits offered by outer space; a robotic presence would allow collecting data, conducting scientific research, attaining resources, engaging in manufacturing, and exploring celestial bodies (Dickens, 2009; Launius, 2006). While many aspirations have remained unfulfilled (see Chapters 1, 2, and 3), activities in outer space are accelerating and are on the brink of an exponential expansion in scope and scale. It remains to be seen to what extent that will entail a robotic or human presence, but two important characteristics of our foray into the Universe are apparent. First, the private sector is increasingly responsible for driving space-related activities. Second, space tourism, as it motivates the development of inexpensive and reusable spacecraft, is playing an important role in overcoming the primary obstacle impeding access to outer space – launch costs. The combination of these two factors – greatly enhanced access to space, both touristic and otherwise, that is increasingly achieved under the purview of the private sector – has significant and far-reaching implications for the concepts of sustainability and the Anthropocene.

The Anthropocene argument does little to help conceptualize the relationship between tourism and outer space. The Anthropocene's two main flaws (its ahistorical, abstract view of humanity and its deterministic view of technology) will become even more problematic as a very small segment of the world's population begins engaging in space tourism and developing new forms of technologies and resources in outer space. As stated by Malm and Hornborg:

> The affluence of high-tech modernity cannot possibly be universalized—become an asset of the species—because it is predicated on a global division of labor that is geared precisely to abysmal price and wage difference between populations. (2014, p. 64)

Likewise, despite the rhetoric, space tourism, and the benefits it engenders, it is not an "asset of the species" but rather an asset of a small cadre of individuals and companies.

The Anthropocene glosses over relations of power by positioning humans as a unified entity that acts upon the Earth, largely tracing the burden of blame back to particular technologies. A rather different perspective instead envisions humans as individuals and collectives that act upon one another and argues that those intra-species interactions are responsible for the impacts on the planet. The Anthropocene may be an effective concept in geology, but its applicability in tourism should be carefully critiqued. Those critiques should take into account the advent space tourism. As argued in this chapter, the Capitalocene is a useful conceptual lens for understanding how the space development process will affect socio-politico-economic relations and hence impacts on the Earth and other celestial environs. The Capitalocene encourages evaluating who is likely to benefit from outer space. As has been the case with terrestrial developments, the Capitalocene indicates that benefits of space will not be shared equally among an undifferentiated "humankind." The pro-space discourses espoused by those in the space tourism business share a flaw with the Anthropocene narrative. Travel to outer space is often discussed in terms of its benefits for all, yet the masses may primarily experience it via commodified replicas offered by virtual reality (see Chapter 5) and films and games (Chapter 4).

Travel to outer space also considerably complicates the notion of sustainable development. At the heart of this issue is tension regarding how we envision our species' future. On one end of the spectrum are techno-centered perspectives that deem outer space as our manifest destiny, a limitless realm for tourism and expansion, means of fulfilling the survival imperative, and even an essential step toward a transhumanist future. For instance, the Homo Spaciens Foundation (n.d.), which advocates for humankind becoming a multiplanetary species, states that "Homo Spaciens, a new species of humanity, is being born from the cradle of the Earth to live in space and on other worlds" (n.p.) At the other end of the spectrum are views of sustainability that urge a transition "back to nature": a quick retreat from rapid development, reliance on technology, unfettered expansion, and globalization. Just as the panacea-peddling aspect of techno-centric approaches must be challenged, the myopic nature of many sustainability discourses is already being demonstrated by activities in outer space. Antidevelopment rationales based on limits to growth, finite resources, and the inescapability of the biosphere will be forced to hone more contemporary arguments if they are to successfully engage with the free market, entrepreneurial, and rapidly developing space tourism industry.

Regardless of the extent to which the future of our species lies beyond the biosphere and whether outer space is accessed by robots, humans, or some other species, capital is intrinsically important for understanding how we relate to one another, to the Earth, and to the Universe. Analyses of the Anthropocene, sustainability, and the implications of space tourism need to address the social relations and distribution of resources created by the existence of capital. We should be very wary of discourses, whether related to geology or the galaxy, that conceal rather than unmask the precursors, present state, and future prospects of intra-species inequalities.

CONCLUSION
Space Travel: The Perilous Promise

Sam Spector
University of Canterbury, New Zealand

Erik Cohen
Hebrew University of Jerusalem, Israel

> Man must rise above the Earth—to the top of the atmosphere and beyond—for only thus will he fully understand the world in which he lives. (Socrates, ca. 470–399 BCE)

This volume, *Space Tourism: The Elusive Dream*, constitutes a comprehensive collection of chapters that analyzes the burgeoning phenomenon of space tourism from diverse and analytically sophisticated perspectives. The contributing authors offer important insights into the historical underpinnings, present state, and potential future directions of this dynamic industry. The chapters' principal contributions address five major issues: the role and significance of cosmic imaginaries; the disparity between aspirations and achievements; the quality of the space tourist's experience; the diverse implications of space tourism; and the role of space tourism in the anticipated human expansion into the cosmos. We will conclude the volume by examining these topics in light of the ideas presented in the preceding pages and offering some broader discussion of the consequences of humankind's efforts to expand into space.

Space Tourism: The Elusive Dream
Tourism Social Science Series, Volume 25, 263–273

ISSN: 1571-5043/doi:10.1108/S1571-504320190000025024

COSMIC IMAGINARIES

This volume highlights the notable advances in space science and technology that brought the ancient human dream of cosmic travel ever closer to realization (Chapters 1, 2, and 7). However, these advances are situated within the historical, mythological, artistic, and virtual imaginaries of the cosmos that paved the way to contemporary visions of and aspirations for travel and tourism in outer space. In the Introduction chapter, we raised a fundamental question that has long fascinated humans: Are we alone in the Universe? Space tourism, even once well-developed, seems unlikely to resolve this question. Intrepid tourists meeting aliens in space might remain a cherished fantasy, resembling the legendary nineteenth-century encounter between Stanley and Livingstone in Central Africa (Dugard, 2003; Jeal, 2007), but the discovery of life in space is far more likely to be achieved by exo-biologists and their advanced instrumentation. Yet, the question is not irrelevant in the context of space tourism; there is little doubt that fantasies of alien life-forms have spurred the public's imagination and, to some extent, fueled the desire to travel into space (Chapter 3; see also Cohen, 2016). Human imagery of the cosmos and life on other heavenly bodies has a long and rich history which in the West culminated during the early modern period in a view of a solar system densely populated with extraterrestrial life, but modern science has gradually disenchanted this picture by providing evidence of lifeless and barren planets that are inhospitable to human visitation and settlement (Chapter 3).

The cosmos was re-enchanted in the contemporary period by a proliferation of films, games, and virtual reality programs that depict space as abounding in fantastic life-forms and exotic destinations (Chapters 4 and 5). These enthused the popular imagination with expectations of the extraordinary experiences that future space tourism might offer tourists in addition to creating virtual forms that might constitute surrogates for "real" spaceflight. As the authors of Chapters 4 and 5 argue, in the foreseeable future, space tourism will remain a niche activity reserved for a very select segment of society, so the broader public will be left to experience it primarily via affordable and convenient modes of virtual travel. Some might see in such substitutes a novel "opium for the masses," a postmodern version of Marx's view of the role of religion in society.

Indeed, even if space tourism becomes more widely available, virtual surrogates might increasingly become preferable to actual spaceflight. Whereas most of the enthusiasts currently involved in space tourism development grew up during the Apollo era, some studies indicate that younger generations might not share the same fascination with the cosmos as their predecessors (Chapter 10; see also Vedda, 2008). Younger people also seem to be more trusting of computers and robots and, in contrast to older individuals, might therefore advocate robotic rather than human exploration of the cosmos (Vedda, 2008; see also Chapter 1 for analysis of public support for human spaceflight). This indicates the possibility that while individuals such as Elon Musk, Richard Branson, and Jeff Bezos may be motivated by the dream of humanity traveling to and expanding into the Universe, younger generations may not be equally enthused.

ASPIRATIONS AND ACHIEVEMENTS

The preceding chapters also explore the discrepancies between the ambitions associated with spaceflight and the actual achievements (in addition to the frequent setbacks) in the ongoing effort to create a viable space tourism industry. The aspiration to travel to the stars is ancient, but only in recent times has space tourism for the wider public become feasible. Several contributing authors (Chapters 1, 2, and 7) highlight the significant and increasingly promising scientific and technological advances achieved in the field in recent decades.

As those authors indicate, space tourism has been hovering on the verge of realization for a relatively long time, particularly as it increasingly fell under the purview of a small cadre of private companies whose ambitious leaders promise an impending era of mass spaceflight. Virgin Galactic's Richard Branson recently said:

> We hope to create thousands of astronauts over the next few years and bring alive their dream of seeing the majestic beauty of our planet from above, the stars in all their glory and the amazing sensations of weightlessness and space flight. (quoted in Davenport, 2018, p. 80)

Jeff Bezos, the founder of the spaceflight company Blue Origin, talked about "having millions of people and then billions of people and then finally a trillion people in space" (quoted in Clifford, 2018, n.p.). But those who follow the news on the space industry will likely be familiar with the many expectations and predications that subsequently proved premature. There remains an unbridged gap between the ambitions iconically expressed in twentieth-century strivings to "reach to the stars" and the still unachieved aim of a viable space tourism industry in the twenty-first century. Space tourism, as a regular human activity, remains an elusive dream.

Some sources that historically advocated human spaceflight have begun to adopt a more critical bearing toward the industry. For instance, a recent article from Space.com, entitled "Sorry Elon Musk, But It's Now Clear That Colonizing Mars Is Unlikely—And A Bad Idea" (Coates, 2018), discussed the difficulties in terraforming the Red Planet, the inaccessibility of any water that might reside there, and the risk that human visitation would contaminate the planet. The article argues that SpaceX's "highly ambitious but technically challenging" plans for settling Mars "have started to look more like fantasy" (Coates, 2018, n.p.). Thus, as elucidated in the preceding chapters, there are indications that it might be difficult to identify and sustain a "compelling rationale for human spaceflight," as Launius (2006, p. 64) has worded it elsewhere.

THE SPACE TOURIST'S EXPERIENCE

Contributors to this volume note that space tourism might function as a conduit for transformative experiences (Chapters 1, 2, 4, 6, and 7). Touristic journeys to suborbital space, the International Space Station, the Moon, and Mars are portrayed by the space industry as offering the ultimate opportunity for adventure, exploration, and excitement. Tourists are promised they will see the curvature of the Earth and non-twinkling stars, float weightlessly, sleep in a space hotel, and even stroll on other celestial bodies. By traveling into outer space, tourists will experience the "overview effect" of seeing the Earth floating in space, which astronauts cite as a significant existential experience (White, 1998).

Such portrayals stimulate public interest in space tourism. Yet, though a variety of motivations might presently inspire people to desire to engage in space tourism, its long-term attractiveness remains an uncertain and complicated matter (see Chapters 1, 2, 6, 7, and 10). Many people express a vague desire to travel to space, but demand drops when they are informed of the risks involved and probed about their willingness to pay the high price and endure the long preparations required to realize the experience in the foreseeable future (Futron Corporation, 2002). While often compared to the early days of the airline industry, space tourism is still hugely behind aviation in terms of the safety, reliability, and affordability of its transport apparatus. In addition to the risks involved and the high price tag, low uptake of repeat purchases could also hinder the sustainability of demand for space tourism.

While viewing the lunar landscape, the surface of Mars, or the curvature of the Earth would surely be an incredible experience for most space tourists, there are relatively few viable destinations for near-future space tourism, and their ability to retain tourists' interest over long periods of time remains unclear. There are also less thrilling aspects of space tourism. Once the excitement of the launch subsides, it is not clear how well tourists will cope with the nine-month to one-year transit required to reach Mars with present technologies (SpaceX, 2017). Fantasies of outer space engendered by tales of heroic astronauts exploring virgin landscapes and encountering exotic extraterrestrials may contrast with the tedium inherent in spending lengthy periods of time confined in a spacecraft or spacesuit. Unlike professional astronauts, space tourists will be primarily passive tourists, lacking the scientific and technical expertise necessary to substantively contribute to the mission.

Finally, a future normalization of space tourism might affect the quality of the experience. In pointing out the attractiveness of space tourism, some authors treat it as a novel commercialized service that will soon be offered to an ever-broader segment of tourists (Chapter 6). Paradoxically, opening space tourism to the masses may denigrate or alter some of the very aspects that currently motivate demand. What has been lauded as a possibly transformative, even transcendental, experience could become a banal one if space tourism does indeed turn into an everyday occurrence. In *The Spirit of St. Louis*, Charles Lindbergh described air travel as follows:

> A pilot was surrounded by beauty of earth and sky. He brushed treetops with the birds, leapt valleys and rivers, explored the cloud canyons he had gazed at as a child. Adventure lay in each puff of wind. I began to feel that I lived on a higher plane than the skeptics of the ground; one that was richer because of its very association with the element of danger they dreaded, because it was freer of the earth to which they were bound. In flying, I tasted a wine of the gods of which they could know nothing. (1953, pp. 261–262)

For most contemporary tourists, flying in an airplane does not rouse such sentiments, the experience having been trivialized by the very ease, affordability, and accessibility that the industry strove to develop. Space tourism, if it becomes normalized and commercialized, may undergo a similar disenchantment.

IMPLICATIONS

The authors address the implications of space tourism from a range of perspectives, including law (Chapter 8), power relations between astronauts and mission controllers (Chapter 9), the cosmic search for capital "fixes" (Chapter 10), and sustainability and the Anthropocene (Chapter 11). Those chapters show that the ability to considerably enlarge the spatial reach of humanity is accompanied by a great deal of uncertainty regarding the consequences of such an expansion. Despite these uncertainties, outer space is being opened by corporations, many of which hope to capitalize on human aspirations to travel to space by offering touristic spaceflight programs.

Growth in commercial space tourism might reduce launch costs, thereby facilitating the development of other forms of space exploration and exploitation. If the dynamic proves similar to that experienced by the airline industry, each 20% reduction in ticket price could result in traffic doubling, creating a positive feedback loop whereby technological advances lead to reduced launch costs and increased demand, thus raising the revenue required for further technological development (Penn & Lindley, 2003). This feedback loop may eventually facilitate mass travel in, and potentially beyond, suborbital space.

Space tourists might also make a more direct contribution. In contrast to highly trained and specialized astronauts, space tourists are the first ordinary humans to venture into space. The physiological and psychological effects and consequences of their sojourns could provide useful insights regarding the viability of humans in space. The opening of space to travel and tourism might thus help develop capabilities for future settling or mining of celestial bodies, accessing ever more remote areas of the cosmos for scientific study, engaging in zero-gravity manufacturing, and expanding the search for exo-life-forms.

However, rather than accruing to ordinary people, the benefits generated by lower launch costs and other scientific and technological developments in space tourism could be primarily garnered by governments for strategic, military, or political purposes or by the corporations currently leading the development of the industry. The forays of early "explorers" into Africa, the New World, and the American West were portrayed as scientific expeditions, thus concealing the exploitative and colonizing nature of such endeavors. Expansion into outer space seems to be different. The absence of life-forms in the regions earmarked for space tourism development (such as suborbital and orbital space, the Moon, and Mars) means that other sentient beings will not be colonized. Space advocates thus feel free to suggest initiatives that openly exert very substantial impacts on other celestial bodies, such as terraforming Mars by pumping halocarbons into its atmosphere (Zubrin, 2011) or putting a large dipole magnet in space to shield it from solar radiation (Green et al., 2017). While exerting long-lasting, transformative impacts on presently pristine stellar environments, these types of engineering projects do not directly involve a subjugation of sentient beings in the same manner as other historic colonizations.

Yet, the less privileged segments of human society on the Earth stand to be further disadvantaged as dominant countries, companies, and individuals attain control of space and the benefits thereby generated. Space represents a matchless frontier for exploration, technological advancement, learning, and discovery; but it is also a medium through which powerful individuals or organizations might exploit other humans, the Earth, and other celestial bodies on an unprecedented scale. This raises questions regarding whether space tourism is a desirable, even essential, evolutionary step for humanity or an eventuality that would greatly exacerbate the serious issues our species already faces on the Earth in addition to adding a raft of new ones.

SPACE TOURISM: HUMAN EXPANSION INTO THE UNIVERSE

There are limits to how long the Earth will sustain life, and those limits are likely inescapable. The Sun's increasing radiation will eventually make the Earth inhospitable, and the Milky Way galaxy will one day collide with the Andromeda Galaxy. These events will not occur, respectively, for another one billion and four billion years. But more immediate risks to humanity – including asteroids, earthquakes, mega-tsunamis, super-volcanoes, and various human-induced calamities, such as nuclear wars – cause some scholars to see an urgent need to extend human life beyond the biosphere (Burrows, 2006; Davies, 2009; Hawking, 2012). For instance, astronomers locate increasing more asteroids and comets that have paths crossing within 45 million kilometers of our planet and are thus considered near-Earth (Chapman, 2004). The probability of impact is low – less than one in 100,000 during this century for a two-kilometer diameter or larger "civilization destroyer" (Chapman, 2004) – but the comet Shoemaker-Levy 9 hitting Jupiter in 1994 provided a jarring example of the forces involved, while craters such as the one at Chicxulub, Mexico (which might have been the cause of the dinosaurs' extinction) indicate the effects such impacts can have on the Earth. The asteroid Apophis will come within approximately 30,000 kilometers of the Earth in 2029 and was originally thought to have a 2.7% chance of collision (Center for Near-Earth Object Studies, 2013). Though the figure was revised and Apophis is no longer expected to hit the Earth in 2029, the object will return in 2036 and the probability of impact during this second visit is difficult to accurately predict. While unlikely to pose a threat given current forecasts, the prospect of this type of cataclysmic event abets those who advocate extending human life beyond the Earth in the near future.

There is no lack of proclamations regarding the importance of space tourism for humanity's future, nor a shortage of ambition for its realization, including among the leaders of the space tourism and travel industry. Elon Musk, the founder of SpaceX, put it in stark, apocalyptic terms:

> The future of humanity is going to bifurcate in two directions: Either it's going to become multiplanetary, or it's going to remain confined to one planet and eventually there's going to be an extinction event. (2013, n.p.)

The aspiration to leave the Earth is shared by many of the world's preeminent scientists. Stephen Hawking (2010) pronounced, "Our only chance of long-term survival is not to remain inward looking on planet Earth but to spread out into space" (2010, n.p.). Carl Sagan argued that "we have a basic responsibility to our species to venture to other worlds" (1994, p. 312). Organizations such as the Centre for the Study of Existential Risk at the University of Cambridge and the Future of Humanity Institute at the University of Oxford similarly advocate a spacefaring future for humanity.

The "survival imperative" offers the primary justification for humans, rather than only robots, to explore, mine, terraform, and settle outer space (Burrows, 2006). However, even if one accepts the eventual necessity of extending life beyond the Earth, there are counterarguments to the intensive, immediate development of space tourism as a preliminary to such an expansion. Our species is confronted with calamities such as hunger, warfare, and inequality on the Earth. One proposal is to use available resources on the Earth to address those issues before looking skyward; a rather different tack argues that the solutions to Earthly problems lie in outer space (Lin, 2006).

THE (UN)ANTICIPATED FUTURES OF SPACE TOURISM

Uncertainty regarding whether outer space will contribute to exacerbating or remedying the issues faced by the Earth and the species that inhabit it demonstrates a need for critical discussion among stakeholders, academics, and the wider public. This volume demonstrates that the prerequisites for future space tourism are currently being put into place, primarily by the private sector under a rather limited regulatory regime and without significant critical engagement from scholars. Space tourism's "path dependency" is currently being set, and we hope that shedding light on that process will incite scholars and others to further engage in debates that will determine the future direction of the industry.

If humankind becomes a spacefaring species, the future might entail creating settlements on other planets to mitigate overpopulation and resource scarcity on the Earth and to enhance our ability to survive existential threats. On the one hand, that process could lead to an immense increase in wealth and standard of living for some segments of society, in addition to a successful implementation of techno-fixes such as space-based solar energy – a clean and extensive energy source. On the other hand, one can image an unprecedented and violent empire-building race to claim resources and territories in outer space, provoking new tensions and creating further disparities among the countries in the world.

The US Space Resource Exploration and Utilization Act states that the President and relevant Federal agencies should:

> facilitate the commercial exploration and utilization of space resources […] discourage government barriers […] and promote the right of United States commercial entities to explore outer space and utilize space resources. (2015, n.p.)

Likewise, many works that consider the politics of space tourism have a nation-building, "manifest destiny" approach. For instance, Dolman, who sought to highlight the importance of outer space in determining the relative power of nations, states that his theory of *Astropolitik* "describes the geopolitical bases for power in outer space, and offers suggestions for dominance of space through military means" (2002, p. 3).

International agreements – such as the United Nations "Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies" (1967) – might prove to be insufficient regulatory instruments, or be broken or nullified, as the stakes associated with exploiting space continue to increase. Indeed, in its reference to "the Moon and other celestial bodies" (effectively, the Moon and every other corner of the vast Universe), the mere title of this treaty indicates a need for a more current conceptualization that accounts for emergent political issues regarding exploration, exploitation, and settlement of the Moon, the planets, and exo-planets around other suns (see Chapter 8 for further discussion of the regulation of space tourism). Outer space is often optimistically positioned as a panacea for humanity; this is seen in research titles such as "What the growth of a space tourism industry could contribute to employment, economic growth, environmental protection, education, culture and world peace" (Collins & Autino, 2010). The role and interests of the private sector often remain largely unquestioned, issues related to the equitable distribution of space resources and technologies largely ignored. Chapters in this volume have begun addressing important questions regarding these topics, and further debate and analysis is certainly warranted.

There is also a pressing need to evolve an ethics of space tourism, and this could proceed on two levels. First, a debate is required regarding the justification for space tourism itself. This involves questioning the moral right of humans to appropriate space and dominate other celestial bodies, some of which might have (intelligent) extraterrestrial life-forms; the right to claim, access, use, and benefit from space-based resources; and the justification for extending capitalism into the cosmos. The second level of space ethics entails formulating the characteristics and determinants of what constitutes ethical space tourism. This includes aspects of business ethics, such as the ethics of putting professional astronauts, test pilots, ground crew, and passengers at risk. Discussion of environmental ethics is also needed, including the implications of affecting other celestial bodies, the buildup of debris in space, and the fact that 1,000 suborbital launches per year would match the greenhouse gas emissions associated with the entire aviation industry (Ross et al., 2010). Finally, political and legal issues should be further analyzed, such as who has the authority to enforce the ethics of space tourism, how to create an internationally agreed regulatory regime for space tourism and for such issues as the exploitation of the resources gained by accessing space, the activities of the private space sector, and the complex problems of sovereignty over future settlements on other celestial bodies.

As this collection has shown, the development of space tourism is imbued with complex, unsolved, and highly contestable questions regarding how our actions now will shape humanity's future both in space and on the Earth. Through a burgeoning space travel industry, tourism could become an increasingly influential force in the realm of technological and scientific advancement. Space tourism would affect humans' relationships with themselves, with the Earth and, possibly, with exo-life. Enhanced access to outer space, of which touristic spaceflight is an important driver, could constitute a hugely significant evolutionary development. This volume has hopefully contributed to an improved understanding of the (un)anticipated futures of space tourism and provided the reader occasion to consider space travel's role in shaping the evolution of humanity.

This page intentionally left blank

References

Abercrombie, N., & Longhurst, B.
(1998). *Audiences*. London: Sage.

Agapito, D., Mendes, J., & Valle, P.
(2013). Exploring the conceptualization of the sensory dimension of tourist experiences. *Journal of Destination Marketing & Management*, *2*(2), 62–73.

Alberts, P.
(2011). Responsibility towards life in the early Anthropocene. *Angelaki: Journal of the Theoretical Humanities*, *16*(4), 5–17.

Aldrin, B.
(1973). *Return to earth*. New York, NY: Bantam Books.

Aldrin, B.
(2013). *Mission to Mars: My vision for space exploration*. Washington, DC: National Geographic Society.

Altvater, E.
(2016). The capitalocene, or, geoengineering against capitalism's planetary boundaries. In J. W. Moore (Ed.), *Anthropocene or Capitalocene? Nature, history, and the crisis of capitalism* (pp. 138–152). Oakland, CA: PM Press.

Anderson, M. J., & Shaw, R. N.
(1999). A comparative evaluation of qualitative data analytic techniques in identifying volunteer motivation in tourism. *Tourism Management*, *20*, 99–106.

Appadurai, A.
(1996). *Modernity at large: Cultural dimensions of globalization*. Minneapolis, MN: University of Minnesota Press.

Armstrong, N. A., Collins, M., & Aldrin, E. E. Jr
(1970). *First on the Moon: A voyage with Neil Armstrong, Michael Collins and Edwin E. Aldrin, Jr*. written with Gene Farmer and Dora Jane Hamblin. Boston, MA: Little, Brown and Company.

Arnould, E. J., & Price, L. L.
(1993). River magic: Extraordinary experience and the extended service encounter. *Journal of Consumer Research*, *20*(1), 24–45.

Ashford, D. M.
(1990). Prospects for space tourism. *Tourism Management*, *11*(2), 99–104.

Ashford, D. M.
(2002). *Spaceflight revolution*. London: Imperial College Press.
Ashford, D. M.
(2007). Report: New business opportunities in space. *Space Policy*, *23*, 241–242.
ASI.
(2007). *Artemis*. Retrieved from www.asi.org
Associated Press.
(2008, October 20). Latest space tourist gets his money's worth. *Associated Press Archive*.
Atkinson, N.
(2013, August 1). How many people have walked on the moon? *Universe Today*. Retrieved from http://www.universetoday.com/55512/how-many-people-have-walkedon-the-moon/
Augé, M.
(1995 [1992]). *Non-places: An Iniroduction to anthropology of supermodernity*. London: Verso.
B.B.C.
(2006). Horizon: Space tourists. *BBC/Travel Channel*.
Bærenholdt, J.
(2016). Experiencing the enchantment of place and mobility. *Journal of Consumer Culture*, *16*(2), 393–411.
Bainbridge, W. S.
(1976). *The spaceflight revolution: A sociological study*. New York, NY: Wiley.
Baker, R.
(2006, November 11). Joy ride. *Guardian Weekend*.
Barclay, R. L., & Brooks, R.
(2002). In situ preservation of historic spacecraft. *Journal of the British Interplanetary Society*, *55*(5–6), 173–181.
Barger, L. K., Flynn-Evans, E. E., Kubey, A., Walsh, L., Ronda, J. M., Wang, W., Wright Jr, K. P., & Czeisler, C. A.
(2014). Prevalence of sleep deficiency and use of hypnotic drugs in astronauts before, during and after spaceflight: An observational study. *Lancet Neurology*, *8*(13), 904–912.
Basalla, G.
(2006). *Civilized life in the universe*. Oxford: Oxford University Press.
Beard, S. S., Starzyk, J., Webber, D., Murphy, C., McAlister, P., & Foust, J.
(2002). *Space tourism market study: Orbital space travel and destinations with suborbital spacettravel*. Bethesda, MD: Futron Corporation.
Beck, L. W.
(1985 [1971]). Extraterrestrials intelligent life. In E. Regis (Ed.), *Extraterrestrials: Science and alien intelligence* (pp. 3–18). New York, NY: Cambridge University Press.

Bell, T. E.

(1985). Upward: Status report and directory of the American Space Interest Movement, 1984–1985. Unpublished manuscript [referenced in M. A. Michaud (1986) *Reaching for the high frontier: The American pro-space movement, 1972-84*]. Praeger (356), New York, NY.

Berger, E.

(2017, October 26). Saudi Arabia invests $1 billion in Richard Branson's spaceplane and rocket. *Ars Technica*.

Bernasconi, M. C., & Bernasconi, C.

(2004). Why implementing the space option is necessary for society. *Acta Astronautica*, *54*(5), 371–384.

Best, S., & Kellner, D.

(2001). *The postmodern adventure: Science, technology and cultural studies at the third millennium*. London: Routledge.

Billings, L.

(2006). Exploration for the masses? Or joyrides for the ultra rich? Prospects for space tourism. *Space Policy*, *22*, 162–164.

Billings, L.

(2015). The allure of alien life: Public and media framing of extraterrestrial life. In S. J. Dick (Ed.), *The impact of discovering life beyond Earth* (pp. 308–323). Cambridge: Cambridge University Press.

Blackmore, S.

(1998). Abduction by aliens or sleep paralysis? *Skeptical Inquirer*, *22*(3), 23–28.

Bloomberg News.

(2016). *China's secretive space program threatens NASA dominance*. Retrieved from bloomberg.com/graphics//2016-asia-space-race/china.html

Boas, G.

(2012). *Public International Law*. Northampton, MA: Edward Edgar Publishing.

Bode, J. E.

(1776). Erläuterung der Sternkunde n. l.

Boellstorff, T.

(2015). *Coming of age in second life*. Princeton, NJ: Princeton University Press.

Boorstin, D.

(1964). *The image: A guide to pseudo-events in America*. New York, NY: Harper.

Bostrom, N.

(2013). Existential risk prevention as global priority. *Global Policy*, February, 15–31.

Bostrom, N., & Ćirković, M.

(Eds.). (2008). *Global catastrophic risks*. Oxford: Oxford University Press.

Bourdieu, P.
(1984). *Distinction: A social critique of the judgement of taste*. London: Routledge.
Boyce, N.
(2012). The psychiatrist who wanted to believe. *The Lancet*, *380*(9848), 1140–1141.
Bozeman, J. M.
(2015). *Searching for SETI: The social construction of aliens and the quest for a technological mythos*. PhD dissertation, Falls Church, VA: Virginia Polytechnic Institute and State University.
Brannen, T.
(2010). Private commercial space transportation's dependence on space tourism and NASA's responsibility to both. *Journal of Air Law and Commerce*, *75*, 639–688.
Braverman, H.
(1974). *Labor and monopoly capital. The degradation of work in the twentieth century*. New York, NY: Monthly Press.
Britton, S.
(1991). Tourism, capital, and place: Towards critical geography of tourism. *Environment and Planning D, Space and Society*, *9*, 451–478.
Bryan, C. D. B.
(2001 [1995]). *Close encounters of the fourth kind: Alien abductions, UFOs and the conference at M.I.T*. New York, NY: Knopf.
Buchanan, M.
(2017). Colonizing Mars. *Nature Physics*, *13*(11), 1035.
Bulkeley, R.
(1991). *The Sputniks crisis and early United States space policy: A critique of the historiography of space*. Bloomington, IN: Indiana University Press.
Burrows, W. E.
(1998). *This new ocean: The story of the first space age*. New York, NY: Random House.
Burrows, W. E.
(2006). *The survival imperative: Using space to protect Earth*. New York, NY: Tom Doherty Associates.
Cabrol, N. A.
(2016). Alien mindscapes – A perspective on the search for extraterrestrial intelligence. *Astrobiology*, *16*(9), 661–676.
Carter, M., Bergstrom, K., & Woodford, D.
(Eds.) (2016). *Internet spaceships are serious business: An EVE online reader*. Minneapolis, MN: University of Minnesota Press.
Carter, M., & Gibbs, M. R.
(2013). eSports in EVE online: Skulduggery, fair play and acceptability in an

unbounded competition. In *Proceedings of the Foundations of Digital Games 2013 Conference*, 47–54.

Cater, C.
(2010). Steps to space: Opportunities for astrotourism. *Tourism Management*, *31*, 838–845.

Celsi, R. L., Rose, R. L., & Leigh, T. W.
(1993). An exploration of high-risk leisure consumption through skydiving. *Journal of Consumer Research*, *20*(1), 1–23.

Center for Near Earth Object Studies.
(2013). *Predicting Apophis' Earth encounters in 2029 and 2036* (National Aeronautics and Space Administration). Retrieved from https://cneos.jpl.nasa.gov/doc/apophis/

Chaikin, A.
(1994). *A man on the Moon: The voyages of the Apollo astronauts*. New York, NY: Viking.

Chang, Y. W.
(2015). The first decade of commercial space tourism. *Acta Astronautica*, *108*, 79–91.

Chang, Y. W.
(2017). A preliminary examination of the relationship between consumer attitude towards space travel and the development of innovative space tourism technology. *Current Issues in Tourism*, *20*(14), 1431–1453.

Chang, Y. W., & Chern, J. S.
(2016). Ups and downs of space tourism development in 60 years: From moon register to spaceshiptwo CRASH. *Acta Astronautica*, *127*, 533–541.

Chapman, C.
(2004). The hazard of near-earth asteroid impacts on earth. *Earth and Planetary Science Letters*, *221*, 1–15.

Charmaz, K.
(1995). Grounded theory. In J. Smith, R. Harré, & L. Van Langenhove (Eds.) *Rethinking methods of psychology* (pp. 27–49). London: Sage.

Chatzipanagiotis, M.
(2011). *The legal status of space tourists in the framework of commercial suborbital flights*. Cologne: Karl Heymanns Verlag.

Chauhan, P.
(2016). Understanding our celestial neighbours: An Indian perspective in planetary sciences and exploration. *Proceedings of the Indian National Science Academy*, *82*(3), 403–423.

Chion, M.
(2008). *Les films de science fiction*. Paris: Cahiers du Cinéma.

Clarke, A. C.
(1945a, February). Peacetime uses for V2: V2 for ionospheric research? *Wireless World*, 58.

Clarke, A. C.
(1945b, October). Extra-terrestrial relays: Can rocket stations give world-wide radio coverage? *Wireless World*, 305–308.
Clement, G.
(2011). *Fundamentals of space medicine*. New York, NY: Springer.
Clifford, C.
(2018, May 1). Jeff Bezos dreams of a world with a trillion people living in space. *CNBC*. Retrieved from https://www.cnbc.com/2018/05/01/jeff-bezos-dreams-of-a-world-with-a-trillion-people-living-in-space.html
Coates, A.
(2018, August 5). Sorry Elon Musk, but it's now clear that colonizing Mars is unlikely — And a bad idea. Retrieved from https://www.space.com/41381-mars-colonization-elon-musk-bad-idea.html?utm_source=sdc-newsletter&utm_ medium=email&utm_campaign=20180806-sdc
Cocconi, G., & Morrison, P.
(1959). Searching for interstellar communications. *Nature*, *184*, 844–846.
Cohen, E.
(1972). Towards asociology of international tourism. *Social Research*, *39*, 164–189.
Cohen, E.
(1988). Authenticity and commoditization in tourism. *Annals of Tourism research*, *15*(3), 371–386.
Cohen, E.
(1995). Contemporary tourism – Trends and challenges: Sustainable authenticity or contrived post-modernity? In R. Butler & D. Pearce (Eds.), *Change in tourism: People, places, processes* (pp. 12–29). London: Routledge.
Cohen, E.
(2004). *Contemporary tourism: Diversity and change*. Kidlington: Elsevier.
Cohen, E.
(2016). Cosmic strangers: Humans and aliens on space travel cartoons. *Tourism Analysis*, *21*, 131–143.
Cohen, E.
(2017). The paradoxes of space tourism. *Tourism Recreation Research*, *42*(1), 22–31.
Cohen, E., & Cohen, S. A.
(2012a). Authentication: Hot and cool. *Annals of Tourism Research*, *39*(3), 1295–1314.
Cohen, E., & Cohen, S. A.
(2012b). Current sociological theories and issues in tourism. *Annals of Tourism Research*, *39*(4), 2177–2202.
Cohen, E., & Cohen, S. A.
(2015). A mobilities approach to tourism from emerging world regions. *Current Issues in Tourism*, *18*(1), 11–43.

Cohen, S., & Taylor, L.
(1992). *Escape attempts: The theory and practice of resistance to everyday life*. London: Routledge.
Cohen, T.
(Ed.), (2012). *Telemorphosis: Theory in the era of climate change*. Ann Arbor, MI: Open Humanities Press.
Collins, M.
(1974). *Carrying the fire: An astronaut's journeys*. New York, NY: Farrar, Straus and Giroux.
Collins, P., & Autino, A.
(2010). What the growth of a space tourism industry could contribute to employment, economic growth, environmental protection, education, culture and World peace. *Acta Astronautica*, *66*, 1553–1562.
Collins, P., Fukuoka, T., & Nishimura, T.
(2000). Orbital sports stadium. In S. W. Johnson & K. Chua (Eds.), *Space 2000*. Reston, VA: American Society of Civil Engineers.
Collins, P., & Graham, J.
(1984). Human flapping-wing flight under reduced gravity. *Aeronautical Journal of the Royal Aeronautical Society*, *98*(975), 177–184.
Corcoran, P. L., Moore, C. J., & Jazvac, K.
(2014). An anthropogenic marker horizon in the future rock record. *GSA Today*, *24*(6), 4–8.
Cosgrove, D.
(1994). Contested global visions: One-world, whole-Earth, and the Apollo space photographs. *Annals of the Association of American Geographers*, *84*(2), 270–294.
Cosgrove, D.
(2001). *Apollo's eye: A cartographic genealogy of the Earth in the Western imagination*. Baltimore: The Johns Hopkins University Press.
Craib, I.
(1998). Sigmund Freud. In R. Stones (Ed.), *Key sociological thinkers*. Basingstoke: MacMillan.
Crang, M.
(2006). Cultural geographies of tourism. In A. Lew, M. Hall, & A. Williams (Eds.) *A companion to tourism*. Oxford: Blackwell.
Crouch, D.
(2006). Tourist practices and performances. In A. Lew, M. Hall, and A. Williams (Eds.) *A companion to tourism*. Oxford: Blackwell.
Crouch, D., Jackson, R., & Thompson, F.
(2005). *The media and the tourist imagination*. London: Routledge.
Crouch, G. I.
(2001). The market for space tourism: Early indications. *Journal of Travel Research*, *40*(2), 213–219.

Crouch, G. I., Devinney, T. M., Louviere, J. J., & Islam, T.
(2009). Modelling consumer choice behaviour in space tourism. *Tourism Management*, *30*(3), 441–454.
Crouch, G. I., & Laing, J. H.
(2004). Australian public interest in space tourism and a cross-cultural comparison. *Journal of Tourism Studies*, *15*(2), 26–36.
Crowe, M. J.
(1997). A history of the extraterrestrial life debate. *Zygon*, *32*(2), 147–142.
Crowe, M. J.
(1999). *The extraterrestrial life debate, 1750–1900*. Mineola, NY: Dover Publications.
Crowe, M. J.
(2008). *The extraterrestrial life debate, antiquity to 1915*. Notre Dame, IN: Notre Dame University Press.
Crowe, M. J.
(2011). The surprising history of claims for life on the sun. *Journal of Astronomical History and Heritage*, *14*(3), 169–179.
Crutzen, P. J., & Stoermer, E. F.
(2000, May). The "Anthropocene". The International Geosphere–Biosphere Programme Newsletter, 41, pp. 17–18.
Cubitt, S.
(1998). *Digital aesthetics*. London: Sage.
Damjanov, K., & Crouch, D.
(2018). Extra-planetary mobilities and the media prospects of virtual space tourism. *Mobilities*, *13*(1), 1–13.
Daniels, P.
(2017). *Astronauts. past, present and future*. Washington, DC: National Geographic Partners.
Davé, S.
(2017). Racial accents, Hollywood casting, and Asian American studies. *Cinema Journal*, *56*(3), 142–147. doi:10.1353/cj.2017.0030
Davenport, C.
(2018). *The space barons: Elon Musk, Jeff Bezos and the quest to colonize the cosmos*. New York, NY: Public Affairs.
Davies, P.
(2009, May 25). A one-way ticket to Mars. *Astrobiology Magazine*. Retrieved from https://www.astrobio.net/paul-davies-a-one-way-ticket-to-mars/
Dean, J.
(1998). *Aliens in America: Conspiracy cultures from outer space to cyberspace*. Ithaca, NY: Cornell University Press.
Deleuze, G., & Guattari, F.
(1987). *A thousand plateaus: Capitalism and schizophrenia*. London: Blooomsbury Publishing.

Deleuze, G., & Guattari, F.
(2003). *A thousand plateaus: Capitalism and schizophrenia*. London: Continuum.
deMonchaux, N.
(2011). *Spacesuit: Fashioning Apollo*. Cambridge, MA: MIT Press.
Denzler, B.
(2001). *The lure of the edge: Scientific passions, religious beliefs, and the pursuit of UFOs*. Berkeley, CA: University of California Press.
Dick, S. J.
(1982). *Plurality of worlds: The extraterrestrial life debate from Democritus to Kant*. Cambridge: Cambridge University Press.
Dick, S. J.
(1993). The search for extraterrestrial intelligence and the NASA High Resolution Microwave Survey (HRMS): Historical perspectives. *Space Science Review*, *64*, 93–139.
Dick, S. J.
(1998). *Life on other worlds: The 20th century extraterrestrial life debate*. Cambridge: Cambridge University Press.
Dick, S. J.
(2003). Cultural evolution, the postbiological universe and SETI. *International Journal of Astrobiology*, *2*(1), 65–74.
Dick, S. J.
(2006). Anthropology and the search for extraterrestrial intelligence: A historical view. *Anthropology Today*, *22*(2), 3–7.
Dick, S. J.
(2013). The twentieth century history of the extraterrestrial life debate: Major themes and lessons learned. In D. A. Vakoch (Ed.), *Astrobiology, history and society* (pp. 133–173). Berlin: Springer.
Dickens, P.
(2004). *Society and nature: Changing our environment, changing ourselves*. London: Polity.
Dickens, P.
(2009). The cosmos as capitalism's outside. *The Sociological Review*, *57*(1), 66–82.
Dickens, P.
(2015). Alternative worlds in the cosmos. In R. Vidal & I. Cornils (Eds.) *Alternative worlds: Blue skies thinking since 1900* (pp. 355–382). Oxford: Peter Lang.
Dickens, P.
(2016). Capitalism, class and the cosmos. In P. Dickens & J. S. Ormrod (Eds.) *The Palgrave handbook of society, culture and outer space* (pp. 71–93). Basingstoke: Palgrave Macmillan.

Dickens, P., & Ormrod, J. S.
(2007). *Cosmic society: Towards a sociology of the universe*. New York, NY: Routledge.

Dickens, P., & Ormrod, J. S.
(2009). Globalization of space: From the global to the galactic. In B. S. Turner (Ed.), *The Routledge international handbook of globalization studies* (p. 531–553), London: Routledge.

Dickson, P.
(2001). *Sputnik: The shock of the century*. New York, NY: Walker and Co.

Diederiks-Verschoor, I. H. P.
(2012). *An introduction to Air Law* (9th rev. ed). Alphen an den Rijn: Kluwer Law International.

Divine, R. A.
(1993). *The Sputnik challenge: Eisenhower's response to the Soviet satellite*. New York, NY: Oxford University Press.

Dolman, E. C.
(2002). *Astropolitik: Classical geopolitics in the space age*. London: Frank Cass Publishers.

Dorrian, G., & Whittaker, I.
(2018a). Mars mission: How increasing levels of space radiation may halt human visitors. *The Conversation*.

Dorrian, G., & Whittaker, I.
(2018b). Radiation could kill off a manned mission to Mars. *'I' Newspaper*, *5*(4), 18.

Dubbs, C., & Paat-Dahlstrom, E.
(2011). *Realizing tomorrow: The path to private spaceflight*. Lincoln, NE: University of Nebraska Press.

Dugard, M.
(2003). Stanley meets Livingstone. *Smithsonian Magazine*. Retreived from https://www.smithsonianmag.com/history/stanley-meets-livingstone-91118102

Dunér, D.
(2013). Interstellar subjectivity: The significance of shared cognition for communication, empathy and altruism in space. In D. A. Vakoch (Ed.), *Extraterrestrial altruism* (pp. 141–167). Heidelberg: Springer.

Dunnett, O., & MacLaren.
(2017, September 18). Towards an anthropology of space: Orientating cosmological futures. Proceedings of Geographies of Outer Space' Conference, Department of Anthropology, UCL, London.

Durrani, H.
(2016). *Space crystals and 'our window on the world'*. MPhil thesis, Department of History and Philosophy of Science, University of Cambridge.

Dyson, F. J.
(1997, November). Warm-blooded plants and freeze-dried fish. *The Atlantic Online*. Retrieved from http://www.theatlantic.com/past/issues/97nov/space.htm

Edwards, P.
(2003). *James Cook: The journals*. London: Penguin.

Ehrlich, P. R., & Ehrlich, A. H.
(1990). *The population explosion*. New York, NY: Simon and Schuster.

Eisenhower, D. D.
(1962, August 11). Are we headed in the wrong direction? *Saturday Evening Post*, 19–25.

Eisenhower, D. D.
(1964, April 11). Why I am a Republican. *Saturday Evening Post*, 19.

Elden, S.
(2012). *Sloterdijk now*. Cambridge: Polity Press.

Emme, E. M.
(Ed.). (1961). *Aeronautics and astronautics: An American chronology of science and technology in the exploration of space, 1915-1960*. Washington, DC: National Aeronautics and Space Administration.

Emme, E. M.
(1965). *The history of space flight*. New York, NY: Van Notstrand.

Erwin, S.
(2019). Defence contractors see growth in space. *Space News*. Retrieved from http://spacenews.com/defence-contractors

Evans, N. J.
(2014). Extraterrestrial life in the milky way galaxy? *Europhysics News*, *45*(5–6), 37–41.

Ewalt, D.
(2015). Virtual reality revenues could reach $21.8 billion by 2020. *Forbes*. Retrieved from https://www.forbes.com/sites/davidewalt/2015/07/28/virtual-reality-revenues-could-reach-21-8-billion-by-2020/#2006ce1393ee

Ezell, E. C., & Neumann Ezell, L.
(1984). *On Mars: Exploration of the red planet, 1958-1978*. SP-4212. Washington, DC: NASA.

Ezzy, D.
(2002). Qualitative analysis: Practice and innovation. Crow's Nest: Allen and Unwin.

Fara, P.
(2004). Heavenly bodies: Newtonianism, natural theology and the plurality of worlds debate in the eighteenth century. *Journal of the History of Astronomy*, *35*(Part 2), 143–160.

Farman, A.
(2012). Re-enchantment cosmologies: Mastery and obsolescence in an intelligent universe. *Anthropological Quarterly*, *85*(4), 1060–1088.
Fédération Aéronautique Internationale.
(2004). *100 km altitude boundary for astronautics*. Retrieved from http://www.fai.org/astronautics/100km.asp
Feifer, M.
(1985). *Going places: The ways of the tourist from imperial Rome to the present day*. London: Macmillan.
Ferrando, F.
(2013). Posthumanism, transhumanism, antihumanism, metahumanism, and new materialisms. *Existenz*, *8*(2), 26–32.
Ferreira-Snyman, A.
(2014). Legal challenges relating to the commercial use of outer space, with specific reference to space tourism. *Potchefstroom Electronic Law Journal/ Potchefstroomse Elektroniese Regsblad*, *17*(1), 2–51.
Fingas, J.
(2015). *Russia will resume space tourism in 2018*. Retrieved from https://www.engadget.com/2015/03/25/russia-resuming-space-tourism/
Fishman, C.
(2015). 5,200 Days in space. *Atlantic Magazine*. Retrieved from http://www.theatlantic.com/magazine/archive/2015/01/5200-days-in-space/303510?
Fogg, M. J.
(2000). The ethical dilemmas of space settlement. *Space Policy*, *16*, 205–211.
Fong, K.
(2014a). *Extreme medicine. How exploration transformed medicine in the twentieth century*. New York, NY: Penguin.
Fong, K.
(2014b). The strange deadly effect Mars would have on your body. *Wired Magazine*. Retrieved from https://wired.com/2014/02
Foust, J.
(2017). Virgin galactic carries out 'dry run' for powered SpaceShipTwo flights. *SpaceNews*. Retrieved from spacenews.com/virgin-galactic-carries-out-dry-run
Foust, J.
(2018). Potential end of the ISS raises concerns, presents opportunities. *SpaceNews*. Retrieved from http://spacenews.com/potential-end-of-the-iss-raises-concerns-presents-opportunities/
Franklin, A., & Craig, M.
(2001). The trouble with tourism and travel theory? *Tourist Studies*, *1*(1), 5–22.

Franzen, C.
(2016). NASA Video shows HoloLens being used on the space station. *Australian Popular Science*. Retrieved from http://www.popsci.com.au/tech/nasa-video-shows-hololens-being-used-on-the-space-station,416923

Freeland, S.
(2005). Up, up and…back: The emergence of space tourism and its impact on the international law od outer space. *Chicago Journal of International Law*, *6*(1), 1–22.

Freud, S.
(1973). The libido theory and narcissism. In S. Freud (Ed.), *Introductory lectures on psychoanalysis*. Harmondsworth: Penguin.

Freudenthal, G.
(1986). *Atom and individual in the age of Newton*. Dordrecht: Reidel.

Futron Corporation.
(2002). *Space tourism market study*. Retrieved from http://www.spaceportassociates.com/pdf/tourism.pdf

Galántai, Z.
(2004). Long futures and type IV civilizations. *Periodica Polytechnica. Series Social and Management Sciences*, *12*(1), 83–89.

Galliott, J.
(2016). *Commercial space exploration: Ethics, policy and governance*. London: Routledge.

Geppert, A. C. T.
(2012). European astrofuturism, cosmic provincialism: Historicising the space age. In A. C. T. Geppert (Ed.), *Imagining outer space: European astroculture in the twentieth century* (pp. 3–26). New York, NY: Palgrave Macmillan.

Germann Molz, J.
(2015). *Travel connections: Tourism, technology, and togetherness in a mobile world*. London: Routledge.

Germann Molz, J., & Paris, C. M.
(2015). The social affordances of flashpacking: Exploring the mobility nexus of travel and communication. *Mobilities*, *10*(2), 173–192.

Gibney, E.
(2015, October 8). Science fiction: Crusoe on Mars. *Nature*, *526*, 193.

Glaser, B., & Strauss, A. L.
(1967). *The discovery of grounded theory: Strategies for qualitative research*. Chicago, IL: Aldine.

Goddard, R. A.
(1919). *A method of reaching extreme altitudes* (Vol. 71, No. 2.). Washington, DC: Smithsonian Miscellaneous Collections.

Gomel, E.
(2014). *Science fiction, alien encounters and the ethics of posthumanism*. London: Palgrave Macmillan.

Goss, J.
(2006). The souvenir: Conceptualizing the object(s) of tourism. In A. Lew, M. Hall, & A. Williams (Eds.) *A companion to tourism*. Oxford: Blackwell.
Grady, M.
(2017). Private companies are launching a new space race – Here's what to expect. Retrieved from https://phys.org/news/2017-10-private-companies-space.html
Gramsci, A.
(1971). *Antonio Gramsci. Selections from the prison notebooks*. London: Lawrence and Wishart.
Green, J. L., Hollingsworth, J., Brain, D., Airapetian, V., Glocer, A., Pulkkinen, A., … Bamford, R.
(2017). *A future Mars environment for science and exploration*. National Aeronautics and Space Administration: Planetary Science Vision 2050 Workshop. Retrieved from https://www.hou.usra.edu/meetings/V2050/pdf/8250.pdf
Gren, M., & Huijbens, E. H.
(2014). Tourism and the Anthropocene. *Scandinavian Journal of Hospitality and Tourism*, *14*(1), 6–22.
Griffin, A.
(2018). SpaceX launch: Elon Musk shares 'last' image of Tesla car as it heads into deep space. *Independent.co.uk*. Retrieved from https://www.independent.co.uk/life-style/gadgets-and-tech/news/spacex-launch-elon-musk-car-instagram-picture-photo-earth-space-asteroid-a8200366.html
Guarino, B.
(2015). The overview effect will save Earth one rich space tourist at a time. *Inverse Science*. Retrieved fom https://www.inverse.com/article/6301-overview-everview-effect-space-tourism-environmentalism-spacex-richard-garriot
Guthke, K. S.
(1990). *The last frontier: Imagining other worlds from Copernican revolution to modern fiction*. Ithaca, NY: Cornell University Press.
Guttentag, D. A.
(2010). Virtual reality: Applications and implications for tourism. *Tourism Management*, *31*(5), 637–651.
Gyimóthy, S., & Mykletun, R. J.
(2004). Play in adventure tourism: The case of Arctic trekking. *Annals of Tourism Research*, *31*(4), 855–878.
Haldrup, M., & Larsen, J.
(2006). Material cultures of tourism. *Leisure Studies*, *25*(3), 275–289.
Hale, T.
(2017). Take a virtual 3D tour of The UAE's future city on Mars. *IFL Science*. http://www.iflscience.com/space/take-a-virtual-3d-tour-of-the-uae-s-future-city-on-mars

Hall, P.
(2001, January 6). The X-prize: Design a spaceship and win $10 million. *The Guardian Weekend*, p. 19.
Hallion, R. P.
(2003). *Taking flight: Inventing the aerial age, from antiquity through the First World War*. New York, NY: Oxford University Press.
Hamilton, C.
(2010). *Requiem for a species: Why we resist the truth about climate change*. London: Earthscan.
Hannam, K., Butler, G., & Paris, C. M.
(2014). Developments and key issues in tourism mobilities. *Annals of Tourism Research*, *44*, 171–185.
Hannam, K., Sheller, M., & Urry, J.
(2006). Editorial: Mobilities, immobilities and moorings. *Mobilities*, *1*(1), 1–22.
Haraway, D.
(1985). Manifesto for cyborgs: Science, technology, and socialist feminism in the 1980s. *Socialist Review*, *80*, 65–108.
Hardt, M., & Negri, A.
(2000). *Empire*. Cambridge, MA: Harvard University Press.
Harrison, A. A., & Dick, S. J.
(2000). Contact: Long-term implications for humanity. In A. Tough (Ed.), *When SETI succeeds: The impact of high-information contact* (Section II, pp. 7–31). Bellevue, WA: The Foundation for the Future.
Hartley, D.
(2016). Anthropocene, capitalocene, and the problem of culture. In J. W. Moore (Ed.), *Anthropocene or Capitalocene? Nature, history, and the crisis of capitalism* (pp. 154–165). Oakland, CA: PM Press.
Harvey, D.
(2003). *The new imperialism*. Oxford: Oxford University Press.
Hashimoto, T., Hoshino, T., Tanaka, S., Otake, H., Otsuki, M., Wakabayashi, S., & Masuda, K.
(2014). Introduction to Japanese exploration study to the Moon. *Acta Astronautica*, *104*(2), 545–551.
Hawking, S.
(2001). *The universe in a nutshell*. New York, NY: Bantam Books.
Hawking, S.
(2010, August 6). *Stephen Hawking's warning: Abandon Earth – Or face extinction*. Retrieved from http://bigthink.com/dangerous-ideas/5-stephen-hawkings-warning-abandon-earth-or-face-extinction
Hawking, S.
(2012). *Brave new world with Stephen Hawking* [DVD]. London: Acorn Media.

Head, L.
(2014). Contingencies of the Anthropocene: Lessons from the "Neolithic". *The Anthropocene Review*, *1*(2), 113–125.
Heede, R.
(2014). Tracing anthropogenic carbon dioxide and methane emissions to fossil fuel and cement producers, 1854–2010. *Climatic Change*, *122*(1–2), 229–241.
Heinlein, R. A.
(1950, July). Shooting destination Moon. *Astounding Science Fiction*. Greenwich, CT: Gold Medal Books.
Heppenheimer, T. A.
(1999). *The space shuttle decision: NASA's search for a reusable space vehicle*. Washington, DC: NASA SP-4221.
Heelas, P.
(1996). *The new age movement: The celebration of the self and the sacralization of modernity*. Oxford: Blackwell.
Heppenheimer, T. A.
(2002). *Development of the space shuttle, 1972–1981 (history of the space shuttle, volume 2)*. Washington, DC: Smithsonian Institution Press.
Hiltzik, M.
(2015). The day three astronauts staged a strike in outer space. *Los Angeles Times*. 28 December. Retrieved from https://www.latimes.com/business/hiltzik/la-fi-mh-that-day-three-nasa-astronauts-20151228-column.html
Hind, A.
(2005). *Human transformation and alien encounters*. Retrieved from johnmackinstitute/category/human-transformation-and-alien-encounters/
Hobe, S.
(2007). Legal aspects of space tourism. *Nebraska Law Review*, *86*(2), 439–458.
Holden, K. J., & French, C. C.
(2002). Alien abduction experiences: Some clues from neuropsychology and neuropsychiatry. *Cognitive Neuropsychiatry*, *7*(3), 163–178.
Homo Spaciens Foundation.
(n.d.). Retrieved from http://www.homospaciens.org/about-hsf.html
Houston, R., & Heflin, M.
(2015). *Go flight! The unsung heroes of mission control*. Lincln, NE: University of Nebraska Press.
Hubbard, B. M.
(1989). *The hunger of Eve: One woman's Odyssey toward the future*. Washington, DC: Island Pacific NW.
Hughes, T. R., & Rosenberg, E.
(2005). Space travel law (and politics): The evolution of the Commercial Space Launch Amendments Act of 2004. *Journal of Space Law*, *31*, 1.

Huijbens, E. H., & Gren, M.
(2015). *Tourism and the Anthropocene*. New York, NY: Taylor and Francis.
Hunt, A. N.
(2015). Traces of transcendence: C. S. Lewis and the ciphers of being. *Sehnsucht: The C. S. Lewis Journal*, *9*, 47–74.
Hunter, J. P.
(2014). *UFOs and aliens: Should we be afraid?* Newark, DE: Speedy Publishing.
IFLS Store.
(2016). *Vacation to the Moon for $150 million*. Retrieved from http://www.iflscience.com/space/vacations-mon-150-million/
Inoue, M., & Yokoo, H.
(2011). Type III Dyson sphere of highly advanced civilizations around a super massive black hole. *IBIS*, *64*, 58–62.
International Dark Sky Association.
(2018). Retrieved from http://www.darksky.org/idsp/
International Space Exploration Coordination Group.
(2013, September). *Benefits stemming from space exploration*. Retrieved from https://www.nasa.gov/exploration/about/isecg/#.WLyrAVN9670
Jacobs, D. M.
(2009). A brief history of abduction research. *Journal of Scientific Explanation*, *23*(1), 59–77.
Jacobsen, A.
(2014). Operation paperclip. *The secret intelligence program that brought Nazi scientists to America*. Boston, MA: Little-Brown.
Jaffe, R.
(2011). *Anthropogenic relation to other biota: Connections to disorders and crises of our time*. Ashburn, VA: Health Studies Collegium.
Jeal, T.
(2007). *Stanley: The impossible life of Africa's greatest explorer*. New Haven, CT: Yale University Press.
Jenkins, D. R.
(2000). *Space shuttle: The history of the National Space Transportation System, the first 100 missions*. Cape Canaveral, FL: Specialty Press.
Jenkins, D. R.
(2017). *Space shuttle: Developing an icon, 1972–2013*. North Branch, MN: Speciality Press (3 vols).
Jenkins, R.
(2000). Disenchantment, enchantment and re-enchantment. *Max Weber Studies*, *1*, 11–32.
Johnson, J. R.
(2012). *Comprehending the cosmos: A macro view of the universe*. North Charleston, SC: CreateSpace.

Johnson, M. R., & Martin, D.
(2016). The anticipated futures of space tourism. *Mobilities*, *11*(1), 135–151.
Johnson, M. R., & Mejia, R.
(2017). Making science fiction real: Neoliberalism, real-life and esports in EVE Online. *Journal of Virtual Worlds Research*, *10*(3), 1–12.
Johnson, P.
(2010). The roles of NASA, astronauts and their families in long duration missions. *Acta Astronautica*, *67*(5–6), 561–571.
Jones, E.
(1913). *Essays in applied psychoanalysis*. London: International Psychoanalytic Press.
Jones, S.
(2006). *Antonio Gramsci*. London: Routledge.
Jung, C. G.
(1968). The origin of the hero. In *Collected works of C.G. Jung* (Vol. *5*). Princeton, NJ: Princeton University Press.
Jung, K. G.
(1969 [1958]). *Flying saucers: A modern myth of things seen in the skies*. New York, NY: Signet Books.
Kardashev, N. S.
(1964). Transmission of information by extraterrestrial civilizations. *Soviet Astronomy*, *8*, 217–221.
Keller, C.
(1986). *From a broken web: Separation, sexism and self*. Boston, MA: Beacon.
Kilbryde, A.
(2015). Space travel as a means of re-enchantment, unification, and spiritual fulfilment. *The Journal of Astrosociology*, *1*, 83–95. Retrieved from www.astrosociology.org
Klein, N.
(2014). *This changes everything: Capitalism vs. the climate*. New York, NY: Simon & Schuster.
Knutson, T.
(2007). What is 'informed consent' for space-flight participants in the soon-to-launch space tourism industry? *Journal of Space Law*, *33*, 105–122.
Koestler, A.
(1989). *The sleepwalkers: A history of man's changing vision of the universe*. London: Penguin Arkana.
Koplow, D. A.
(2017). *The fault is not in the stars: Avoiding an arms race in outer space*. Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3057583
KSC.
(2018). *Kennedy space center visitor complex*. Retrieved from http://www.kennedyspacecnter.com/. Accessed on April 16, 2018.

Ladkin, A.
(2011). Exploring tourism labour. *Annals of Tourism Research*, *38*, 1135–1155.

Laing, J., & Frost, W.
(2014). *Explorer travellers and adventure tourism*. Bristol: Channel View.

Laing, J. H., & Crouch, G. I.
(2004). Vacationing in space: Tourism seeks 'new skies'. In T. V. Singh (Ed.), *Novelty tourism: Strange experiences and stranger practices* (pp. 11–25). Wallingford: CABI Publishing.

Laing, J. H., & Crouch, G. I.
(2005). Extraordinary journeys: An exploratory cross-cultural study of tourists on the frontier. *Journal of Vacation Marketing*, *11*(3), 209–223.

Laing, J. H., & Crouch, G. I.
(2009a). Exploring the role of the media in shaping motivations behind frontier travel experiences. *Tourism Analysis*, *14*(2), 187–198.

Laing, J. H., & Crouch, G. I.
(2009b). Lone wolves? Isolation and solitude within the frontier travel experience. *Human Geography/Geografiska Annaler B*, *91*(4), 325–342.

Laing, J. H., & Crouch, G. I.
(2009c). Myth, adventure and fantasy at the frontier: Metaphors and imagery behind an extraordinary travel experience. *International Journal of Tourism Research*, *11*(2), 127–141.

Laing, J. H., & Crouch, G. I.
(2011). Frontier tourism: Retracing mythic journeys. *Annals of Tourism Research*, *38*(4), 1516–1534.

Lappas, V.
(2006). Space tourism. In D. Buhalis & C. Costa (Eds.), *Tourism business frontiers: Consumers, products, and industry* (pp. 157–167). Oxford: Elsevier.

Lasch, C.
(1979). *The culture of narcissism: American life in an age of diminishing expectations*. New York, NY: Norton.

Lash, S., & Urry, J.
(1994). *Economies of signs and space*. London: Sage.

Latour, B.
(1991). *We have never been modern*. Cambridge, MA: Harvard University Press.

Launius, R. D.
(1998). *Frontiers of space exploration*. Westport, CT: Greenwood Press.

Launius, R. D.
(2006). Compelling rationales for spaceflight? History and the search for relevance. In S. J. Dick & R. D. Launius (Eds.), *Critical issues in the history of spaceflight* (pp. 37–70). Washington, DC: National Aeronautics and Space Administration.

Launius, R. D., & Jenkins, D. R.
(2006). Is it finally time for space tourism? *Astropolitics*, *4*(3), 253–280.
Lefebvre, H.
(1991[1974]). *The production of space*. Oxford: Blackwell.
Lefebvre, H.
(2004 [1992]). *Rhythmanalysis: Space, time and everyday life*. Elden & G. Moore (Trans.). London: Continuum.
Lemmens, P.
(2015). Post- and transhumanism: An introduction. *Human Studies*, *38*(3), 431–438.
Lenzen, M., Sun, Y., Faturay, F., Ting, Y., Geschke, A., & Malik, A.
(2018). The carbon footprint of global tourism. *Nature Climate Change*, *8*(6), 522.
Leotta, A.
(2016). Navigating movie (m)apps: Film locations, tourism and digital mapping tools. *M/C Journal*, *19*(3), n.p.
Lewin, S.
(2016). NASA showcases virtual reality for space exploration. *Scientific American*. Retrieved from https://www.scientificamerican.com/article/nasa-showcases-virtual-reality-for-space-exploration
Lewis, J. R.
(1995). *The gods have landed: New religions from other worlds*. Albany, NY: University of New York Press.
Lewis, J. S.
(1997). *Mining the sky: Untold riches from the asteroids, comets, and planets*. New York, NY: Basic Books.
Library of Congress.
(2003). Commercial Space Act Of 2003 Hr 3245. Introduced 10/2/2003. Washington, DC: Library of Congress.
Lin, P.
(2006). Viewpoint: Look before taking another leap for mankind – Ethical and social considerations in rebuilding society in space. *Astropolitics*, *4*, 281–294.
Lindbergh, C. A.
(1953). *The spirit of St. Louis*. New York, NY: Scribner.
Logsdon, J. M.
(2010). *John F. Kennedy and the race to the Moon*. New York, NY: Palgrave Macmillan.
Loizou, J.
(2006). Turning space tourism into commercial reality. *Space Policy*, *22*(4), 289–290.
Loomis, E.
(2017). *This day in labor history*. Retrieved from www.lawyergunsmoneyblog.

com/2015/12this-day-in-history-december-28-1972. Accessed on December 28, 1973.

Lord, M. G.
(2000). Are we a spacefaring species? Acknowledging our fragility as a first step to transcending it. In S. Dick & R. Launius (Eds.), *Societal impact of spaceflight*. Houston, TX: NASA.

Lord, M. G.
(2007). Are we a spacefaring species? Acknowledging our physical fragility as a step to transcending it. In Dick, J. and R. Launius, (Eds.) *Societal Impact of Spaceflight* (pp. 603–614). Washington, DC: National Aeronautics and Space Administration Office of External Relations, History Division.

Lorimer, J.
(2012). Multinatural geographies for the Anthropocene. *Progress in Human Geography*, *36*(5), 593–612.

Lovejoy, A. O.
(1964). *The great chain of being: A study of the history of an idea*. Cambridge, MA: Harvard University Press.

Lowell, P.
(1906). *Mars and its canals*. New York, NY: Macmillan.

Lowell, P.
(1908). *Mars as the abode of life*. New York, NY: Macmillan.

Lupton, D., & Tulloch, J.
(2002). Life would be pretty dull without risk: Voluntary risk taking and its pleasures. *Health, Risk and Society*, *4*(2), 113–124.

MacCannell, D.
(1973). Staged authenticity: Arrangements of social space in tourist settings. *American Journal of Sociology*, *79*(3), 589–603.

MacCannell, D.
(2013 [1976]). *The tourist: A new theory of the leisure class*. Berkeley, CA: University of California Press.

MacDonald, F.
(2007). Anti-Astropolitik – Outer space and the orbit of geography. *Progress in Human Geography*, *31*(5), 592–615.

MacDonald, F.
(2009). High hope: Rocketry and the popular geopolitics of space exploration, 1944-62. In S. Naylor & J. R. Ryan (Eds.), *New spaces of exploration* (pp. 196–221). London: LB. Taurus.

Mack, J. E.
(1994). *Abduction: Human encounters with aliens*. New York, NY: Scribner.

Mack, J. E.
(2000). *Passport to the cosmos: Human transformation and alien encounters*. New York, NY: Three Rivers Press.

Mack, J. E.
(2006). Psychoanalysis and the self: Towards a spiritual point of view. *Journal of Science and History*, *2*(1), 30–36.
Malm, A., & Hornborg, A.
(2014). The geology of mankind? A critique of the Anthropocene narrative. *The Anthropocene Review*, *1*(1), 62–69.
Marboe, I.
(2015). National space law. In F. G. von der Dunk & F. Tronchetti (Eds.), *Handbook of space law*. Northampton, MA: Edward Elgar Publishing.
Marciacq, J. B., Morier, Y., Tomasello, F., Erdelyi, Z., & Gerhard, M.
(2010). Accommodating sub-orbital flights into the EASA regulatory system. In J. N. Pelton & R. S. Jakhu (Eds.) *Space safety, regulations and standards* (pp. 187–212). Waltham, MA: Butterworth-Heinemsan.
Marsh, M.
(2006). Ethical and medical dilemmas of space tourism. *Advances in Space Research*, *17*, 1823–1827.
Martinez, C. L. F.
(2014). SETI in the light of cosmic convergence evolution. *Acta Astronautica*, *104*, 341–349.
Marx, K.
(1973). *Grundrisse*. London: Penguin Classics.
Marx, K.
(1975). *Early writings*. Harmondsworth: Penguin.
Mattia, R., Rydge, J., & Stern, N.
(2012). *Recklessly slow or a rapid transition to a low-carbon economy? Time to decide*. Centre for Climate Change, Economics and Policy Grantham Research Institute on Climate Change and the Environment. Retrieved from http://www.lse.ac.uk/GranthamInstitute/wp-content/uploads/2014/03/transition-low-carbon-economy.pdf
McCracken, G.
(1988). *The long interview*. Newbury Park, CA: Sage.
McCurdy, H. E.
(1997). *Space and the American imagination*. Washington, DC: Smithsonian Institution Press.
McCurdy, H. E.
(2011). *Space and the American imagination* (2nd ed). Baltimore, MD: Johns Hopkins University Press.
McDougall, W. A.
(1985). *The Heavens and the Earth: A political history of the space age*. New York, NY: Basic Books.
McNally, R. J.
(2005). Sleep paralysis, sexual abuse, and space alien abduction. *Transcultural Psychiatry*, *42*(1), 113–122.

Meadows, D. H., Meadows, D. L., Randers, J., & Behrens, W. W.
(1972). *The limits to growth*. New York, NY: Universe Books.
Meadows, D. H., Randers, J., & Meadows, D. L.
(2004). *Limits to growth: The 30-year update*. White River Junction, VT: Chelsea Green Publishing Group.
Melton, J. G.
(1995). *The gods have landed: New religions*. Albany, NY: State University of New York Press.
Michaud, M. A.
(1986). *Reaching for the high frontier: The American pro-space movement, 1972–84*. New York, NY: Praeger.
Michaud, M. A. G.
(2007). *Contact with alien civilizations: Our hopes and fears about encountering extraterrestrials*. New York, NY: Copernicus Books.
Michel, P. H.
(1973). *The cosmology of Giordano Bruno*. Paris: Hermann.
Mihalic, T., & Gartner, W. C. (Eds.).
(2013). *Tourism and evelopment: Issues and challenges*. New York, NY: Nova Publishers.
Milde, M.
(2016). *International air law and ICAO* (3rd ed). Amsterdam: Elsevier International Publishing.
Millard, W.
(2014). Boldly go – The commercial space flight industry is taking off, and with it a new architectural typology: The spaceport. *The Southwest Architects Newspaper*, 3 December, pp. 11–13.
Mirmina, S. C.
(2015). Astronauts redefined: The commercial carriage of humans to space and the changing concepts of astronauts under international and U.S. law. *Florida International University Law Review*, *10*, 669.
Mitchell, E. D., & Staretz, R.
(2010). Our destiny: A space faring civilization. *Journal of Cosmology*, *12*, 3500–3505.
Mitroff, S.
(2015). *Let's go to Mars! The future of space travel*. Retrieved from https://www.cnet.com/news/lets-go-to-mars
Moltz, J. C.
(2015). Brazil's space program: Dreaming with its feet on the ground. *Space Policy*, *33*(1), 13–19.
Moon, M.
(2015). Falcon 9 disaster messes up SpaceX's launch schedule. *Engadget*. Retrieved from engadgetcom2015/06/30/spacex-schedule-disaster

Moon, M.
(2017). See how NASA envisions a 'Mars 2030' landing in VR. *Engadget*. Retrieved from https://www.engadget.com/2017/08/01/mars-2030-nasa-virtual-reality
Moore, J. W.
(2014a). *The capitalocene, Part I: On the nature and origins of our ecological crisis*. Retrieved from http://www.jasonwmoore.com/Essays.html
Moore, J. W.
(2014b). *The capitalocene, Part II: Abstract social nature and the limits to capital*. Retrieved from http://www.jasonwmoore.com/Essays.html
Moore, J. W.
(2015). *Capitalism in the web of life: Ecology and the accumulation of capital*. New Nork, NY: Verso Books.
Moore, J. W.
(Ed.). (2016). *Anthropocene or capitalocene? Nature, history, and the crisis of capitalism*. Oakland, CA: PM Press.
Moreno-Villanueva, M., Wong, M., Lu, T., Zhang, Y., & Honglu, W.
(2017). Interplay of space radiation and microgravity in DNA damage and DNA damage response. *Npj Microgravity*, *3*(1), 14 (online art). Retrieved from https://www.nature.com/articles/s41526-017-0019-7
Moskowitz, S.
(1992). The growth of science fiction from 1900 to the early 1950s. In F. I. Ordway III & R. Lieberman (Eds.), *Blueprint for space: Science fiction to science fact* (pp. 69–82). Washington, DC: Smithsonian Institution Press.
Mowforth, M., & Munt, I.
(1998). *Tourism and sustainability. New tourism in the Third World*. London: Routledge.
Muecke, S., & Wergin, C.
(2014). Materialities of tourism in the twenty-first century: A very brief introduction. *Tourist Studies*, *14*(3), 227–230.
Murray, C. A., & Bly Cox, C.
(1989). *Apollo, the race to the Moon*. New York, NY: Simon and Schuster.
Musk, E.
(2013, May 29). *Quoted in an interview during the All Things Digital Conference*. Retrieved from https://www.youtube.com/watch?v=UiPO4BUfov8
NASA.
(1994). *Commercial space transportation study*. Retrieved from http://1www.hq.nasa.gov/webaccess/CommSpaceTrans/SpaceCommTransSec35/CommSpacransSec35.html#3_5_6
NASA.
(2011). *Falcon 9 launch vehicle NAFCOM cost estimates*. Retrieved from http://www.nasa.gov/pdf/586023main_8-3-11_NAFCOM.pdf

NASA.

(2013). *Is there atmosphere on the Moon?* Retrieved from https://www.nasa.gov/missin_pages/LADEE/news/lunar-atmspfere.html

NASA.

(2015). *Microsoft collaborate to bring science fiction to science act*. Retrieved from https://www.nasa.gov/press-release/nasa-microsoft-collaborate-to-bring-science-fiction-to-science-fact

NASA.

(2017a). *NASA extends expandable habitat's time on the international space station*. Retrieved from https://www.nasa.gov/feature/nasa-extends-beam-s-time-on-the-international-space-station

NASA.

(2017b). *Take a walk on Mars – In your own living room*. Retrieved from https://www.nasa.gov/feature/jpl/take-a-walk-on-mars-in-your-own-living-room

NASA.

(n.d.). *The Apollo program*. Retrieved from http://spaceflight.nasa.gov/history/apollo/

National Space Centre.

(2007). Retrieved from http://www.spacecentre.co.uk/aboutus/index.htm#

Negoda, S. A.

(2003). Legal aspects of the commercial development of the Russian segment of the ISS. *Air and Space Law*, *28*, 89.

Neuman, W. L.

(1997). *Social research methods: Qualitative and quantitative approaches* (2nd ed). Boston, MA: Allyn and Bacon.

Newbery, B.

(1997). The ultimate room with a view. *Geographical Magazine*, October, 9–14.

Newman, L. S., & Baumeister, R. F.

(1996). Toward an explanation of the UFO abduction phenomenon: Hypnotic elaboration, extraterrestrial sadomasochism, and spurious memories. *Psychological Inquiry*, *7*(2), 99–126.

Normile, D.

(2016). Red star rising. *Science*, *353*(6297), 342–345.

Novoa, A.

(2016). Alien life matters: Reflections on cosmopolitanism, otherness and astrobiology. *Civil Societies*, *1*(1), 1–26.

NTSB.

(2015). *Lack of Consideration for human factors led to in-flight breakup of SpaceShipTwo*. National Transportation Safety Board, 25 July.

Oculus.

(2018a). *Experiences: Hello Mars*. Retrieved from https://www.oculus.com/experiences/gear-vr/1263460633768255

Oculus.

(2018b). *Experiences: Solar system*. Retrieved from https://www.oculus.com/experiences/gear-vr/1327971593879954

Oculus.

(2018c). *Experiences: Discovering Space 2*. Retrieved from https://www.oculus.com/experiences/rift/1108062115894494/

Oculus.

(2018d). *Experiences: Mission ISS*. Retrieved from https://www.oculus.com/experiences/rift/1178419975552187

Oculus.

(2018e). *Experiences: Titans of space 2.0*. Retrieved from https://www.oculus.com/experiences/rift/1023198204421743

Oculus Rift.

(2018). Retrieved from https://www.oculus.com/rift

OECD.

(2004). *Space 2030: Exploring the future of space applications*. Retrieved from http://www.space-library.com/0404OECD_Space2030-1_2To1.pdf

OECD.

(2008). *Climate change mitigation: What do we do?* Booklet of OECD General Secretary, pp. 1–35. Retrieved from http://www.oecd.org/env/cc/41751042.pdf

Olsen, G.

(2005). Q & A: Third space tourist. *BBC News*, 4 May. Retrieved from http://news.bbc.co.uk/go/pr/fr/-/1/hi/sci/tech/3682397.stm. Accessed on November 9, 2005.

Olson, S. J.

(2017). Estimates for the number of visible galaxy-spanning civilizations and the cosmological expansion of life. *International Journal of Astrobiology*, *16*(2), 176–184.

Olson, V., & Messeri, L.

(2015). Beyond the Anthropocene: Un-earthing an epoch. *Environment and Society: Advances in Research*, *6*, 28–47.

Ormrod, J. S.

(2006). *The pro-space movement in the 21st century: A sociological and psychoanalytic study of space advocacy and activism*. Unpublished PhD thesis, University of Essex.

Ormrod, J. S.

(2007). Pro-spaceactivism and narcissistic phantasy. *Psychoanalysis, Culture and Society*, *12*(3), 260–278.

Ormrod, J. S.
(2009). Phantasy and social movements: An ontology of pro-space activism. *Social Movement Studies*, *8*(2), 115–129.
Ormrod, J. S.
(2016). Space activism: A psychosocial perspective. In J. S. Ormrod & P. Dickens (Eds.) *The Palgrave handbook of society, culture and outer space*. Basingstoke: Palgrave.
Ormrod, J. S., & Dickens, P.
(Eds.). (2017). *The Palgrave handbook of society, culture and outer space*. Basingstoke: Palgrave.
Palmer, S. J.
(2004). *Aliens adored: Raël's UFO religion*. New Brunswick, NJ: Rutgers University Press.
Palsson, G., Szerszynski, B., Sörlin, S., et al.
(2013). Reconceptualizing the 'Anthropos' in the Anthropocene: Integrating the social sciences and humanities in global environmental change research. *Environmental Science & Policy*, *28*, 3–13.
Papagiannis, M. D.
(1984). Natural selection of stellar civilizations and the limits of growth. *Quarterly Journal of the Royal Astronomical Society*, *25*(3), 309–318.
Partridge, C.
(Ed.) (2003a). *UFO religions*. London: Routledge.
Partridge, C.
(2003b). Understanding UFO religions and abduction spiritualities. In Ch. Partridge (Ed.), *UFO religions* (pp. 3–43). London: Routledge.
Pearce, P. L.
(1982). *The social psychology of tourist behaviour*. Oxford: Pergamon.
Peeters, W.
(2010). From suborbital space tourism to commercial personal spaceflight. *Acta Astronautica*, *66*(11–12), 1625–1632.
Peldszus, R., Dalke, H., Pretlove, S., & Weld, C.
(2014). The perfect boring situation: Addressing the experience of monotony during crewed deep space missions through habitability design. *Acta Astronautica*, *94*(1), 262–276.
Penn, J. P., & Lindley, C. A.
(2003). Requirements and approach for a space tourism launch system. *Acta Astronautica*, *52*, 49–75.
Phillips, R.
(2012). *Grappling with gravity*. New York, NY: Springer.
Piketty, T.
(2015). *The economics of inequality*. Paris: Éditions La Découverte.

Planetary Collective.
(2012). *Overview* [film]. Retrieved from https://www.space-policy.com/new-publications-in-outer-space-politics/overview-effect-video-25-years-on. Accessed in June 2018.
Pomerantz, W. J., & Isakowitz, S. J.
(2013). Virgin galactic. *New Space*, *1*(4), 167–170.
Qiu, J., & Stone, R.
(2013). Chinese mission ushers in new era of lunar exploration. *Science*, *342*(6162), 1026.
Reddy, M. V., Nica, M., & Wilkes, K.
(2012). Space tourism: Research recommendations for the future of the industry and perspectives of potential participants. *Tourism Management*, *33*(5), 1093–1102.
Reijnders, S.
(2011). *Places of the imagination: Media, tourism, culture*. Surrey: Ashgate.
Reuters.
(2007). *Three killed in blast at rocket site in California*. July 27. Retrieved from https://www.reuters.com/article/us-airport-explosion/three-killed-in-blast-at-rocket-site-in-calif-idUSN2625793820070727
REWIND.
(2018). *Portfolio: Home – A VR spacewalk*. Retrieved from http://rewind.co/portfolio/bbc-home-vr-spacewalk
Roberts, J. T., & Parks, B. C.
(2007). *A climate of injustice: Global inequality, North-South politics, and climate policy*. Cambridge, MA: MIT Press.
Robertson, D. G.
(2016). *UFOs, conspiracy theories and the New Age*. New York, NY: Bloomsbury.
Roden, D.
(2015). *Posthuman life: Philosophy at the edge of the human*. London: Routledge.
Rogers, T. F.
(2004). Safeguarding tranquility base: Why the Earth's Moon base should become a World Heritage Site. *Space Policy*, *20*(1), 5–6.
Rojek, C., & Urry, J.
(1997). Transformations of travel and theory. In C. Rojek & J. Urry (Eds.), *Touring cultures: Transformations of travel and theory* (pp. 1–10). London: Routledge.
Rood, R. T., & Trefil, J. S.
(1981). *Are we alone? The possibility of extraterrestrial civilizations*. New York, NY: Charles Scribner and Sons.
Rose, D. B., van Doreen, T., Chrulew, M., Cooke, S., Kearnes, M., & O'Gorman, E.
(2012). Thinking through the environment, unsettling the humanities. *Environmental Humanities*, *1*, 1–5.

Rosen, E.
(Trans.). (1967). *Kepler's Somnium: The dream or posthumous work on lunar astronomy*. Madison, MA: University of Wisconsin Press.
Ross, M., Mills, M., & Toohey, D.
(2010). Potential climate impact of black carbon emitted by rockets. *Geophysical Research Letters*, *37*(24), 1–6.
Rowen, R.
(2017, September 18). Owning the final frontier? Proceedings of the Emerging Geographies of Outer Space Conference, Department of Anthropology, UCL, London.
Ruddiman, W. F., Ellis, E. C., Kaplan, J. O., & Fuller, D. Q.
(2015). Defining the epoch we live in. *Science*, *348*(6230), 38–39.
Ryabinkin, C. T.
(2004). Let there be flight: It's time to reform the regulation of commercial space travel. *Journal of Air Law and Commerce*, *69*, 101–137.
Ryff, C. D., & Singer, B. H.
(2008). Know thyself and become what you are: A eudaimonic approach to psychological well-being. *Journal of Happiness Studies*, *9*(1), 13–39.
Sagan, C.
(1973). On the detectivity of advanced galactic civilizations. *Icarus*, *19*(3), 350–352.
Sagan, C.
(1994). *Pale blue dot: A vision of the human future in space*. New York, NY: Random House.
Sagan, C.
(1995). In defense of the search for extraterrestrial intelligence. *Bioastronomy News*, *7*(4), 1–4.
Sagan, C., & Fox, P.
(1975). The canals of Mars: An assessment and Mariner 9. *Icarus*, *25*(4), 602–612.
Sage, D.
(2008). Framing space: A popular geopolitics of American manifest destiny in outer space. *Geopolitics*, *13*(1), 27–53.
Sage, D.
(2014). *How outer space made America: Geography, organization and the cosmic sublime*. London: Routledge.
Sahlins, R.
(1998). The Original Affluent Society. *In Limited Wants, Unlimited Means: A Reader on Hunter-Gatherer Economics and the Environment*, ed. J. Gowdy. Washington, DC: Island Press, (pp. 5–41).
Saler, B.
(2009). *UFO crash at Rockwell: The genesis of a modern myth*. Old Saybrook, CT: Konetsky & Konetsky.

Saler, B., Ziegler, C. A., & Moore, C. B.
(1997). *UFO crash at Roswell: The genesis of a modern myth*. Washington, DC: Smithsonian Institution Press.
Sarli, B., Cabero, M., Lopez, A., Cardoso, J., Jimenez, D., Roman-Gonzalez, A., Villena, G., Vargas-Cuentas, N. I., & Perazzo, F.
(2015). South American space era. Paper presented at 66th International Astronautical Congress, Jerusalem, Israel.
Savage, M., Barlow, J., Dickens, P., & Fielding, A.
(1992). *Property, bureaucracy and culture: Middle class formation in contemporary Britain*. London: Routledge.
Schiesel, S.
(2007, November 28). *In an ever-changing galaxy, the action's starting to get intriguing*. Retrieved from http://www.nytimes.com/2007/11/28/arts/television/28eve.html
Schorn, R. A.
(1998). *Planetary astronomy: From ancient times to the third millennium*. College Station, TX: A&M University Press.
Scolaro, C.
(2016). Virtual reality could become an $80B industry: Goldman. *CNBC*. Retrieved from https://www.cnbc.com/2016/01/14/virtual-reality-could-become-an-80b-industry-goldman.html
Seale, C.
(1999). *The quality of qualitative research*. London: Sage.
Seaton, A. V.
(2002). Tourism as metempsychosis and metensomatosis: The personae of eternal recurrence. In G. Dann (Ed.), *The tourist as a metaphor of the social world* (pp. 135–168). Wallingford: CABI Publishers.
Sentes, B., & Palmer, S.
(2000). Presumed immanent: The Raëlians, UFO religions, and the postmodern condition. *Nova Religio: The Journal of Alternative and Emergent Religions*, *4*(1), 86–105.
Sharp, T.
(2017). Mars' atmosphere: Composition, climate & weather. *Space.com*. Retrieved from https://www.space.com/16906-mars-atmosphere-climate-weather.html
Sharpe, C., & Tronchetti, F.
(2015). Legal aspects of public manned spaceflight. In F. G. von der Dunk & F. Tronchetti (Eds.), *Handbook of space law*. Northampton, MA: Edward Elgar Publishing.
Sherwood, B.
(2011). Comparing future options for human space flight. *Acta Astronautica*, *69*, 346–353. doi:10.1016/j.actaastro.2011.04.006

Shields, R.
(1991). *Places on the margin*. London: Routledge.
Shklovskij, I. S., & Sagan, C. E.
(1966). *Intelligent life in the universe*. San Francisco, CA: Holden-Day.
Shostak, S.
(2018). Introduction: The true nature of aliens. *International Journal of Astrobiology*, *17*(4), 281.
Shuttleworth, M.
(2002a, April 3). *Interview with Mark Shuttleworth*. Retrieved from http://www.firstafricaninspace.com/home/mission/faq/interview2.shtml. Accessed on November 9, 2005.
Shuttleworth, M.
(2002b). *On his past*. Retrieved from http://www.firstafricaninspace.com/home/mission/faq/leadership.shtml. Accessed on November 9, 2005.
Siddiqi, A. A.
(2000). *Challenge to Apollo: The Soviet Union and the space race, 1945-1974*. SP-2000-4408. Washington, DC: NASA.
Siddiqi, A. A.
(2002). *Deep space chronicle: Robotic exploration missions to the planets*. SP-2002-4524. Washington, DC: NASA.
Siddiqi, A. A.
(2010). Competing technologies, national(ist) narratives, and universal claims: Toward a global history of pace exploration. *Technology and Culture*, *51*(2), 425–443.
Singletary, C.
(2017). Mission: ISS is a free space simulation that makes you the astronaut. *UpLoadVR*. Retrieved from https://uploadvr.com/mission-iss-space-simulation-makes-you-astronaut
Smith, A.
(2005). *Moondust: In search of the men who fell to earth*. London: Bloomsbury.
Smith, L. J., & Hörl, K. U.
(2004). Legal parameters of space tourism. *Proceedings of the Forty-Sixth Colloquium on the Law of Outer Space*. Reston, VA : American Institute of Aeronautics and Astronautics.
Smith, V. L.
(2000). Space tourism: The 21st century 'frontier'. *Tourism Recreation Research*, *25*(3), 5–15.
Smith, V. L.
(2001). Stone age to Star Trek. In V. L. Smith & M. Brett (Eds.) *Hosts and guests revisited: Tourism issues of the 21st century*. New York, NY: Cognizant.

Sommer, R., & Sommer, B.
(2002). *A practical guide to behavioral research* (5th ed). Oxford: Oxford University Press.
Space Adventures.
(2007). *Space adventures*. Retrieved from www.spaceadventures.com.
Space Adventures.
(2018). *Experiences*. Retrieved from http://www.spaceadventures.com/experiences/. Accessed on June 2018.
Space Frontier Foundation.
(2009). Retrieved from http://newspace.spacefrontier.org/
Space Tourism Society.
(2007). Retrieved from http://www.spacetourismsociety.org/aboutus.html
SpaceX.
(2017). *Making life multiplanetary*. Retrieved from: https://www.spacex.com/mars
Spector, S., Higham, J. E., & Doering, A.
(2017). Beyond the biosphere: Tourism, outer space, and sustainability. *Tourism Recreation Research*, *42*(3), 273–283.
Spencer, J., & Rugg, K.
(2004). *Space tourism: Do you want to go?* Burlington: Apogee.
Spennemann, D. H. R.
(2007). Extreme cultural tourism: From Antarctica to the Moon. *Annals of Tourism Research*, *34*(4), 898–918.
Spennemann, D. H. R., & Kosmer, L.
(2005). Heritage sites of the US space program in Australia: Are we managing them adequately? *QUEST—The History of Spaceflight Quarterly*, *12*(2), 52–64.
Spudis, P. D.
(1996). *The once and future Moon*. Washington, DC: Smithsonian Institution Press.
Steer, C.
(2017). Global commons, cosmic commons: Implications of military and security uses of outer space. *Georgetown Journal of International Affairs*, *18*(1), 9–16.
Steffen, W., Grinevald, J., Crutzen, P., & McNeill, J.
(2011). The Anthropocene: Conceptual and historical perspectives. *Philosophical Transactions of the Royal Society*, *369*(1938), 842–867.
Steffen, W., Persson, Å., Deutsch, L., Zalasiewicz, J., Williams, M., Richardson, K., … Gordon, L.
(2011). The Anthropocene: From global change to planetary stewardship. *Ambio*, 7444–7447.
Steiger, B.
(1988). *The UFO abductors*. New York, NY: Berkley.

Steiger, B., & Steiger, S. H.
(2011). *Real aliens, space beings and creatures from other worlds*. Canton, MI: Visible Ink Press.

Stiglitz, J. E.
(2002). *Globalisation and its discontents*. London: W.W. Norton & Company Ltd.

Strauss, A., & Corbin, J.
(1990). *Basics of qualitative research: Grounded theory procedures and techniques*. Newbury Park, CA: Sage.

Stuart, W. J.
(1956). *Forbidden planet*. New York, NY: Farrar, Straus & Cudahy.

Suresh, B. N.
(2014). The Indian space launch program. In K. U. Schrogl, P. L. Hays, J. Robinson, & G. Gionnnopapa (Eds.) *Handbook of space security* (pp. 921–938). New York, NY: Springer.

Svetlik, J.
(2017). BBC VR spacewalk experience lets you walk in Tim Peake's shoes. *uSwitch*. Retrieved from https://www.uswitch.com/tv/news/2017/02/bbc_vr_spacewalk_experience_lets_you_walk_in_tim_peakes_shoes

Szendy, P.
(2013). *Kant in the land of extraterrestrials*. New York, NY: Fordham University Press.

Szerszynski, B., & Urry, J.
(2006). Visuality, mobility and the cosmopolitan: Inhabiting the world from afar. *The British Journal of Sociology*, *57*(1), 113–131.

Tang, T. B., & Chang, G.
(1991). Classification of extraterrestrial civilizations. *Quarterly Journal of the Royal Astronomical Society*, *32*, 189–191.

Tarnas, R.
(2006). *Cosmos and psyche: Intimations of a new world view*. New York, NY: Viking.

Tarter, J.
(2001). The search for extraterrestrial intelligence (SETI). *Annual Review of Astronomy and Astrophysics*, *39*, 511–548.

Taylor, N., Bergstrom, K., Jenson, J., & de Castell, S.
(2015). Alienated playbour: Relations of production in *EVE Online*. *Games and Culture*, *10*(4), 365–388.

Taylor, S. J., & Bogdan, R.
(1998). *Introduction to qualitative research methods: A guidebook and resource* (3rd ed). Hoboken, NJ: Wiley.

Tcharfas, J.
(2015). Through the lens of a space tourist. *Science Museum Group Journal*

Autumn, (4). Retrieved from http://journal.sciencemuseum.ac.uk/browse/issue-04/space-tourist/

The Economist.

(2015). *Human space flights: The orphans of Apollo*. Retrieved from Economist.com/technology-quarterly/2016-25-08/space-2016

Thrift, N. J.

(1990). The making of capitalist time consciousness. In J. Hassard (Ed.), *The sociology of time*. Basingstoke, Hampshire: Macmillan.

Time.

(1960). Project Ozma. *Times*, April 8.

Titcomb, J.

(2017). Musk plans London to New York rocket flights could be reduced to 29 minutes. *Daily Telegraph*. Retrieved from https://www.telegraph.co.uk/technology/2017/09/29/elon-musk-unveils-plans-london-new-york-rocket-flights-30-minutes/

Traphagan, J.

(2015). *Extraterrestrial intelligence and human imagination: SETI at the intersection of science, religion, and culture*. Berlin: Springer.

Treaty on principles governing the activities of states in the exploration and use of outer space, including the Moon and other celestial bodies. London/Moscow/Washington, done on 27 January 1967.

Tronchetti, F.

(2015a). Legal aspects of the military uses of outer space. In F. G. von der Dunk & F. Tronchetti (Eds.), *Handbook of space law*. Northampton, MA: Edward Elgar Publishing.

Tronchetti, F.

(2015b). Legal aspects of space resource utilization. In F. G. von der Dunk & F. Tronchetti (Eds.) *Handbook of space law* (pp. 769–813). Northampton, MA: Edward Elgar Publishing.

Turner, L., & Ash, J.

(1976). *The Golden Hordes: International tourism and the pleasure periphery*. London: Constable.

Turner, V.

(1969). *The ritual process: Structure and anti-structure*. Chicago, IL: Aldine.

Turner, V., & Turner, E.

(1978, 2011). *Image and pilgrimage in Christian culture*. New York, NY: Columbia University Press.

U.S. Space Resource Exploration and Utilization Act.

(2015). Retrieved from https://www.congress.gov/bill/114th-congress/house-bill/1508

United Nations.

(2010). *Momentum gathering for weaponization of outer space, risk of outer* *space arms race*. Retrieved from http://www.un.org/News/Press/docs/2010/gadis3421.doc.htm

United Nations Framework Convention on Climate Change.
(2015). *The Paris agreement*. Retrieved from http://bigpicture.unfccc.int/#content-the-paris-agreemen

Urry, J.
(1992). The tourist gaze 'revisited'. *American Behavioral Scientist*, *36*(2), 172–186.

Urry, J.
(1995). *Consuming places*. London: Routledge.

Urry, J.
(2002 [1990]). *The Tourist gaze: Leisure and travel in contemporary societies*. London: Sage.

Urry, J.
(2007). *Mobilities*. Cambridge: Polity.

Urry, J., & Larsen, J.
(2011). *The Tourist Gaze 3.0*. London: Sage.

US Fish and Wildlife Service.
(2007). Retrieved fom http://www.fws.gov/merrittisland/

Vakoch, D. A., & Dowd, M. F.
(Eds.) (2015). *The Drake equation: Estimating the prevalence of extraterrestrial life*. Cambridge: Cambridge University Press.

van Fenema, H. P.
(2005). Suborbital flights and ICAO. *Air and Space Law*, *30*, 396.

van Pelt, M.
(2005). *Space tourism: Adventures in earth orbit and beyond*. New York, NY: Copernicus Books.

Vaughan, D.
(1996). *The challenger launch decision: Risky technology, culture, and deviance at NASA*. Chicago, IL: University of Chicago Press.

Vaughan, D.
(2016). *The Challenger decision: Risky technology, culture and deviance at NASA*. Chicago, IL: University of Chicago Press.

Vaughan, J.
(2017). The space kingdom of Asgardia says it's the first nation with 'all of its territory in space' – But space law experts dispute the claim, *Business Insider*, 7 December. Retrieved from https://www.businessinsider.com.au/asgardia-1-satellite-first-country-exist-space-2017-12

Veblen, T.
(1973 [1899]). *The theory of the leisure class*. Boston, MA: Houghton Mifflin.

Vedda, J. A.
(2009). The role of space development in globalization. In S. Dick &

R. Launius (Eds.), *Societal impact of spaceflight*. Washington, DC: NASA History Series.
Vedda, J. A.
(2008). Challenges to the sustainability of space exploration. *Astropolitics*, *6*, 22–49.
Vidal, C.
(2015). A multidimensional impact model for the discovery of extraterrestrial life. In S. J. Dick (Ed.), *The impact of discovering life beyond Earth* (pp. 55–75). Cambridge: Cambridge University Press.
Vidmar, M., & Webber, D.
(2017). *Gateway Earth: A pragmatic modular architecture for space access and exploration*. IAC Congress, Adelaide, Australia, IAC-17-D3.1.1.
Viikari, L.
(2015). Environmental aspects of space activities. In F. G. von der Dunk & F. Tronchetti (Eds.), *Handbook of space law*. Northampton, MA: Edward Elgar Publishing.
Villard, R., & Sahu, K.
(2012, January 11). *The milky way contains at least 100 billion planets according to survey*. Retrieved from http://hubblesite.org/newscenter/archive/releases/2012/07/full/
Virgin.
(2018). *Virgin experience days*. Retrieved from https://www.virginexperiencedays.co.uk/
Virgin Galactic.
(2018). Retrieved fom http://www.virgingalactic.com
Virilio, P.
(1994 [1988]). *The vision machine*. J. Rose (Trans.). Indianapolis, IN: Indiana University Press.
Vissepó, V. J.
(2005). Legal aspects of reusable launch vehicles. *Journal of Space Law*, *31*, 85.
von der Dunk, F.
(2011). Space tourism, private spaceflight and the law: Key aspects. *Space Policy*, *27*, 146–152.
von der Dunk, F. G.
(2008). Passing the buck to Rogers: International liability issues in private spaceflight. *Nebraska Law Review*, *86*, 400.
von der Dunk, F. G.
(2013). The integrated approach—Regulating private human spaceflight as space activity, aircraft operation, and high-risk adventure tourism. *Acta Astronautica*, *92*(2), 199–208.
von der Dunk, F. G.
(2015b). Legal aspects of private manned spaceflight. In F. G. von der

Dunk & F. Tronchetti (Eds.), *Handbook of space law*. Northampton, MA: Edward Elgar Publishing.

von der Dunk, F. G.

(2016). Space traffic management: A challenge of cosmic proportions. In *Proceedings of the International Institute of Space Law 2015* (Vol. 58). The Hague: Eleven International Publishing.

von Karman, T., & Edson, L.

(1967). *The wind and beyond: Theodore von Karman, pioneer in aviation and pathfinder in space*. Boston, MA: Little, Brown.

Wall, M.

(2011). *First space tourist: How a U.S. millionaire bought a ticket to orbit. Space.com*. Retrieved from https://www.space.com/11492-space-tourism-pioneer-dennis-tito.html

Wallace, R. M. M.

(1997). *International law* (3rd ed). New York, NY: Sweet and Maxwell.

Walter, M., & Davies, P. C. W.

(1999). *The search for life on Mars*. Cambridge, MA: Perseus Books.

Wandel, A.

(2017). How far are extraterrestrial life and intelligence after Kepler? *Acta Astronautica*, *137*, 498–503.

Wang, N.

(1999). Rethinking authenticity in tourism experience. *Annals of Tourism Research*, *26*(2), 349–370.

Wearing, S., & Wearing, B.

(2001). Conceptualising the selves of tourism. *Leisure Studies*, *20*(2), 143–159.

Weaver, A.

(2005). The McDonaldization thesis and cruise tourism. *Annals of Tourism Research*, *32*(2), 346–366.

Webber, D.

(2005). *Horses for courses – Spaceport types*. Washington, DC: International Space Development Conference, ISDC, Washington, DC, May 20–25.

Webber, D.

(2010a). Point-to-point sub-orbital space tourism: Some initial considerations. *Acta Astronautica*, *66*(11–12), 1645–1651.

Webber, D.

(2010b). *The Wright stuff: The century of effort behind your ticket to space*. Burlington, ON: Apogee Books.

Webber, D.

(2013). Space tourism: Its history, future and importance. *Acta Astronautica*, *92*, 138–143.

Webber, D.
(2016). *No bucks, no Buck Rogers – Creating the business of commercial space*. Boca Raton, FL: Curtis Press.
White, F.
(1987). *The overview effect: Space exploration and human evolution*. Washington, DC: American Institute of Aeronautics and Astronautics.
White, F.
(1998). *The overview effect* (2nd ed). Reston, VA: Institute of Aeronautics and Astronautics.
White, F.
(2014). *The overview effect: Space exploration and human evolution* (3rd ed). Reston, VA: American Institute of Aeronautics.
Whitters, K.
(2012). Reëlism: Publicity as a recruitment technique. *Nova Religion: The Journal of Alternative and Emergent Religions*, *15*(3), 11–16.
Wilhelms, D. E.
(1993). *To a rocky Moon: A geologist's history of lunar exploration*. Tucson, AZ: University of Arizona Press.
Williams, A.
(2006). Toward a political economy of tourism. In A. Lew, C. Hall, & A. Williams (Eds.) *A companion to tourism*. Oxford: Blackwell.
Williams, G.
2016. Development: Part I. In J. A. Agnew & J. S. Duncan (Eds.), *The Wiley-Blackwell companion to human geography* (pp. 559–574)). Chichester: John Wiley & Sons.
Williamson, M.
(2001). *The Cambridge dictionary of space technology*. Cambridge: Cambridge University Press.
Winter, F. H.
(1983). *Prelude to the space age: The rocket societies, 1924-1940*. Washington, DC: Smithsonian Institution Press.
Woods, B.
(2009). A political history of NASA's space shuttle: The development years, 1972–1982. In David Bell & Martin Parker (Eds.), *Space Travel & Culture: From Apollo to Space Tourism*. Hoboken, NJ: Blackwell Publishing.
World Commission on Environment and Development.
(1987). *Our common future*. New York, NY: Oxford.
Yaden, D. B., Iwry, J., Slack, K. J., Eichstaedt, J. C., Zhao, Y., Vaillant, G. E., & Newberg, A. B.
(2016). The overview effect: Awe and self-transcendent experiences in space flight. *Psychology of Consciousness: Theory, Research, and Praxis*, *3*(1), 1–11.

Yarris, L.
(2010, May 1). *Tapping into solar energy riches: Berkeley lab's Helios Project and the Solar Energy Research Center*. Lawrence Berkeley National Laboratory. Retrieved from http://www.lbl.gov/Publications/YOS/Apr/

Zacharias, K.
(2018). *Tesla in space could carry bacteria from Earth*. Purdue University. Retrieved from https://www.purdue.edu/newsroom/releases/2018/Q1/tesla-in-space-could-carry-bacteria-from-earth.html

Zahle, K.
(2001). Decline and fall of the Martian Empire. *Nature*, *412*(6843), 209−213.

Zalasiewicz, J., Waters, C. N., Summerhayes, C. P., Wolfe, A. P., Barnosky, A. D., Cearreta, A., … Williams, M.
(2017). The working group on the Anthropocene: Summary of evidence and interim recommendations. *Anthropocene*, *19*, 55−60.

Zannoni, D.
(2013). Conflict and conciliation of national space laws. *Annals of Air and Space Law*, *38*, 343.

Zhu, Y.
(2012). Performing heritage: Rethinking authenticity in tourism. *Annals of Tourism Research*, *39*(3), 1495−1513.

Zubrin, R.
(1999). *Entering space: Creating a spacefaring civilization*. New York, NY: Tarcher/Putnam.

Zubrin, R.
(2011). *The case for Mars: The plan to settle the Red Planet and why we must* (rev. ed). New York, NY: Free Press.

Zuckerman, B.
(1985). Stellar evolution: Motivation for mass interstellar migrations. *Quarterly Journal of the Royal Astronomical Society*, *26*, 56−59.

VR SPACE TOURS

3D Virtual Tour of the International Space Station. (2016). European Space Agency. Retrieved from https://www.youtube.com/watch?v=UDW_GSFOg0I&list=

Access Mars. (2017). Google Creative Lab and NASA JPL. Retrieved from https://accessmars.withgoogle.com/

Adr1ft. (2016). Three One Zero and 505 Games. Retrieved from www.adr1ft.com

Destination: Mars. (2016). NASA JPL and Microsoft HoloLens. Retrieved from http://media.kennedyspacecenter.com/presskits/destination-mars.htm

Discovering Space 2. (2017). DiscoveringVR. Retrieved from http://discoveringvr. com/
EarthlightVR. (2017). Opaque Space. Retrieved from http://www.earthlightvr.com
Experience Curiosity. (2015). NASA JPL. Retrieved from https://eyes.nasa.gov/curiosity
Hello Mars. (2017). UCCVR Experience Lab. Retrieved from http://mars.uccvr.com/en/landing_en/
Home: A VR Spacewalk. (2017). BBC Media Applications Technologies Limited. Retrieved from http://www.bbc.co.uk/guides/zknffcw
Intergalactic Travel Bureau VR. (2017). Guerilla Science. Retrieved from http://guerillascience.org/event/itb
Mars 2030. (2017). Fusion Media Group. Retrieved from http://mars2030-vr.com
Mars 2117. (2017). UAE. Retrieved from https://youtu.be/JboqeUqQiv4
Mars Experience. (2017). Lockheed Martin Corporation. Retrieved from https://lockheedmartin.com/generationbeyond/mars-experience
Mission: ISS. (2017). Magnopus and Oculus. Retrieved from http://missioniss.magnopus.com
NASA VR: On the surface of planet TRAPPIST-1d. (2017). NASA. Retrieved from https://exoplanets.nasa.gov/vr/trappist-1d
Solar system. (2015). Fuero Games and Illusion Ray. Retrieved from https://www.oculus.com/experiences/gear-vr/1327971593879954
Space Station 360. (2016). European Space Agency. Retrieved from http://www.esa.int/Our_Activities/Human_Spaceflight/International_Space_Station/Highlights/International_Space_Station_panoramic_tour
Titans of Space 2.0. (2016). DrashVR LLC. Retrieved from https://www.oculus.com/experiences/rift/1023198204421743

FILMOGRAPHY

Beard, T. (Director) & Cox, B. (Presenter) (2017). *The 21st Century Race for Space* [TV Documentary]. London: BBC Two.
Blomkamp, N. (Director). (2013). *Elysium* [Motion picture]. Culver City, CA: TriStar Pictures.
Cuarón, A. (Director). (2013). *Gravity* [Motion picture]. Los Angeles, CA: Warner Bros.
Jennings, G. (Director). (2005). *The Hitchhiker's Guide to the Galaxy* [Motion picture]. Burbank, CA: Touchstone Pictures.
Jones, D. (Director). (2009). *Moon* [Motion picture]. Los Angeles, CA: Liberty Films UK.

Kubrick, S.
(Director). (1968). *2001: A Space Odyssey* [Motion picture]. Beverly Hills, CA: MGM.
Lucas, G.
(Director). (1977). *Star Wars* [Motion picture]. San Francisco, CA: Lucasfilm.
Miller, G.
(Director). (2005). *Mad Max: Fury Road* [Motion picture]. Los Angeles, CA: Warner Bros.
Niccol, A.
(Director). (1997). *Gattaca* [Motion picture]. Los Angeles, CA: Columbia Pictures.
Nolan, C.
(Director). (2014). *Interstellar* [Motion picture]. Los Angeles, CA: Paramount Pictures.
Scott, R.
(Director). (1979). *Alien* [Motion picture]. Los Angeles, CA: Brandywine Productions.
Scott, R.
(Director). (2015). *The Martian* [Motion picture]. Los Angeles, CA: Twentieth Century Fox.
Spielberg, S.
(Director). (1977). *Close Encounters of the Third Kind* [Motion picture]. London: EMI Films.
Tyldum, M.
(Director). (2016). *Passengers* [Motion picture]. Los Angeles, CA: Columbia Pictures.

LUDOGRAPHY

Dead Space.
(2008). *EA Redwood Shores.*
Dead Space 2.
(2011). *Visceral Games.*
Dead Space 3.
(2013). *Visceral Games.*
Elite.
(1984). *David Braben & Ian Bell.*
EVE Online.
(2003–Present). *CCP Games.*
Mass Effect.
(2007). *BioWare.*

Mass Effect 2.
(2010). *BioWare*.
Mass Effect 3.
(2012). *BioWare*.
No Man's Sky.
(2016). *Hello Games*.

About the Contributors

Carl Cater <carl.cater@swansea.ac.uk> is an Associate Professor in Tourism at Swansea University, UK. His research centers on the experiential turn in tourism and the subsequent growth of special interest sectors, particularly adventure and ecotourism. He has written over 40 papers and book chapters, including coauthoring *Marine Ecotourism: Between the Devil and the Deep Blue Sea* (CABI, 2007) and serving as editor for the *Encyclopaedia of Sustainable Tourism* (CABI, 2015). Having traveled to more than 80 countries, he has undertaken field research, supervision, curriculum oversight, and teaching worldwide and is a fellow of the Royal Geographical Society.

Maud Ceuterick <maud.ceuterick@uib.no> is a Marie Skłodowska-Curie fellow in Digital Culture at the University of Bergen in Norway. Her research deals with the relations between gender, space, and power on screen, including digital media. She earned her PhD in Film and Media Studies from the University of Otago in New Zealand; her thesis considered filmic esthetics and women's occupation of space in contemporary cinema. Among other topics, she has previously published on the road movie genre, masculinity and domesticity in transnational cinema, and women and everyday spaces on screen.

Erik Cohen <erik.cohen@mail.huji.ac.il> is the George S. Wise Professor of Sociology (emeritus) at the Hebrew University of Jerusalem, Israel. He has conducted research in Israel, Peru, the Pacific Islands and, since 1977, in Thailand. He is the author of more than 200 publications and of several books, including *Contemporary Tourism: Diversity and Change* (Elsevier, 2004), and *Explorations in Thai Tourism* (Emerald, 2008). He is a founding member of the International Academy for the Study of Tourism and was awarded the UN World Tourism Organization's Ulysses Prize for 2012. He presently lives and does research in Thailand.

David Crouch <david.crouch@uwa.edu.au> is based in the School of Humanities at the University of Western Australia. He completed his PhD at the University of Melbourne where he taught in the School of Social and Political Sciences and the School of Culture and Communication. His research interests span social theory and policy, cultural and media histories, technology and new materialisms. He is the author of *Colonial Psychosocial* (CSP, 2015), and his work has been published in the *International Journal of Cultural Studies, Space and Culture, Nineteenth-Century Context*, *Open Cultural Studies* and *Journal of Australian Studies*.

Katarina Damjanov <katarina.damjanov@uwa.edu.au> is a Lecturer in Digital Media and Communication Design in the School of Social Sciences at the University of Western Australia. She completed her PhD at the University of Melbourne where she also taught in the School of Social and Political Sciences and the School of Culture and Communication. Her research interests revolve around considerations of the material and social dimensions of technological progress on and off the Earth. Some of her recent work features in *Environment and Planning D: Society and Space*; *Science, Technology & Human Values*; *Mobilities*; *Fibreculture;* and *Leonardo*.

Peter Dickens <p.dickens1@ntlworld.com> originally trained as an Architect at the University of Cambridge, United Kingdom; he was then an Urban Sociologist at the University of Sussex from the 1970s to 1990s. In 2000, he returned to Cambridge to work on environmental sociology. His book, *Society and Nature* (2004), earned an "Outstanding Publication" award from The American Sociological Association. His recent research and publications have focused on the sociology of outer space, including *Cosmic Society* (2007) and an edited collection, *The Palgrave Handbook of Society, Culture and Outer Space* (2016).

Warwick Frost <w.frost@latrobe.edu.au> is an Associate Professor in the Department of Management, Sport and Tourism at La Trobe University in Melbourne, Australia. His research interests include tourism and the media, nature-based tourism (particularly national parks and zoos), events, and cultural heritage tourism. He is a coeditor of the Routledge series *Advances in Events Research* and also Convenor of the International Tourism and Media Conference series, which has been staged biennially since 2004. He has cowritten six research books, including *Imagining the American West Through Film and Tourism* (Routledge, 2015), with Jennifer Laing.

James E.S. Higham <james.higham@otago.ac.nz> is a Professor at the University of Otago, New Zealand and Visiting Professor at the University of Stavanger, Norway. He is the coeditor of the *Journal of Sustainable Tourism*. His research interests generally address tourism, sustainable development, and environmental change. He has been researching climate change and long-haul aviation since 2009. His other major, long-standing field of research addresses the interplay of sport and tourism.

Mark R. Johnson <markrjohnsongames@gmail.com> is a Killam Postdoctoral Fellow in the Department of Political Science at the University of Alberta, Canada. His research examines intersections between play and money, such as eSports, live streaming, fantasy sports betting, gamification, and loot boxes. He has published in academic journals including *Convergence, Information, Communication and Society; The Sociological Review;* and *Games and Culture*. His first book, *The Unpredictability of Gameplay* (2018), is now out from Bloomsbury Academic. Beyond academia, he is an independent game developer, a regular games blogger and podcaster, and a former professional poker player.

Jennifer Laing <jennifer.laing@latrobe.edu.au> is an Associate Professor in the Department of Management, Sport and Tourism at La Trobe University in Melbourne, Australia. Her research interests include travel narratives, the role of events in society, rural and regional regeneration through tourism and events, and health and wellness tourism. Jennifer is a coeditor of the Routledge *Advances in Events Research* series. She has co-written six research books, including *Explorer Travellers and Adventure Tourism* (Channel View, 2014) with Warwick Frost. In 2017, she was recognized as an Emerging Scholar of Distinction by the International Academy for the Study of Tourism.

Roger D. Launius <launiusr@gmail.com> was a US government historian for 35 years. From 1990 to 2002, he was the Chief Historian at NASA. He then worked at the Smithsonian Institution's National Air and Space Museum (2002–2017), most recently as Associate Director for Collections and Curatorial Affairs. He is now Principal of Launius Historical Services. He is author or editor of more than 30 books on aerospace history; a Fellow of the American Association for the Advancement of Science, the International Academy of Astronautics, and the American Astronautical

Society; and an Associate Fellow of the American Institute for Aeronautics and Astronautics.

James Ormrod <j.s.ormrod@brighton.ac.uk> completed his undergraduate, Master's, and PhD degrees in Sociology at the University of Essex, UK. Since 2007, he has worked at the University of Brighton, UK, and is currently Principal Lecturer in Sociology. His research interests are in social movements and the relationships human beings have with their environment and the universe in general. He is the coauthor of *Cosmic Society* (Routledge, 2007) and the author of *Fantasy and Social Movements* (Palgrave, 2014). He is also the editor of *Changing Our Environment, Changing Ourselves* (Palgrave, 2016) and the coeditor of the *Palgrave Handbook of Society, Culture and Outer Space* (Palgrave, 2016).

Sam Spector <samuel.spector@gmail.com> earned his PhD from the Department of Tourism at the University of Otago in New Zealand and was subsequently a Postdoctoral Research Fellow at the Centre for Sustainability, also at the University of Otago. He then served as Graduate Diploma Programme Leader at Queenstown Resort College, New Zealand, developing and directing a new graduate diploma program for the College. He is now a Lecturer in the Department of Management, Marketing and Entrepreneurship at the University of Canterbury, New Zealand. His research focuses on the intersections between tourism, transport, sustainability, and resilience.

Frans G. von der Dunk <fvonderdunk2@unl.edu> is the Harvey & Susan Perlman Alumni/Othmer Professor of Space Law at the University of Nebraska-Lincoln's unique post-graduate program in Space, Cyber, and Telecommunications Law, the United States. He also owns a consultancy in the Netherlands, Black Holes BV, in matters of space law and policy. In both capacities he has been researching international and national space law for three decades, including issues such as the privatization and commercialization of the space sector, major space applications, and the military uses of outer space.

Derek Webber, <DWspace@aol.com> the Founder of Spaceport Associates (USA), has been involved in establishing the marketing and regulatory aspects of private spaceflight for two decades. He is currently working on a proposed space tourism hotel in geostationary orbit, "Gateway Earth," which is intended to furnish revenue for an interplanetary exploration initiative. He was a Judge in the Google Lunar XPRIZE contest and is now seeking, via involvement in the leadership of the non-profit For All Moonkind, to obtain international regulations to protect the Lunar heritage sites. He is the author of three books about the history and development of space exploration and business.

This page intentionally left blank

INDEX