Ecopolitical Transformations and the Development of Environmental Philosophical Awareness in Science Fictional Narratives of Terraforming.

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Abstract

This thesis examines the motif of terraforming from Wells' *War of the Worlds* (1898) to James Cameron's film *Avatar* (2009) in order to assess the dialogical development of ecological themes and its imbrication with politics in science fictional narratives of terraforming. It tracks the growth of the theme in four distinct phases that are contextualised by a short history of terraforming in the introductory first chapter. Chapter two examines the appearance of proto-terraforming and proto-Gaian themes in British scientific romance and American pulp sf prior to Jack Williamson's coining of the term "terraform" in 1942. Environmental philosophical concepts of nature's otherness, Lee's Asymmetry, Autonomy and No-Teleology Theses and notions of identification with nature are examined in this connection to illustrate the character of these texts' engagement with environmental philosophy and ecopolitics. Chapter three examines the development of the terraforming theme in primarily American 1950s terraforming stories and explores how the use of elements of the American Pastoral are deployed within the discourse of sf to consider the various ways in which the political import of terraforming is imagined. Chapter four explores the impact of the environmental movement of the 1960s in terraforming stories of the 1960s-1970s. Beginning with a consideration of the use of Gaian images in characterisations of alien ecologies, this chapter then progresses to consider a parallel strand of terraforming stories that transform the themes of the 1950s texts in the light of the impact of the 1960s environmental movement. Chapter five concludes this analysis by considering two major trilogies of terraforming written in the 1980s-1990s, Pamela Sargent's *Venus* and Kim Stanley Robinson's *Mars* trilogies. These works inherit the discourse of terraforming established by earlier works and re-configure them in ways that address contemporary environmental and geopolitical concerns.

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Contents

1. Introduction

1.1 Terraforming: Engineering Imaginary Environments

Science fictional (sf) stories of planetary adaptation – terraforming – offer productive imaginative spaces suited to exploring contemporary ecological and geopolitical concerns. The term "terraforming" denotes a specific process or a complex of processes aimed at adapting the environmental parameters of alien planets to allow their habitation by Earthbound life. These processes include methods for adapting a planet's climate, atmosphere, topology and ecology. Narrative treatments of terraforming have resulted in feedback between scientific and sf discourse, exemplied by Jack Williamson's coining of the term "terraform" in his 1942 short story "Collision Orbit", the term's adoption by scientific discourse and sf's later borrowing from scientific speculation on planetary adaptation.[1] Examples of this exchange include the publication of planetary scientist Christopher P. Mckay's article "On Terraforming Mars" in *Extrapolation*[2] and scientist Geoffrey A. Landis' review of Martyn J. Fogg's *Terraforming* for *The Bulletin of the Science Fiction and Fantasy Writers of America*.[3] In his scientific survey of planetary adaptation in *Terraforming* (1995), Fogg mentions that the technical study of terraforming involves a variety of environmental, social, political, legal and ethical complexities that impact on real-world considerations of planetary adaptation.[4] Although he acknowledges the root of the theme in sf by including a short discussion of relevant sf literature, Fogg's focus as a scientist remains largely on the technical possibilities for terraforming. Although the dialogue between sf and science is central to terraforming, this motif has also gained increasing currency within both environmental and popular spheres. This study proposes to examine the ecocritical issues raised by terraforming in sf and pays special attention to the intersections between environmental, socio-political and ethical ideas.

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[1] Jack Williamson, 'Collision Orbit', in *Seventy-Five: The Diamond Anniversary of a Science Fiction Pioneer*, ed. by Stephen Haffner and Richard A. HauptMann (Michigan: Haffner Press Oak, 2004), pp. 216-277.
[2] Christopher P. McKay, 'On Terraforming Mars', *Extrapolation*, 23.4 (1982), 309-314.
[3] Geoffrey A. Landis, 'Terraforming: Engineering Planetary Environments: by Martyn J. Fogg', *The Bulletin of the Science Fiction and Fantasy Writers of America*, 30.1 (1996), 54-55.
[4] Martyn J. Fogg, *Terraforming: Engineering Planetary Environments* (Warrendale: SAE International, 1995), p. 24.

Given the impossibility of human evolution that would be swift enough to allow the safe habitation of alien environments, the colonisation of other worlds depends upon a series of technological adaptations. These adaptations can involve some form of human adaptation based either on genetic engineering, cyborgisation, or a combination of both, processes known in sf as pantropy. Terraforming refers to the adaptation of space via industrial methods, through a series of adaptations informed by the science of ecology or, once again, through a combination of both.[5] Terraforming and pantropy can also be combined, such as when humans are adapted through genetic engineering to better match the terraformed yet still alien environment of Mars in Kim Stanley Robinson's acclaimed *Mars* trilogy, comprising *Red Mars* (1992), *Green Mars* (1993), and *Blue Mars* (1996).[6] For the purposes of this thesis, emphasis will be placed on issues of terraforming, but it will be important at times to consider how pantropy, as an alternative to terraforming, highlights the concerns that underlie decisions to physically adapt other worlds.

While stories of human interplanetary colonisation are central to a consideration of terraforming, *Brave New Words* lists two further senses of terraforming that offer useful provisional ways of grouping texts.[7] The first of these alternative senses, dated to Robert Silverberg's 1969 *Across A Billion Years*,[8] relates to the planetary adaptation of worlds according to the model of alien planets; the second, dated to Timothy W. Luke's 1997 *Ecocritique*,[9] relates to terraforming that involves the modification of environmental conditions on Earth.[10] A wide range of narratives could be identified under the second rubric, including the human engendered ecotastrophe, stories depicting large scale architectural engineering or portrayals of developing future cities. Fogg helpfully defines terraforming alien planets and terraforming Earth, or "geoengineering" in his terminology, as two subsets of "planetary engineering", arguing that 'phrases such as "terraforming the Earth" have a ring of nonsense about them – how does one make the Earth more like itself?'. He explains that

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[5] Malcolm Edwards and Brian Stableford, 'Terraforming' <http://www.sf-encyclopedia.com/entry/terraforming>, and Peter Nicholls, 'Pantropy', *The Encyclopedia of Science Fiction* (2012) <http://www.sf-encyclopedia.com/entry/pantropy> [accessed 16 July 2012].
[6] Kim Stanley Robinson, *Red Mars* (London: Voyager, 1992; repr. 1996), *Green Mars* (London: Voyager, 1993; repr. 1996) and *Blue Mars* (London: Voyager, 1996).
[7] Jeffery Prucher, ed., *Brave New Words: The Oxford Dictionary of Science Fiction* (Oxford: Oxford University Press, 2007).
[8] Robert Silverberg, *Across a Billion Years* (New York: Tor, 1986).
[9] Timothy W. Luke, *Ecocritique* (Minneapolis: University of Minnesota Press, 1997).
[10] Prucher, p. 235.

'[g]eoengineering is planetary engineering applied specifically to the Earth. It includes only those macroengineering concepts that deal with the alteration of some global parameter, such as the greenhouse effect, atmospheric composition, insolation or impact flux'.[11]

This thesis adopts Fogg's useful conceptual distinction between terraforming and geoengineering for analytical purposes. However, the centrality of the concept of geoengineering and its continuing overlap with narratives of terraforming in sf makes it important to keep in focus both the correspondences and the distinctions between the two.[12] As this thesis will demonstrate, much of the meaning of terraforming in sf is derived from the relationship between terraforming and geoengineering. The historians John McNeill and J. Donald Hughes discuss the effects on the environment of such projects as The Boulder Dam on the Colorado River (renamed The Hoover Dam) and the Aswan High Dam across the Nile, along with other related endeavours such as urbanisation and rapid technological change. The relationship between terraforming and geoengineering is implied by the similarities of language used by advocates of large scale engineering projects to justify these developments. As McNeill and Hughes argue, projects such as dam construction are often motivated by political agendas that sometimes exceed strictly economic concerns.[13] In M. Vassiliev and S. Gouschev's speculative account of the benefits that Soviet science might bring to Russia in the future, geoengineering themes that relate directly to the adaptation of landscapes are anticipated with delight. In the chapter "The Dawning Age of Plenty", several 'glimpses' of the future are described, including 'the enrichment of the soil, the promotion of rain, and the conversion of salt lakes and inland seas into fresh-water ones' so that desert environments can be adapted into fertile agricultural land. In "The Creators of Nature", the global distribution of various natural resources is criticised in order to buttress an argument advocating the transformation of 'our communal house, the earth' to the needs and tastes of humankind. While such transformations of nature have already occurred in Russia, it is predicted that, 'as man's power increases, this transforming activity will develop even further'. The penultimate chapter "In the Lunar City" takes the logic of the technological transformation of nature

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[11] Fogg 1995, p. 90.
[12] Fogg 1995, p. 24.
[13] John McNeill, *Something New Under the Sun: An Environmental History of the Twentieth Century* (London: Penguin Books, 2001), pp. 157-182 and J. Donald Hughes, *An Environmental History of the World: Humankind's Changing Role in the Community of Life*, 2nd edn (London: Routledge, 2009), pp. 175-181.

into space, recounting as it does the construction of dome-like glass cities on the Moon.[14] Adrian Berry focuses particular attention on terraforming and astrophysical engineering in his popular scientific work *The Next Ten Thousand Years* (1974), citing examples of such projects in the sf of Olaf Stapledon and Poul Anderson.[15] Berry critiques the apocalyptic strand of environmentalist discourse, which he sees culminating in the publication of *The Limits to Growth* (1972),[16] the 'Rousseau-like dreams [...] of a "return to nature" and the desirability of living without technical aids like the "noble savage"'.[17] Sir Francis Bacon's notion of progress and the publication of his scientific utopia *The New Atlantis* (1627)[18] are significant in Berry's view because '[i]t was perceived for the first time that humanity might have a hidden purpose, and might be able to execute a long-term plan whose nature had been hitherto concealed'. Berry argues that terraforming and the colonisation of space are precisely such activities and concludes, in contrast to warnings of economic and environmental decline, that '[t]he Baconian scheme can be delayed, but it cannot be stopped'.[19]

Prucher's three definitions are useful guides to tracking the way in which terraforming is imagined in 1942 as part of a human colonisation of space before it becomes established by 1969 as inclusive of any civilisation and, implicitly, the alternative worlds that act as models that guide alien planetary adaptation. By 1997 the imaginative spaces offered to environmental speculation by sf narratives of terraforming are re-connected to Earth, another development that has impacted upon wider scientific and philosophical discourse amidst contemporary anxieties about environmental change. These changes to the context by which terraforming is understood and the ways in which they emphasise different aspects of an ecopolitical intersection suggest that sf has continually shifted focus in response to new conceptions of human relationships to physical, value laden spaces. Terraforming provides a clear example of the dialogue between sf, science and environmentalism that makes it especially significant for ecocritical examination.

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[14] M. Vassiliev and S. Gouschev, ed., *Life in the Twenty-First Century*, trans. by H.E. Crowcroft A.M.I.E.E. and R.J. Wason (London: Penguin Books, 1961), p. 94, 185, 186, 205-208.
[15] Adrian Berry, *The Next Ten Thousand Years: A Vision of Man's Future in the Universe* (Hodder and Stoughton: Coronet, 1976), pp. 93, 91.
[16] Donella H. Meadows, *The Limits to Growth: A Report for the Club of Rome's Project on the Predicament of Mankind* (London: Pan Books, 1974).
[17] Berry, pp. 28-29, 187.
[18] Francis Bacon, *The New Atlantis* (Adelaide: The University of Adelaide Library, 2008).
[19] Berry, pp. 23, 189.

1.2 Sf as Environmental Literature

Environmentalism is a broad term involving several areas of discourse. Susan Stratton suggests that sf owes more to environmentalism as a separate collection of social, political and economically focused movements or projects of protest, activism, reformation and deconstruction than it does to any relatively unified notion of environmentalism.[20] *Silent Spring* (1962) by the scientist Rachel Carson is often cited as the popularising text that brought environmental issues to the forefront of an international awareness in the 1960s.[21] Paul Ehrlich's *The Population Bomb* (1968)[22] and the first images of Earth taken by the U.S. Weather Bureau's TRIOS satellite, launched in the 1960s, also highlighted concerns that were popularised by the first Earth Day in 1970.[23] Contemporary discourses of environmental philosophy grew out of, and to some extent alongside, a burgeoning "activist" strand supported by environmentally focused philosophies. Debates in environmental philosophy tend to centre primarily on issues of ethics and value, although aesthetics, theology and ecofeminism are also dominant areas of philosophical enquiry.

Both environmental philosophy and ecocriticism developed in response to the growth of environmental awareness, but only became established as academic disciplines in the 1980s.[24] Ecocriticism is a form of literary criticism focused on the contribution to environmentalism of literary texts, and involves literary-aesthetic as well as philosophical examination of the relationships between humanity and the environment. The term "ecocriticism" was coined by William Rueckert in his 1978 article "Literature and Ecology: An Experiment in Ecocriticism", since collected in *The Ecocriticism Reader* (1996).[25] Nevertheless, several works that appeared before 1978 in both America and the UK anticipated the concerns of ecocriticism. Richard Kerridge points to Raymond Williams' *The Country*

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[20] Susan Stratton, 'Theory and Beyond: Ecocriticism', *SFRA Review*, 249 (2000), 2-6.
[21] Rachel Carson, *Silent Spring* (Boston: Houghton Mifflin, 2002).
[22] Paul R. Ehrlich, *The Population Bomb* (London: Ballantine, 1971).
[23] Erin Moore Daly and Robert Frodeman, 'Separated at Birth, Signs of Rapproachement: Environmental Ethics and Space Exploration', *Ethics & the Environment*, 13.1 (2008), 135-151 (p. 136).
[24] Daly and Frodeman, p. 137.
[25] William Rueckert, 'Literature and Ecology: An Experiment in Ecocriticism', in *The Ecocriticism Reader: Landmarks in Literary Ecology*, ed. by Cheryll Glotfelty and Harold Fromm (Athens: University of Georgia Press, 1996), pp. 105-123.

and the City (1973),[26] which also includes a chapter on sf, and Annette Kolodny's retrospectively ecofeminist *The Lay of the Land* (1975),[27] which examines the gendered discourse involved in the colonisation of America.[28]

In *Trillion Year Spree* Brian Aldiss defines sf as '*the search for a definition of mankind and his status in the universe which will stand in our advanced but confused state of knowledge (science)*'. By characterising sf as a 'search for a definition', Aldiss claims that sf is a literature of epistemology, an exploration of how science and technology forces a re-evaluation of humankind's place in relation to their environment and the cosmos. Aldiss argues for sf's potential value as environmental literature by claiming that '[t]he greatest successes of science fiction are those which deal with man in relation to his changing surroundings and abilities: what might loosely be called *environmental fiction*'.[29] His emphasis on a loosely defined "environmental fiction" highlights the wide range of issues that inform an environmental awareness while implicitly acknowledging the various ways in which sf explores two major themes which he argues are essential to the mode: our relationship to the environment, and the way in which our abilities – our technologies – can alter both the environment itself and the range of environments made available to us.

Noel Gough argues that sf's focus on the external world and on our interaction with it is a result of sf's 'object orientation'. Like Aldiss, he claims that 'this attention to externalities may mark SF as an environmental literature par excellence'.[30] Patrick D. Murphy concurs with both writers when he calls sf a 'nature-oriented literature'. Like Aldiss and Gough he argues that this is because it 'directs reader attention toward the natural world and human interaction with other aspects of nature within that world', but he also points out that it 'makes specific environmental issues part of the plots

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[26] Raymond Williams, *The Country and the City* (Nottingham: Spokesman Books, 2011).
[27] Annette Kolodny, *The Lay of the Land: Metaphor as Experience and History in American Life and Letters* (Chapel Hill: University of North Carolina Press, 1975).
[28] Richard Kerridge, 'Environmentalism and Ecocriticism', in *Literary Theory and Criticism: An Oxford Guide*, ed. by Patricia Waugh (Oxford: Oxford University Press, 2006), pp. 530-543 (p. 530).
[29] Brian Aldiss and David Wingrove, *Trillion Year Spree: The History of Science Fiction* (London: Stratus, 2001), pp. 4, 8.
[30] Noel Gough, 'Playing with Wor(l)ds: Science Fiction as Environmental Literature', in *Literature of Nature: An International Sourcebook*, ed. by Patrick D. Murphy (London: Fitzroy Dearborn, 1998), pp. 409-414 (p. 411).

and themes of various works'.[31] Terraforming is a particularly significant instance of one such environmental issue because the sf use of the motif flexibly accommodates a range of environmental events, thus opening up a potentially vast field for environmental philosophical speculation. McKay certainly supports this notion when he argues that 'it is becoming increasingly clear that humanity is already engaged in both deliberate and inadvertent global modifications of at least one planet – Earth',[32] a notion that Michael Dumiak echoes in *Cosmos: Mars Special* when he explains that '[t]erraforming Mars is basically a radical application of human-induced climate change'.[33] This sense of terraforming as an extension of anthropogenic climate change illustrates a connection between climate change and geoengineering, and by a further conceptual extension, geoengineering and terraforming. Sf, as the example of terraforming illustrates, is a mode that allows us to explore the status and the consequences of various forms of relationship to space. While consideration of these issues in terraforming stories is usually focused on our attitudes to planets other than Earth, they do allow us to examine and evaluate our historical relationship to our home planet, both philosophical and practical, and to postulate alternatives to our current practices. The "terra" in "terraforming" always refers us to its paradigmatic example (Earth), especially when it is used in sf discourse. The extremes of spatial and temporal scale explored in sf narratives of terraforming allow us to imaginatively re-situate our values in respect to our place in the universe, thus calling on a re-evaluation of the assumptions behind varying positions to nature and to each other.

In order to draw out the range of influences feeding into sf treatments of terraforming, Lovelock's Gaia hypothesis needs to be considered in relation to the motif. The Gaia hypothesis claims that the Earth's planetary environment and its organisms are fundamentally interconnected in a biogeochemical cycle and that life exerts feedback that assists in regulating Earth's climate. Although the implications of this paradigm for terraforming begin to cohere in the late 1980s, the Gaia hypothesis is central to the way in which terraforming develops during the 1970s. Ernest J. Yanarella argues that these two themes reflect each other and that terraforming is the Jungian shadow of the

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[31] Patrick D. Murphy, 'The Non-Alibi of Alien Scapes: SF and Ecocriticism', in *Beyond Nature Writing: Expanding the Boundaries of Ecocriticism*, ed. by Karla Armbruster and Kathleen R. Wallace (Charlottesville: University of Virginia Press, 2001), pp. 263-278 (p. 263).
[32] McKay 1982, p. 309.
[33] Michael Dumiak, 'Turning the Red Planet Green', in *Cosmos: Mars Special*, 18 (2007), 62-65 (62).

Gaia hypothesis.[34] Lovelock argues that terraforming Mars would be an 'unremitting task of nurture and the daily guidance of the newborn planetary life until it could, by itself, sustain homeostasis', thus implying that terraforming would fulfil the reproductive criteria of a Gaian planet seen as a living organism. He goes on to write that '[t]houghts of Gaia will always be linked with space exploration and Mars, for in a sense Mars was the birthplace of the theory'.[35] In addition to the complex of images associated with space exploration that has been informed by sf, Lovelock refers here to his initial inspiration for the Gaia hypothesis, which he traces back to his work developing methods for detecting extraterrestrial life on Mars at NASA. Lovelock has also collaborated with Michael Allaby to write *The Greening of Mars* (1984),[36] a story of the colonisation and terraforming of Mars. He remarks that this book inspired three scientific meetings, during one of which Robert Haynes 'coined the word ecopoiesis – literally, "the making of a home" – for the practice of transforming an otherwise uninhabitable environment into a place fit for life to evolve naturally'.[37] Ecopoiesis is a process closely related to terraforming that often appears in speculative scientific accounts and in sf as an early stage of a more comprehensive terraforming project. Haynes writes that 'the term refers to the fabrication of a sustainable ecosystem on a currently lifeless, sterile planet, thereby establishing a new arena in which biological evolution ultimately might proceed independent of further human husbandry'.[38] The term has since influenced other terraforming stories, including Robinson's *Mars* trilogy and the short story "Ecopoesis",[39] written by NASA scientist Landis.

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[34] Ernest J. Yanarella, *The Cross, The Plow and the Skyline: Contemporary Science Fiction and the Ecological Imagination* (Florida: Brown Walker Press, 2001), pp. 225-288.
[35] James Lovelock, *The Ages of Gaia: A Biography of Our Living Earth*, 2nd edn (Oxford: Oxford University Press, 1995), p. 189.
[36] Michael Allaby and James Lovelock, *The Greening of Mars* (New York: St. Martin's Press, 1984).
[37] Lovelock 1995, pp. 174-175.
[38] Robert H. Haynes, '1: Ecce Ecopoiesis: Playing God on Mars', in *Moral Expertise: Studies in Practical and Professional Ethics*, ed. by Don MacNiven (London: Routledge, 1990), pp. 161-183 (p. 180).
[39] Geoffrey A. Landis, 'Ecopoesis', in *Worldmakers: SF Adventures in Terraforming*, ed. by Gardner Dozois (New York: St. Martin's Griffin, 2001), pp. 311-341.

1.3 A Disciplined Thought Experiment: Landscaping, SF and Terraforming

As science now approaches the "how" of terraforming, science fiction must continue to explore the "why".[40]

Sf narratives of terraforming offer imaginative spaces for reflection on fundamental issues regarding our place in relation to the planets of the solar system (including Earth) and universe, outlooks that in turn feed into our practical attitudes and behaviour toward those spaces. Scientists and environmental philosophers have used the concept of terraforming as a thought experiment to consider human relationships to environments undergoing change. Daly and Frodeman cite Haynes' assertion that 'such a grand experiment would yield valuable information about the complex interworkings of ecosystem processes on Earth', thus highlighting the experimental and scientific knowledge component involved in such thought experiments.[41] This theme is prevalent in terraforming narratives and is often associated with the transformative image of a pastoral garden in contrast to desert spaces: in Pamela Sargent's *Venus of Dreams* Iris Angharad explains that '[m]aking deserts here [on Earth] green again is not going to seem such a problematic undertaking if we can make Venus bloom'.[42] Likewise, philosopher Robert Sparrow uses terraforming as a construct for the exploration of an agent-based virtue ethics, justifying his choice of scenario by arguing that '[t]he sheer scale of such a project allows many issues which arise around other modern technologically oriented environmental projects to be writ large' and because it demonstrates 'a shocking moral bankruptcy at the heart of our attitude toward the environment'.[43] Sf, as a literature of ideas in which the thought variant or experiment raises the idea or the imagined world to the status of hero, affords an ideal mode for speculative enquiry. The capacity for terraforming to be used to magnify issues connected to technologically based environmental projects and to examine the moral shortcomings that give rise to ecopolitical conflict makes it ideally suited to contemporary environmental philosophical speculation.

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[40] McKay 1982, p. 309.
[41] Daly and Frodeman, p. 145.
[42] Pamela Sargent, *Venus of Dreams* (London: Bantam, 1989), p. 237.
[43] Robert Sparrow, 'The Ethics of Terraforming', *Environmental Ethics*, 21.3 (1999), 227-45 (pp. 227, 229-230).

Fogg explains that '[i]f one imagines the playground for thought experimentation as being a multidimensional space controlled by as many parameters as there are dimensions, it can be appreciated that, without any limits on the values of the parameters, the space can enfold an infinite number of possibilities'. To distinguish scientific enquiry from sf, Fogg describes a reduction 'to a subset of *real* possibilities' and the 'accept[ance] first and foremost [of] the constraint of physical law'.[44] This thesis does not investigate the boundaries between science and sf, nor does it read sf against '*real* possibilities'. Fogg's description of the conceptual space of the scientific thought experiment offers a model for the way in which sf representations of imagined future worlds operate and suggests an avenue for the literary analysis of representations of space.

Michael J. McDowell has argued that Mikhail Bakhtin's theories of dialogism and the chronotope incorporate 'much of the thinking about systems and relationships long ago embraced by the hard sciences' and consequently offer ways to analyse texts from ecological perspectives.[45] Significantly for sf, the concept of the chronotope as metaphorically applied to literature is a borrowing from the mathematical discourse underlying part of Einstein's Theory of Relativity. Bahktin summarises the '*chronotope* (literally, "time space")' as 'the intrinsic connectedness of temporal and spatial relationships that are artistically expressed in literature.[46] It is the way in which both time and space are 'expressed' and how time is used to qualify spatial meanings and vice versa that is of interest here. Language is used to give voice to the landscape by representing it as a site of traditional symbolic value as well as a space for the interaction of differing discourses. These values are represented synchronically, as textual spaces that are placed in juxtaposition to each other. Examples of this include the contrast between the icon of the domed city in Sargent's *Venus* trilogy and the Venusian environment visible outside of these domes.[47] This environment is revealed diachronically through its representation within the text. It is this diachronic movement, through

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[44] Fogg 1995, p. 88.
[45] Michael J. McDowell, 'The Bakhtinian Road to Ecological Insight', in Cheryll Glotfelty and Harold Fromm, ed., *The Ecocriticism Reader: Landmarks in Literary Ecology* (Athens: University of Georgia Press, 1996), pp. 371-391 (p. 372).
[46] M.M. Bakhtin, 'Forms of Time and Chronotope in the Novel', in *The Dialogic Imagination: Four Essays*, ed. by Michael Holquist, trans. by Caryl Emerson and Michael Holquist (Austin: University of Texas Press, 2002), pp. 84-258 (p. 84).
[47] Pamela Sargent, *Venus of Dreams*, *Venus of Shadows* (New York: Doubleday, 1988) and *Child of Venus* (New York: EOS, 2001).

narration and character dialogue, that allows these different spaces to come into contact with one another to construct a network of positions toward value systems within the text.

Darko Suvin draws on Bakhtin's concept of the chronotope for his adapted definition of sf in *Positions and Presuppositions in Science Fiction*, glossed in his 2008 article "Of Starship Troopers and Refuseniks: War and Militarism in U.S. Science Fiction, Part 1 (1945-1974: Fordism)" as 'a literary (etc.) genre *defined by the interaction of estrangement and historical cognition, and whose main formal device is a narrative chronotope and/or agents alternative to the author's empirical world*'.[48] The chronotope as a unit of analysis collapses two central parameters of the sf thought experiment (space and time) with a third, the iconicity of particular spaces in textual representations of terraforming. Terraforming is an especially relevant motif with regard to the concept of the chronotope because it collapses textual worldbuilding (imagined worlds) with representations of physical worldbuilding. In Bakhtinian terms this involves the construction of a global chronotope (the planet to be terraformed) within a dialogic text that puts into play multiple interacting voices and their relationships to their environment. As the global chronotope can itself be broken down into a series of nested spaces at ever decreasing scales, the field for articulating various positions span a variety of continental, regional and local spaces. This dialogic element of the chronotope usefully coheres with Damien Broderick's discussion of the sf text's propensity to engage in a megatextual dialogue with other texts and discourses in *Reading by Starlight*.[49]

The environmental philosophical concept of landscaping emphasises that intentional modification of physical space involves (to some degree) an anthropocentric projection of cultural values onto nature. In the light of this concept Bakhtin's discussion of the chronotope can be seen as a form of landscape. Hailwood defines "landscape" as 'nature insofar as it is modified and interpreted

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[48] Darko Suvin, *Positions and Presuppositions in Science Fiction* (Basingstoke: Macmillan, 1988) and 'Of Starship Troopers and Refuseniks: War and Militarism in U.S. Science Fiction, Part 1 (1945-1974: Fordism)', in *New Boundaries in Political Science Fiction*, ed. by Donald M. Hassler and Clyde Wilcox (Columbia: University of South Carolina Press, 2008), pp. 115-144 (p. 116).
[49] Damien Broderick, *Reading by Starlight: Postmodern Science Fiction* (London: Routledge, 1995).

for *human oriented ends*, moulded and used, or viewed as malleable and useful, for human interests and needs'.[50] Landscaping in Hailwood's sense involves both physical and intellectual processes:

> landscap*ing* [is] the ongoing historical process through which humanity physically shapes its environment[,] fills it with symbolic meaning, historical and aesthetic significance, and so makes itself at home.[51]

Hailwood extends Holmes Rolston III's original concept to include 'any discernible item assigned a symbolic significance within a culture' and notes that '[a]lthough physical and intellectual aspects of landscaping are distinguishable, they are not entirely distinct. The process is dialectical: possibilities of further action, modifications and interpretations are conditioned by those already in place'. Drawing on Karl Marx's note in *The German Ideology*[52] regarding the socially constructed nature of landscape and on Gary Lease's notion in his introduction to *Reinventing Nature?*[53] that '"*humans and nature exist in a dialectical relationship, each imagining the other*"', Hailwood explains that '[i]n landscaping we interact with nature and each other to create and transform the "material conditions" of human life and culture and so recreate ourselves'. In relation to this concept of landscape, Hailwood uses 'the term nature to mean nonhuman nature – *nature insofar as it is not landscaped* – although, of course humanity and human landscapes remain part of […] nature in the all-encompassing sense of "everything"'.[54] The concept of nature that Hailwood describes is cosmological (nature as everything) but exclusive of the human.

Terraforming, on a narrative level, is a form of landscaping in which intellectual landscapes direct physical landscaping. On a textual level, representations of literary spaces, analysable as chronotopes particular to the discourse of sf (megatextual chronotopes), are examples of specific intellectual landscapes, artistic ones that, in the case of terraforming, construct imaginative spaces where social, political and ethical reflection on the values implicit in such landscapes can be explored. This focus on landscape is important because, as Dan McArthur argues in "Ethics and Interplanetary Exploration", '[w]e will take our human moral environment with us to other worlds along with our

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[50] Simon A. Hailwood, "Landscape, Nature, and Neopragmatism", *Environmental Ethics*, 29.2 (2007), 131-149 (pp. 132-133).
[51] Hailwood 2007, p. 133.
[52] Karl Marx and Frederick Engels, *The German Ideology* (London: Lawrence & Wishart, 1965).
[53] Gary Lease and Michael E. Soulé, ed., *Reinventing Nature?: Responses to Postmodern Deconstruction* (Washington, DC: Island Press, 1995).
[54] Hailwood 2007, pp. 133-134.

pith helmets'.[55] This highlights how our contemporary attitudes and perspectives will guide our actions, so examining our ethical position with a view to evaluating these actions is of paramount importance. The concept of a moral landscape and the literary notion of the chronotope can be considered specific forms of Hailwood's notion of intellectual landscaping. Terraforming narratives are experimental spaces within which political, ethical and aesthetic topographies, developed in a dialectical relationship between culture and Earth's nature, are overlaid.

1.4 The Terraforming Tradition

Sf, through a complex of images and concepts subordinated to the overarching motif of terraforming, has long engaged with the same questions modern environmental philosophy explores. Published under John W. Campbell's editorship at a time when Campbell's emphasis on realism in the pulps was paying off with the appearance of many powerful stories between the years 1940-1942, Williamson's "Collision Orbit" (1942) reflects *Astounding*'s emphasis on logically developed and scientifically plausible tales.[56] Perhaps echoing the 1941 Pearl Harbour bombings, "Collision Orbit" tells of a scientific research station threatened by an impending asteroid impact, and of the scientist Drake and his efforts to avert disaster while negotiating for greater autonomy for the station. This short story offers a clear point of demarcation for the development of the terraforming tradition in sf, with texts appearing before this period feeding into the growth of a megatext that becomes readily identifiable in early 1950s pulp sf. A historical overview of this terraforming tradition provides the context for the readings to follow; first, however, a consideration of two stories, one published in 1935 and one in 1998 helps to illuminate the importance of considering the development of the terraforming motif across several periods of the sf tradition.

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[55] Dan McArthur, 'Ethics & Interplanetary Exploration', *Philosophy Now: A Magazine of Ideas Science Fiction Issue*, 34 (2001/2002), 11-13 (p. 13).
[56] Mike Ashley, *The Time Machines: The Story of the Science-Fiction Pulp Magazines from the Beginning to 1950* (Liverpool: Liverpool University Press, 2000), p. 157.

John Russell Fearn's "Earth's Mausoleum" (*Astounding* 1935)[57] and Stephen Baxter's *Moonseed* (1998)[58] share similar themes and narrative elements, despite considerable differences in style and historical context. Both stories centre on the emergence of the alien from within the Moon: in Fearn's story, an alien spaceship proves to be the original impactor that separated the Moon from the Earth; likewise in Baxter's work, in which an astronaut brings to Earth a nanotechnological substance embedded in a Moon rock, the "Moonseed". Terraforming is only embarked upon in *Moonseed* as a desperate attempt to survive the contamination and destruction of Earth, caused by the failure to maintain strict quarantine of the Moon rock. The alien visitors in "Earth's Mausoleum" freely share their technology and expertise with humanity and eventually direct the terraforming of the Moon. Once again, however, failures of character lead to the potential destruction of Earth, in this instance due to the Sun's extinguishment.

Many of the themes in "Earth's Mausoleum" became staples of the terraforming narrative. Crespin, a scientist who makes first contact with Mayro and the other aliens and who becomes Mayro's appointed successor, sees the terraforming of the Moon as an extension of geoengineering, an act of conquest to 'extend Earth's ramifications'. Mayro directs a 'One Year-Plan' to open up Earth's environments and resources for human use, 'the vast improvement in the constructional scheme of the world', which eventually leads to the desire to 'cultivate a perfect little world' on the Moon. Terraforming involves the construction of massive atmosphere generators and much human labour, leading another scientist (Konsicks) to think that they are dealing in things too big for them, 'beating nature at her own game, so to speak'. As the iconic image of a 'softly green "new" Earth visible from the sky' of humankind's first planet takes shape, the second phase of terraforming begins as the tough community of pioneers level mountain ranges and crater walls to shape the Moon's topology. Mayro's discovery of a method for liberating atomic force and the invention of a powerful "dredger" triggers growing social unrest as the once happily busy colonists are deprived of fulfilment in hard work. Capitalising on this disaffection, an oppositional minority sabotage the dredger out of malice toward the aliens but fail to appreciate fully how it operates and accidentally begin to siphon

[57] John Russell Fearn, 'Earth's Mausoleum', *Astounding Stories*, 15.3 (1935), 52-87.
[58] Stephen Baxter, *Moonseed* (London, Voyager, 1998).

energy from the Sun. In order to avert disaster, dreams of a utopian new Earth are abandoned when the Moon is converted into a new sun. Mayro and the surviving aliens, well-meaning scientists who fail to understand the impact of introducing new technology to human society, sacrifice themselves and their ship so as to ensure that humankind survives the catastrophe.[59]

As already discussed, *Moonseed*'s narrative recapitulates elements of Fearn's story. Written six decades later, however, it eschews development of the trope of sentient alien life and instead uses much of its narrative to explore the consequences to civilisation of a nanotechnological entity that consumes olivine (a common mineral that forms much of Earth's geology) in a manner that recalls Wells' red weed in *The War of the Worlds* (1898).[60] Terraforming appears as the aborted project of a geologist who has been unable to secure economic and political support for it until the Earth's imminent destruction encourages the American government to send him to the Moon in order to find a way to neutralise the alien nanotech. *Moonseed* explores the pessimism that further exploration of the solar system is met with after the public decline in interest that affected space programmes since the 1970s. This pessimism contrasts with the optimistic view of terraforming as an activity that provides fulfilment and power to humankind in Fearn's story. Conversely, the pessimistic view of human nature in "Earth's Mausoleum" forms a further contrast to the relative optimism with which Baxter portrays the initial attitudes of the public in coping with the unprecedented threat of the Moonseed. Nevertheless, as this threat increases in severity, Baxter does develop a more complex view of the human reaction to the escalating catastrophe, refusing to conflate, as Fearn does, the responses of individuals, communities and governments.

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[59] Fearn, pp. 71, 72, 75-76, 84.
[60] H.G. Wells, *The War of the Worlds*, *Project Gutenberg* (2004) <http://www.gutenberg.org/cache/epub/36/pg36.txt> [accessed 20 March 2011].

1.4.1 Terraforming Pre-1940s: Scientific Romances and American Pulp SF

Before the terraforming boom of the 1950s there were few texts that dealt with the motif in any sustained or systematic way, but it does appear in the scientific romances of H.G. Wells and Olaf Stapledon. The connection between terraforming and Lovelock's Gaia hypothesis became established in the late 1980s, by which time Lovelock argued that his hypothesis had gained sufficient support to be considered a theory, but the Gaia theme had its roots in pre-1940s scientific romance and American pulp sf. Wells' *The War of the Worlds* features a form of proto-ecopoiesis in which an invasive Martian "red weed" displaces Earth's ecology, granting the intruders more *lebensraum* and further propelling their imperial conquest of Earth. Wells' *The Shape of Things to Come* (1933) is a future history that recounts an episode of "geogonic planning" during the world state's technocratic management of Earth.[61] This example of terraforming is a form of geoengineering embarked upon after Earth's unification as a scientific utopia follows a period of war. Wells sent a copy of this text to his correspondent and admirer Olaf Stapledon, whose *Last and First Men* (1930) and *Star Maker* (1937)[62] feature examples of human and alien terraforming.[63] Stapledon pioneered the form of the future history in what he called "essays in myth creation", which 'construct imaginary worlds to embody metaphysical theses'.[64]

J.B.S. Haldane's scientific paper, "The Last Judgement" (1927),[65] proposed the possibility of terraforming Venus, a scenario Stapledon incorporated into *Last and First Men*. Stapledon's text features two projects of terraforming in response to the sun's cooling: the fifth men terraform Venus and exterminate its indigenous population, while the eighth men colonise Neptune. Various motives inform the galactic expansion and terraforming embarked upon by the various aliens detailed in *Star Maker*. Here the disembodied pan-psychic narrator experiences an incomplete vision of what it calls

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[61] H.G. Wells, *The Shape of Things to Come* (London: Corgi, 1967).
[62] Olaf Stapledon, *Last and First Men* (London: Penguin, 1966) and *Star Maker* (Connecticut: Wesleyan University Press, 2004).
[63] Olaf Stapledon, Letter to Wells dated 24 April 1936 in *The Olaf Stapledon Collection*, Liverpool, Sydney Jones Library Special Collections and Archives, University of Liverpool, OS/H4/3/5.
[64] Brian Stableford, *Scientific Romance in Britain 1890-1950* (London: Fourth Estate, 1985), p. 138.
[65] J.B.S. Haldane, 'The Last Judgement', in *Possible Worlds and Other Essays* (London: Chatto & Windus, 1927), pp. 287-312.

the "Star Maker", a metaphysical being that creates universes and worlds. The narrator's vision is coupled to an uncertainty that confounds his understanding of the Star Maker. The Star Maker's extravagant experiments with its godlike power of world creation informs its growth to maturity and opens a space to consider this image as an early articulation of astrophysical engineering. Astrophysical engineering is a form of terraforming 'taken to represent proposed activities, relating to future habitation, that are envisaged to occur on a scale greater than that of "conventional" planetary engineering'.[66] The narrator's uncertainty also lends the image of the Star Maker, as an expression of the cosmos itself, to interpretation as a landscape applied to cosmological nature's otherness.

Alongside Wells and Stapledon's works appeared several proto-Gaian stories. M.P. Shiel's *The Purple Cloud* (1901),[67] the first part of which was praised by H.P. Lovecraft for 'a skill and artistry falling little short of actual majesty',[68] features an episode in which Adam Jeffson, the solitary survivor of a global catastrophe, confronts a supernatural being during an Arctic expedition, a figure which he ambiguously aligns with the Earth. Sir Arthur Conan Doyle's "When the World Screamed" (1929) is a Professor Challenger story in which the dominating hero-scientist symbolically rapes the feminised living world by drilling into its flesh.[69] These two scientific romances predate a cluster of three living world stories that appeared in American pulp sf. Edmond Hamilton's 1932 story, "The Earth Brain",[70] was published in *Weird Tales* and shares with Shiel's story elements of an aesthetic that Lovecraft designates "weird".[71] In "The Earth-Brain", as in *The Purple Cloud*, an expedition to the Arctic discovers a living world figure, but Hamilton recasts this being as a mythic mountain that literally houses the Earth's brain. The expedition is punished for their transgression and Morris, who manages to escape, is pursued by earthquakes across the planet until his self-sacrifice appeases the Earth.

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[66] Fogg. Martyn J., 'Planetary Engineering Bibliography' (2011) <http://www.users.globalnet.co.uk/~mfogg/biblio.htm> [accessed 15 March 2011].
[67] M.P. Shiel, *The Purple Cloud*, *Project Gutenberg* (1901) <http://www.gutenberg.net/1/1/2/2/11229/> [accessed 4 December 2009].
[68] H.P. Lovecraft, 'Supernatural Horror in Literature', *The H.P. Lovecraft Archive* (1927) <http://www.hplovecraft.com/writings/texts/essays/shil.asp> [accessed 14 January 2012].
[69] Sir Arthur Conan Doyle, 'When the World Screamed', *Forgotten Futures III* (2000) <http://www.forgottenfutures.com/game/ff3/wscream.htm> [accessed 20 March 2011].
[70] Edmond Hamilton, 'The Earth-Brain', in *The Horror on the Asteroid and Other Tales of Planetary Horror* (London: Philip Allan, 1936), pp. 129-183.
[71] 'Supernatural Horror in Literature'.

Jack Williamson's *Astounding* story, "Born of the Sun" (1934), advertised by F. Orlin Tremaine's editorial epigraph as a 'vivid, comfort-destroying story – a thought variant that will thrill you and make you wonder!', recounts the discovery that Earth and the other planetary bodies are the eggs of a vast creature, knowledge of which has been guarded from the world by a mysterious eastern sect.[72] In the same year in *Wonder Stories*, Laurence Manning anticipated the sentient stars of *Star Maker* in "The Living Galaxy". In this story a school child reviews the history of the intrepid explorers who discover a living galaxy that their fear compels them to destroy.[73] Manning's "The Man Who Awoke", serialised in *Wonder Stories* in 1933 in the same year as Wells' *The Shape of Things to Come*, features societies that engage in various acts of geoengineering. "The Man Who Awoke" uses the Rip Van Winkle device to allow a time traveller to explore several future societies, the first of whom practice ecological management, conservation and stewardship of the Earth.[74] Along with "Earth's Mausoleum" already discussed, these scientific romances and pulp sf stories demonstrate the wide ranging treatments terraforming and proto-Gaian narratives receive before the onset of WWII. Terraforming is still in its infancy, while proto-Gaian narratives build on supernatural themes or the sf icon of the sentient world, star or galaxy. *Star Maker*, the last text of this period 1898-1937, illustrates the close connection between terraforming and proto-Gaian themes by combining both into its narrative.

1.4.2 Postwar Terraforming Stories 1945-1960

The first boom of terraforming stories appear after WWII and begin to reflect on the dangers of the limitless potential offered by science and technology in the light of the bombing of Hiroshima and Nagasaki in 1945. Williamson's *Seetee Shock* (1949) continues the CT series in which he coined "terraforming", but reflects this heightened awareness of the dangers of the wartime application of atomic power.[75] In 1946 Ray Bradbury began publishing a series of elegiac and pastoral short stories

[72] Jack Williamson, 'Born of the Sun', in *Astounding Stories*, 12.1 (1934), 10–38 (p. 10).
[73] Laurence Manning, 'The Living Galaxy', in *Wonder Stories* 6.4 (1934), 436-97.
[74] Laurence Manning, *The Man Who Awoke* (New York: Ballantine, 1979).
[75] Jack Williamson, *Seetee Shock* (London: Mayflower, 1969).

in *Planet Stories*, *Thrilling Wonder Stories* and a range of other pulps (but not *Astounding*) that were collected and released with additional stories and vignettes as *The Martian Chronicles* (1950). This collection offers a chronological selection of events during the colonisation and terraforming of Mars between January 1999 and October 2026.[76] Henry Kuttner's *Fury* (written with C.L. Moore and serialised in *Astounding* in 1947) is an alarming story about the failed terraforming of Venus. Prior to the narrative's opening the first colonists from Earth were driven by the fury of the Venusian jungle into the safety of their undersea domes. There, humanity stagnates until the Machiavellian Sam Reed manipulates the population and their rulers and reawakens a colonial desire for the clearing of the jungle for *lebensraum*. Reed's motivation is an entirely personal grasping for power and influence.[77] Of interest is Jack Vance's 1947 *Astounding* story "I'll Build Your Dream Castle", a tale of corporate exploitation and one-upmanship in which Farrero, a former employee of Marlais and Angker, secures a monopoly over the design and construction of habitable asteroids. This story considers corporate social responsibility through Farrero's efforts to break the monopoly Marlais and Angker hold over the construction of Earthbound abodes by making alternative habitations (relatively) economically feasible to a wider market.[78]

These texts feed into the first boom of terraforming stories in the 1950s. The scientific romance and pulp sf traditions were merging by this time, a confluence facilitated by writers (such as Arthur C. Clarke) who were directly influenced by Wells and Stapledon. They exhibit several features that give coherent shape to a motif that, despite differences in treatment, reflect the growth of an idea about how terraforming and interplanetary colonisation would take shape in the imaginary universes of sf. Robert A. Heinlein's juvenile *Farmer in the Sky* (1950)[79] and Clarke's *The Sands of Mars* (1951)[80] were the first novels to explore terraforming as the central element of their narratives. Isaac Asimov's "The Martian Way" (*Galaxy* 1952) deals with the efforts of a group of "scavengers" on

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[76] Ray Bradbury, *The Martian Chronicles* (New York: Doubleday, 1958).
[77] Henry Kuttner, *Fury* (London: Gollancz, 2000).
[78] Jack Vance, 'I'll Build Your Dream Castle', in *The World Thinker and Other Stories* (Oakland: The Vance Integral Edition, 2005), pp. 37-60.
[79] Robert A. Heinlein, *Farmer in the Sky* (London: Pan Books, 1967).
[80] Arthur C. Clarke, *The Sands of Mars* (London: Sidgwick & Jackson, 1951; repr. 1976).

Mars who attempt to gain economic and political independence from Earth.[81] In contrast to these variously optimistic visions of terraforming, Walter M. Miller's "Crucifixus Etiam" (*Astounding* 1953)[82] and Poul Anderson's "The Big Rain" (*Astounding* 1954) and *The Snows of Ganymede* (*Startling Stories* 1955; novelised 1958)[83] depict the human exploitation by dystopian societies that accompanies terraforming. Frederik Pohl and C.M. Kornbluth's *The Space Merchants* (serialised as "Gravy Planet" in *Galaxy* 1952; novelised 1953) likewise portrays a dystopian future in which terraforming is embarked upon as a stage in the capitalistic expansion of a multinational corporation before it is co-opted by an oppositional group of conservationists (Consies).[84]

Toward the end of the decade Cordwainer Smith's "When the People Fell" (*Galaxy* 1959)[85] and Anderson's "Sister Planet" (*Satellite Science Fiction* 1959)[86] use the figure of the alien to consider human relationships to human and non-human others. Smith's "When the People Fell" offers an iconic image of terraforming that draws connections between the exploitation of aliens and people who bear a relation of cultural otherness to a governing group. Anderson's "Sister Planet" features a scientific outpost on the ocean world Venus, which has established trading partnerships with a dolphin like "cetoid" life form that brings valuable resources from the ocean depths. Whether or not the colonists' presence on Venus can be considered an invasion is linked to the debate regarding cetoid sentience, which is questioned by everyone except the protagonist. This question is considered by interrogating the very concept of value and sentience in the short story.

These works represent an important period in the gradual cohesion of textual elements and the terraforming motif, generating the first distinctive dialogue in the tradition. Taken together, they express a consensus, as each text voices its own attitude toward, or hopes and anxieties about, the future. Kuttner and Moore's *Fury*, Clarke's *The Sands of Mars*, Asimov's "The Martian Way" and

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[81] Isaac Asimov, 'The Martian Way', in *The Science Fiction Hall of Fame*, ed. by Ben Bova (New York: Tom Doherty Associates, 1973), II B (1974), pp. 1-45.
[82] Walter M. Miller, 'Cruxifixus Etiam', in *The View From the Stars* (Hertfordshire: Panther, 1968; repr. 1973), pp. 58-78.
[83] Poul Anderson, 'The Big Rain', in *Worldmakers: SF Adventures in Terraforming*, ed. by Gardner Dozois (New York: St. Martin's Griffin, 2001), pp. 1-49; and *The Snows of Ganymede* (New York: Ace, 1958).
[84] Frederik Pohl and C.M. Kornbluth, *The Space Merchants* (New York: Random House, 1953; repr. 1974).
[85] Cordwainer Smith, 'When the People Fell', in *Worldmakers: SF Adventures in Terraforming*, ed. by Gardner Dozois (New York: St. Martin's Griffin, 2001), pp. 50-59.
[86] Poul Anderson, 'Sister Planet', in *Get Out of My Sky: Three Short Novels of Science Fiction*, ed. by Leo Margulies (New York: Crest, 1960), pp. 87-128.

Anderson's "The Big Rain" and *The Snows of Ganymede* all feature the chronotope of the domed settlement that allows the colonists to overcome the problems of habitation and establish boundaries for their communities. Images of the garden, farm and wilderness are used to portray the alien conditions and technological adaptations on planets undergoing terraformation. Heinlein, Clarke and Asimov tackle the theme of the colonist's economic and political independence from Earth, while Miller and Anderson invert the successes of the colony portrayed in these works to depict communities that are exploited as slave labour within the framework of a rigid hierarchy. Like Bradbury in the late forties and the beginning of the fifties, Smith and Anderson use the figure of the alien to critique colonialism and the limits of a narrow vision that excludes alternative approaches toward valuing other cultures, organisms and their environment.

1.4.3 Transitions: Proto-Gaian Worlds and Ecology

There were fewer proto-Gaian narratives during the period in which the post-WWII terraforming boom was developing, although some important stories that would have a great impact on terraforming's ecological engagement were published. In Murray Leinster's "The Plants" (*Astounding* 1946), interplanetary explorers encounter a world covered by a single species of flower that works in concert to subdue aggressive intruders.[87] This premise distantly resonates with Lovelock's Daisyworld, a computer simulation that models a simple homeostatic system on a planet populated by light and dark shades of daisy. The cyclical dominance of one shade of daisy over another governs the variation in albedo of the planet, thus highlighting the regulatory function of life on a planet's climatology.[88] George R. Stewart's *Earth Abides* (1949) is a post-apocalyptic story in which civilisation's collapse is precipitated by an unknown plague. *Earth Abides* is significant for its characterisation of the interrelationships between Earth's processes and the decline of civilisation, and for its development of an ecological view of a vast, old and indifferent planet.[89]

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[87] Murray Leinster, 'The Plants', *Astounding*, 36.5 (1946), 138-151.
[88] See *The Ages of Gaia* for more information on the Daisy World model.
[89] George R. Stewart, *Earth Abides* (London: Transworld Publishers, 1956; repr. 1961).

Leinster's "The Lonely Planet" (*Thrilling Wonder Stories* 1949) tells of the sentient living world Alyx, whose consciousness emerges through its relationship of otherness to human colonists. This story deals with the ensuing paranoid reaction and aggression directed toward Alyx when it makes its intelligence known.[90] Ray Bradbury's "Here There Be Tygers" (1951) offers a pastoral wish fulfilment narrative similar in many respects to Leinster's and, like the underlying anxieties explored in his story, suggest that humanity could reconcile themselves to a utopian existence in harmony with their planet but for the fears and insecurities that underlie their socio-political institutions and their relationship to nature.[91] Stanislaw Lem's groundbreaking *Solaris* (1961, first English translation 1970)[92] deals with another confrontation with a Gaian planet but, in contrast to the anthropomorphised living worlds depicted in Leinster and Bradbury's short stories, Lem offers an incomprehensible entity that in many ways resonates with Stapledon's vision of the *Star Maker*. This anthropomorphic critique is anticipated in 1957 by Sir Fred Hoyle's *The Black Cloud*, the story of an approaching cosmic cloud that causes unprecedented ecological crises on a global scale.[93] This story redeploys the Stapledonian theme of a sentient cosmic body; the cloud is a reiteration of the proto-Gaian stellar intelligence.

Other more clearly recognisable Gaian stories include John W. Jakes' "The Dreaming Trees" (*Fantastic Adventures* 1950)[94] and Richard McKenna's "The Night of Hoggy Darn" (*If* 1958).[95] Jakes' story of the threatened clearing of an intelligent species of tree for *lebensraum* recalls the deforestation in *Fury*. The destruction of the Dreaming Trees is prevented by raising a force field that makes the forest an impenetrable and self-contained biosphere or dome. McKenna's "The Night of Hoggy Darn" offers a mythic account of the conflict between humanity and the native stompers, but his 1963 rewrite of this story as "Hunter, Come Home" (*The Magazine of Fantasy and Science Fiction*) incorporates a significant mystical, Gaian element to the sentient ecosphere against which is thrown into relief a deeper tendency toward fear and aversion when humankind is confronted with an

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[90] Murray Leinster, 'The Lonely Planet', *Thrilling Wonder Stories*, 35.2 (1949), 80-97.
[91] Ray Bradbury, 'Here There Be Tygers', in *R is for Rocket* (London: Pan, 1972), pp. 119-133.
[92] Stanislaw Lem, *Solaris* (London: Faber & Faber, 2003).
[93] Sir Fred Hoyle, *The Black Cloud* (London: Heinemann, 1957).
[94] John W. Jakes, 'The Dreaming Trees', in *Fantastic Adventures*, 10 (1950), 98-106.
[95] Richard McKenna, 'The Night of Hoggy Darn', in *Tomorrow x4*, ed. by Damon Knight (Connecticut: Gold Medal Books, 1964), pp. 9-58.

uncontrollable other. "Hunter, Come Home" stands at the confluence between terraforming and proto-Gaian themes and incorporates ecological motifs to depict a world of harmoniously interconnected life, symbolised by the mixed plant-animal heritage of the indigenous phyto species.[96]

1.4.4 Transformations of the Terraforming and Gaian Theme in 1960s SF

Suvin has called '[t]he period of around 1960-1974, the true and untranscended golden age of Anglophone – U.S. and U.K. – science fiction […] its main preoccupation was not war and militarism (Vietnam began to be fictionally digested only toward the end) but envisaging alternate, usually better, possibilities of human relationships […] they were predominantly antiwar and antimilitaristic'.[97] This period coincides with the growth of the counter culture and American environmental awareness. Susan Stratton has argued that 'the sense of urgency that created ecocriticism has marked SF since the 1960s'.[98] This sense of urgency can be traced further back, and while it may not have "marked" sf to the degree evidenced by the explosion of ecologically focused sf stories in the 1960s, the upsurge of ecotastrophe stories in the 1950s focused attention onto the role of humanity as instigators of or subject to ecological crisis.[99] Illustrative of this sense of urgency in the 1960s is Clarke's 1961 "Before Eden" (*Amazing*),[100] a proto-ecopoiesis story of the thoughtless contamination of Venus and the extinction of its native life, which anticipated Rachel Carson's 1962 account of chemical contamination on Earth in *Silent Spring*. Carson's text could itself be considered an account of geoengineering and a work of sf.

The turning point for the terraforming narratives of the 1960s is marked by Frank Herbert's *Dune* trilogy[101] and Heinlein's *The Moon is a Harsh Mistress* (serialised in *If* 1965-1966).[102] Frank

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[96] Richard M. McKenna, 'Hunter, Come Home', in *Worldmakers: SF Adventures in Terraforming*, ed. by Gardner Dozois (New York: St. Martin's Griffin, 2001), pp. 69-98.
[97] Suvin 2008, p. 129.
[98] Susan Stratton, 'Theory and Beyond: Ecocriticism', *SFRA Review*, 249 (2000), 2-6 (p. 4).
[99] Brian Stableford, 'Science Fiction and Ecology', in *A Companion to Science Fiction*, ed. by David Seed (Malden, MA: Blackwell, 2005), pp. 127-141 (p. 137).
[100] Arthur C. Clarke, 'Before Eden', in *Worldmakers: SF Adventures in Terraforming*, ed. by Gardner Dozois (New York: St. Martin's Griffin, 2001), pp. 60-68.
[101] Frank Herbert, *Dune* (Kent: New English Library, 1968; repr. 1983), *Dune Messiah* (Kent: New English Library, 1972; repr. 1985) and *Children of Dune* (Kent: New English Library, 1977; repr. 1985).

Herbert serialised "Dune World" and "The Prophet of Dune" in *Analog* from 1963-1965 before the acclaimed terraforming novel *Dune* was published in 1965. This was followed over the next couple of decades by the publication of a series of *Dune* stories, some posthumous; *Dune Messiah* (1970) and *Children of Dune* (1976) are the most relevant from the terraforming perspective, and complete a relatively self-contained trilogy. Recalling his earlier novel (*Farmer*) and the terraforming narratives of the 1950s, Heinlein's *The Moon is a Harsh Mistress* tells of a convict population on the Earth's terraformed Moon and their attempt to gain political and economic independence. Heinlein's text re-uses narratives and tropes that can be traced forward through Gregory Benford's *Jupiter Project* (1972)[103] and Le Guin's *The Dispossessed* (1974),[104] to James Lovelock and Michael Allaby's *The Greening of Mars* (1984) and the developing coherence of the terraforming boom of the mid 1980s and 1990s. Le Guin's groundbreaking *The Dispossessed* is a critical utopia set in her Hainish Universe. In this story the Odonians struggle on a resource scarce Moon to maintain a society that rejects the capitalist corruption of their ancestral homeworld Io. Herbert, Heinlein and Le Guin's terraforming narratives exemplify the way in which wider cultural trends feed into terraforming narratives in the 1960s and 1970s and transform the way in which the motif is used.

Roger Zelazny's "The Keys to December" (*New Worlds* 1966)[105] was published in the same year as the novel version of *The Moon is a Harsh Mistress*. It tells of a group of humans who have been genetically engineered by December, Inc. for habitation of a unique planet. When this planet is destroyed, the posthumans begin the slow process of terraforming another planet to suit their specialist needs, only to discover that their long term project of planetary adaptation has simultaneously facilitated the evolution of an indigenous intelligence while threatening their existence by accelerating the pace of environmental change beyond the capacity of the planet's indigenous life to successfully adapt. Zelazny critiques the hubris that has often accompanied terraforming and explores the depths of responsibility that the creators, the members of the terraforming team, have toward the created, the new forms of life that develop under their aegis. Edmund Cooper's *The Last*

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[102] Robert A. Heinlein, *The Moon is a Harsh Mistress* (London: Gollancz, 2001).
[103] Gregory Benford, *Jupiter Project* (London: Sphere, 1982).
[104] Ursula K. Le Guin, *The Dispossessed* (London: Millenium, 1974).
[105] Roger Zelazny, 'The Keys to December', in *Worldmakers: SF Adventures in Terraforming*, ed. by Gardner Dozois (New York: St. Martin's Griffin, 2001), pp. 99-117.

Continent (1969) has, as background to its story of re-discovery, a Mars terraformed by humankind after the historical evacuation of Earth.[106] Previous habitation of Earth has since become a myth, and a small expedition is sent to explore the planet. This text exemplifies the backgrounding of terraforming typical in many sf narratives, yet it also illustrates an inversion of the terraforming impulse inward, back to Earth, though this is qualified by the Martian society's redefinition of Mars as humankind's cultural centre.

1.4.5 The Gaia Hypothesis, Terragouging and Pantropy in the 1970s

It was during the 1960s that terraforming first began to receive sustained attention from scientists interested in developing proposals for terraforming based upon then contemporary data of the solar system. Carl Sagan wrote on the possibility of terraforming Venus by seeding its clouds with microbial life in "The Planet Venus" (*Science* 1961). It was not until the 1970s, however, that scientific speculation on terraforming began to burgeon. Sagan turned his attention to Mars in "Planetary Engineering on Mars" (*Icarus* 1973)[107] while M.M. Averner and R.D. MacElroy's NASA report "On the Habitability of Mars: An Approach to Planetary Ecosynthesis" was published in 1976.[108] Sagan also attempted to popularise scientific speculation on the colonisation and terraformation of the solar system in *Carl Sagan's Cosmic Connection* (1973),[109] which was closely followed by Berry's *The Next Ten Thousand Years* (1974). Technical scientific consideration of terraforming and popular scientific accounts would continue to be published in increasing number throughout the 1980s-2000s; significant works of scientific speculation include James E. Oberg's *New*

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[106] Edmund Cooper, *The Last Continent* (London: Coronet Books, 1971; repr. 1974).
[107] Carl Sagan, 'The Planet Venus', *Science*, 133 (1961), 849-858 and 'Planetary Engineering on Mars', *Icarus*, 20 (1973), 513-514.
[108] M.M. Averner and R.D. MacElroy, 'On the Habitability of Mars: An Approach to Planetary Ecosynthesis', NASA Report 19770005775, *Ames Research Centre* (1976) <http://ntrs.nasa.gov/search.jsp?R=19770005775> [accessed 16 July 2012].
[109] Carl Sagan, *Carl Sagan's Cosmic Connection: An Extraterrestrial Perspective* (Cambridge: Cambridge University Press, 2000).

Earths (1981),[110] for which Jack Williamson wrote the foreword and in which other sf writers including Clarke, Anderson, Asimov, Heinlein and Stapledon are acknowledged.[111]

Lovelock began to popularise the Gaia hypothesis in the 1970s with the publication of *Gaia* in 1973, although he had published several technical articles on aspects of his Gaia hypothesis beginning in 1971.[112] By this time proto-Gaian images had appeared in much sf as literal living worlds or as extensions of local and regional ecological zones to planetary scales. Le Guin's "Vaster Than Empires and More Slow" (1971) features a Gaian planet whose forests are interconnected and form a single planetary consciousness.[113] James White's "Major Operation" (1971) is a sequel to his 1969 "Meatball" and portrays a Gaian entity that has been the target of atomics by the intelligent indigenous Drambons; the Sector General Hospital, an intergalactic hospital specialising in exotic medical cases, engages in surgery to cut away the cancerous sections of land in a terraforming operation.[114] Theodore Sturgeon's "Case and the Dreamer" (1973) is a borderline Gaian text that features a creature able to assume any shape at will, including that of a living world.[115]

Ernest J. Callenbach's millenarian *Ecotopia* (1975) is another landmark text and, although excluded from consideration as a terraforming text under a narrow definition of the term, it informs the development of ecologically conscious terraforming stories.[116] As an example of geoengineering, however, this text can easily be incorporated into this analysis. In *Ecotopia*, the American West Coast has gained independence and has begun the process of political and economic decentralisation. On a social level the ecotopians have begun to develop ecologically oriented lifestyles and cultures. This text brings together political, cultural and ecological considerations, demonstrating their interconnections and imbrication by showing how changes to one dimension impact on others. Le

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[110] James Edward Oberg, *New Earths: Transforming Other Planets for Humanity* (Harrisburg, Pa: Stackpole Books, 1981).
[111] See Fogg 1995 and Martin Beech, *Terraforming: The Creating of Habitable Worlds* (New York: Springer, 2009) for a more detailed overview of the scientific literature on terraforming.
[112] Lovelock 1987.
[113] Ursula K. Le Guin, 'Vaster than Empires and More Slow', in *The Wind's Twelve Quarters* (London: Granada, 1982), II, pp. 25-59.
[114] James White, 'Meatball', pp. 103-135 and 'Major Operation', pp. 136-183, in *Major Operation* (New York: Ballantine Books, 1971).
[115] Theodore Sturgeon, 'Case and the Dreamer', in *Case and the Dreamer and Other Stories* (London: Pan, 1974), pp. 9-59.
[116] Ernest Callenbach, *Ecotopia: A Novel About Ecology, People and Politics in 1999* (London: Pluto Press, 1978).

Guin's *The Word for World is Forest* (1972) offers a critique of the Vietnam War and portrays the imperial colonisation and enslavement of the indigenous population alongside the destructive logging of the planet.[117] This logging is an example of terragouging, which refers to terraforming where 'whatever necessary would be done to facilitate extraction of raw materials for earthly consumption'.[118] Suvin calls this story a red-green novel, 'one that combines acute sensitivity to ecology not only with the condemnation of a colonial war but also with a depth search for its psychological equivalents in the macho mentality that wants to tame and rape the environment as well as women'.[119] Gregory Benford's *Jupiter Project* (serialised in *Amazing* 1972; novel publication 1975), a direct homage to *Farmer in the Sky*, tells of a scientific community inhabiting a space station orbiting Jupiter.[120] The role of the scientific station is to monitor Jupiter for signs of alien life, a long term project that is threatened when Earth decides to terminate it for political and economic reasons. The inhabitants of the station, some of whom were born there, decide to resist decommissioning and remain at the station to plan for the eventual terraforming of Ganymede.[121]

Another group of texts that appeared in the late 1970s dealt with transformations of the body as a method for inhabiting alien planets. Frederik Pohl's *Man Plus* (1976) deals with the terraforming of Mars as a strategy to avoid the predicted economic and social collapse of Earth's societies. Roger Torraway is cyborged to allow him to survive on the Martian surface and successfully terraform it.[122] The narrative itself is a nostalgic reflection on the Cold War space race, while the "Plus" of the title ironically echoes Hugo Gernsback's use of the symbol to indicate the superiority of the hero of *Ralph 124 C41+* (serialised in *Modern Electrics* 1911-1912; novelised 1925)[123] over the rest of humankind. John Varley's short story "Retrograde Summer" (*The Magazine of Fantasy and Science Fiction* 1975)

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[117] Ursula K. Le Guin, *The Word for World is Forest* (New York: Berkley Publishing Corporation, 1976).
[118] Murphy 2001, p. 270.
[119] Suvin 2008, p. 133.
[120] Gregory Benford, 'Terraforming Ganymede with Robert A. Heinlein' (2011) <http://www.baen.com/TerraformingGanymede1.asp> [accessed 16 July 2012].
[121] A chapter of this story was revised and published as "Shall We Take a Little Walk" (1981), Gregory Benford, in *Worldmakers: SF Adventures in Terraforming*, ed. by Gardner Dozois (New York: St. Martin's Griffin, 2001), pp. 134-149. It retained terraforming as part of its background while introducing a BDO as the main focus of its storyline. BDOs are Big Dumb Objects: 'vast enigmatic constructions [...] in space or on other planets', David Langford and Peter Nicholls, "Macrostructures" in *The Encyclopedia of Science Fiction* (2012) <http://www.sf-encyclopedia.com/entry/macrostructures> [accessed 10 July 2012].
[122] Frederik Pohl, *Man Plus* (London: Gollancz, 1976; repr. 2000).
[123] Hugo Gernsback, *Ralph 124C 41+: A Romance of the Year 2660* (Lincoln: University of Nebraska Press, 2000; repr. 2001).

explores terraforming on a social level, examining the range of lifestyles that might develop in an intergalactic community geared toward planetary adaptation.[124] These texts signal the growth in popularity of narratives of pantropy, a trend that would continue to be developed and transformed alongside terraforming stories throughout the 1980s-1990s.

Adam Douglas' *The Hitchhiker's Guide to the Galaxy* (1979), written at the end of the decade, parodies terraforming by portraying it as a creative act of literal design and construction; an art form in its own right, for which its practitioners win awards.[125] Terry Pratchett also parodies the notion of terraforming and geological time in *Strata* (1981), in which investigation into the mystery of the origins of a flat planet (a literal discworld) leads to the discovery that the universe and all its planets are artefacts created by an unknown alien civilisation. The evidence of fossils in the strata of many planets are red herrings that seem to support the long existence of the universe; the cosmos is instead revealed to be a new creation with a history far short of the geological.[126] These two parodies indicate how far terraforming has been assimilated into sf discourse as their subversion of terraforming themes depend for their success on the dialogic relationship of these reworkings to the wider terraforming megatext.

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[124] John Varley, 'Retrograde Summer', in *Worldmakers: SF Adventures in Terraforming*, ed. by Gardner Dozois (New York: St. Martin's Griffin, 2001), pp. 118-133.
[125] Adams Douglas, *The Hitchhiker's Guide to the Galaxy* (Oxford: Pan Books, 1979).
[126] Terry Pratchett, *Strata* (New York: Roc, 1983).

1.4.6 Corporations, Cyberpunk and the Confluence of Terraforming and Gaia in the 1980s

Stories that draw directly from Lovelock's Gaia hypothesis begin to appear in the 1980s. The theme of the Gaian planetary ecology had been developed in the context of terraforming since McKenna's "Hunter, Come Home", Herbert's *Dune* and White's "Major Operation", but in the 1980s the implications of Gaia as a planetary ecology regulated by life itself begins to dovetail with terraforming. During the 1970s and 1980s new knowledge of the solar system opened up by the Mariner (1973) and Viking (1975) probes meant that sf writers interested in developing scientific plausibility had increasingly to respond to the new image of the solar system constructed by science, especially if they continued to set their stories within its boundaries. Brian Aldiss' *Helliconia* trilogy (*Helliconia Spring* 1982, *Helliconia Summer* 1983, and *Helliconia Winter* 1985), is a Gaian text that uses the scientific basis of Lovelock's hypothesis to build a world inhabited by two sentient species whose social development is governed by long seasonal cycles and vast climatic fluctuations caused by the planet's elliptical orbit of one of its twin suns. Helliconia's ecology is complexly imagined and the social upheavals and conflicts between the human-like species and the phagors are explored in detail.[127] Isaac Asimov's *Foundation's Edge* (1982) takes a different perspective in its treatment of the theme by portraying a Gaian consciousness developing as a consequence of the three laws of robotics and robot telepathy.[128]

Lovelock and Allaby's *The Greening of Mars* (1984), uses the utopian form to portray the terraforming of Mars in terms of the insights to terraforming offered by the Gaia hypothesis. This landmark text signals the confluence of terraforming and Gaia in stories of space colonisation. Kim Stanley Robinson's short story "Green Mars" (*Asimov's Science Fiction* 1985)[129] and the first two novels of Pamela Sargent's *Venus* trilogy, *Venus of Dreams* (1986) and *Venus of Shadows* (1988), continue this focus on ecology, terraforming and society. These narratives explore the political,

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[127] Brian Aldiss, *Helliconia Spring* (London: Triad/Granada, 1983), *Helliconia Summer* (London: Triad/Panther, 1985) and *Helliconia Winter* (London: Triad/Panther, 1986).
[128] Isaac Asimov, *Foundation's Edge* (London : Granada, 1984).
[129] Kim Stanley Robinson, 'Green Mars', in *The Martians* (London: Voyager, 1999; repr. 2000).

economic and socio-cultural factors involved in the terraforming of Mars and Venus respectively, and are pivotal texts for the development of the terraforming narrative. Another series of ecological stories related to Callenbach's *Ecotopia*, though strictly not terraforming or Gaian narratives in themselves, is Robinson's *Orange County* sequence (*The Wild Shore* 1984, *The Gold Coast* 1988 and *Pacific Edge* 1990)[130] and Le Guin's *Always Coming Home* (1985).[131] Nevertheless, *Pacific Edge* and *Always Coming Home* adapt the ecotopian form to explore visions of appropriate human relationships to Earth and, along with Robinson's 1997 *Antarctica*,[132] can be considered terraforming narratives that reflect on geoengineering.

Octavia Butler's *Xenogenesis* trilogy, comprising *Dawn* (1987), *Adulthood Rites* (1987) and *Imago* (1989), recapitulates Wells' red weed with its portrayal of an organic spaceship that engages in biological terragouging: it consumes all of Earth's resources in order to reproduce.[133] Brian Stableford's "Wildland" (1989) continues this theme with its portrayal of a Gaian organism that displaces Earth's non-human life and establishes ecological hegemony over Earth.[134] Larry Niven and Steven Barnes' *The Barsoom Project* (1989) is the second novel of the *Dream Park* trilogy; although its central theme is virtual reality and live action role playing (LARP), Dream Park is built on a terraformed planet.[135] While this history of adaptation is itself backgrounded, there are implicit connections made between virtual reality and terraforming, both of which are involved with the creation of worlds. However, the significance of virtual worlds such as those that are explored in the cyberpunk tradition of sf falls outside the scope of this thesis.

Bruce Sterling's "Sunken Gardens" (*Omni* 1984) is a cyberpunk story set in his Shaper universe where the repeated terraforming of domed pockets of the Martian landscape takes on social significance as a safety valve in the form of a competition, which regulates through a system of social

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[130] Kim Stanley Robinson, *The Wild Shore* (London: Futura, 1985), *The Gold Coast* (London: Futura, 1989) and *Pacific Edge* (London: Unwin Hyman, 1990).
[131] Ursula K. Le Guin, *Always Coming Home* (Toronto: Bantam Books, 1986).
[132] Kim Stanley Robinson, *Antarctica* (London: Voyager, 1997; repr. 1998).
[133] Octavia E. Butler, *Lilith's Brood* (New York: Grand Central Publishing, 2000; repr. 2007).
[134] Brian Stableford, 'Wildland', in *Arrows of Eros*, ed. by Alex Stewart (Kent: Hodder and Stoughton, 1989), pp. 1-22.
[135] Larry Niven and Steven Barnes, *The Barsoom Project* (London: Pan, 1990).

advancement and diversion the dangerous tensions between posthuman factions.[136] The competition revolves around an ecological aesthetics of terraforming that turns planetary adaptation into a direct expression of artistic and political value. Ian McDonald's "The Catharine Wheel" (*Asimov's Science Fiction* 1984) anticipates the story related in his pastiche *Desolation Road* (1988), which follows the growth of a small community on a Mars undergoing terraforming.[137] The inhabitants of the eponymous town develop a pastoral sense of place and community that is tested by the encroachment of the Bethlehem Ares Railroad Corporation and the Martian government, led by former members of the Desolation Road community itself. Frederick Turner's ambitious 10,000 line work of sf poetry, *Genesis*, was published in 1988.[138] Its form recalls the Homeric epic and mythologises terraforming by aligning future works of macroengineering to the Olympian feats of the Classical heroes of antiquity. Lovelock's Gaia Hypothesis, with its implicit mystical element, alludes to the Greek Gods of the Classical epic and helps to furnish the narrative of *Genesis* with an Ecotheist movement that provides an ideological opposition to the conduct of science on Earth and Mars. Charles Sheffield's "Out of Copyright" (*The Magazine of Fantasy and Science Fiction* 1989) is a story of corporate interest involving a competition between companies which is designed to assess the superiority of their proposals and resources for terraforming Mars.[139] The theme of cloning is wrapped up with terraforming as it has become standard practice for corporations to invest in the clones of dead geniuses to staff their research and development teams.

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[136] Bruce Sterling, 'Sunken Gardens', in *Worldmakers: SF Adventures in Terraforming*, ed. by Gardner Dozois (New York: St. Martin's Griffin, 2001), pp. 166-178.
[137] Ian McDonald, 'The Catharine Wheel', in *Worldmakers: SF Adventures in Terraforming*, ed. by Gardner Dozois (New York: St. Martin's Griffin, 2001), pp. 150-165 and *Desolation Road* (Birmingham: Drunken Dragon Press, 1990).
[138] Frederick Turner, *Genesis: An Epic Poem* (Dallas: Saybrook, 1988).
[139] Charles Sheffield, 'Out of Copyright', in *Worldmakers: SF Adventures in Terraforming*, ed. by Gardner Dozois (New York: St. Martin's Griffin, 2001), pp. 179-192.

1.4.7 The 1980s-1990s Terraforming Boom

Robinson's groundbreaking *Mars* trilogy was published in the early half of the 1990s and was complemented by a collection of short stories that were written in the 1980s-1990s and published as *The Martians* in 1999.[140] Robinson's *Mars* trilogy resembles Sargent's *Venus* trilogy and offers a complex examination of the problems and opportunities associated with developing sound relationships to the Martian environment. Alison Sinclair's *Blueheart* (1996) is another utopian terraforming narrative resembling Sargent and Robinson's trilogies, but it locates the terraforming debate on an ocean planet inhabited by adapted humans, some of whom have been illegally modified.[141] Brian Aldiss and Roger Penrose's *White Mars* (1999) is also similar in form but offers a more explicit opposition to terraforming than any of the above texts.[142] It features a Gaian entity that, once recognised as an alien creature, challenges the ethical dimensions of the terraforming project. All these texts share similarities with David Brin's Gaian narrative *Earth* (1990), which combines ecotastrophe (echoed by Robinson's portrayal of Earth in the *Mars* trilogy) with an apocalyptic tale of cosmic destruction via a new type of black hole.[143] These themes are interwoven into a story of the emergence of a Gaian consciousness.

Other terraforming stories during this period include Orson Scott Card and Kathyrn Kidd's *Lovelock* (1994), the first novel of the as yet uncompleted *Mayflower* trilogy.[144] This story takes place on the Ark, the first colonising spaceship sent to begin the terraformation of new planets. A new scientific discipline, Gaiaology, cued by the title of the text, signals the focus on planetary ecosystems essential for modern treatments of terraforming. Much of the story is devoted to the central theme of enhanced animal intelligence; the main protagonist is a Capuchin monkey adapted for its role as "witness" to the chief Gaiaologist's life and work on board the Ark. Short stories of the period include Landis' "Ecopoesis" (*Science Fiction Age* 1994), a murder mystery set on a Mars undergoing a failed

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[140] Kim Stanley Robinson, *The Martians* (London: Voyager, 1999; repr. 2000).
[141] Alison Sinclair, *Blueheart* (London: Orion, 1996).
[142] Brian Aldiss and Roger Penrose, *White Mars: Or, the Mind Set Free, a 21st Century Utopia* (London: Little, Brown, 1999).
[143] David Brin, *Earth* (London: Futura, 1990).
[144] Orson Scott Card and Kathryn Kidd, *Lovelock* (New York: Tom Doherty Associates, 1994).

ecopoiesis, and G. David Nordley's "Dawn Venus" (*Asimov's Science Fiction* 1995), the story of Bik Wu's struggle to gain custody of his son after his ex-wife's death; echoing the pioneer myth, he travels to Venus in order to claim land to terraform in order to improve his chances of winning custody of his son.[145]

The following short stories explore the relationship between memory and landscape, often reflecting nostalgically on Earth and history. Joe Haldeman's "For White Hill" (1995) features an alien civilisation that threatens Earth with destruction; the narrative is a first person account of the experiences of one of several artists who arrive on Earth for a competition geared toward the creation of a monument to human history.[146] Robert Reed's "A Place with Shade" (*The Magazine of Fantasy and Science Fiction* 1995) continues this theme of memory: Mr Locum is a professional terraformer hired to adapt a privately owned planet and to teach the owner's daughter his trade.[147] She traps him in the world he has created and forces him to face the ethical implications of his actions. Philip C. Jennings' "The Road to Reality" (*Asimov's Science Fiction* 1996) focuses on the terraforming of a planet by virtual reality consciousnesses.[148] As in *The Barsoom Project* (1989), the parallels between physical and virtual worldbuilding are raised and an ethical stance, centred on the responsibility of the creators toward the created, governs the text's philosophical inquiry. Stephen Baxter's "People Came from Earth" (1999) is the story of a Lunar colony that is slowly deteriorating due to resource scarcity, fading cultural memories and the contamination of bodies insufficiently adapted to their environment.[149] William H. Keith Jr's "Fossils" (*Asimov's Science Fiction* 1999) is likewise a story of memory: the last of the old strains of humans inhabiting Eos Chasma on Mars refuses to evacuate the area in the face of an impending flood.[150] The posthuman narrator attempts to convince Paul Norris to

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[145] G. David Nordley, 'Dawn Venus', in *Worldmakers: SF Adventures in Terraforming*, ed. by Gardner Dozois (New York: St. Martin's Griffin, 2001), pp. 221-244.
[146] Joe Haldeman, 'For White Hill', in *Worldmakers: SF Adventures in Terraforming*, ed. by Gardner Dozois (New York: St. Martin's Griffin, 2001), pp. 245-276.
[147] Robert Reed, 'A Place with Shade', in *Worldmakers: SF Adventures in Terraforming*, ed. by Gardner Dozois (New York: St. Martin's Griffin, 2001), pp. 193-220.
[148] Philip C. Jennings, 'The Road to Reality', in *Worldmakers: SF Adventures in Terraforming*, ed. by Gardner Dozois (New York: St. Martin's Griffin, 2001), pp. 277-310.
[149] Stephen Baxter, 'People Came From Earth', in *Worldmakers: SF Adventures in Terraforming*, ed. by Gardner Dozois (New York: St. Martin's Griffin, 2001), pp. 342-351.
[150] William H. Keith Jr., 'Fossils', in *Worldmakers: SF Adventures in Terraforming*, ed. by Gardner Dozois (New York: St. Martin's Griffin, 2001), pp. 352-378.

leave but fails. Instead, it witnesses Norris' televised attempt to ride out the flood on a raft improvised from his home.

Concluding this period of terraforming narratives is Jack Williamson's *Terraforming Earth* (2001), a collection of linked stories that tell of a small Lunar colony and its cloned inhabitants who periodically travel to Earth to witness the changes visited on the planet.[151] This group, along with many of the stories after 1996, tend to see the grandeur of the colonisation and terraforming project with jaded eyes and reflects warily on the future that humankind is adapting for itself. As the title indicates, there is a movement away from reflecting on the terraformation of other planets and a focus on the perceived ecological crisis on Earth. It is important to point out that this strand dovetails with the ecotastrophe narrative, although they are two separate, even if related and overlapping sf themes.

1.4.8 Terraforming in the Years 2000

The 1990s was arguably the high point for terraforming narratives, signalled by Robinson's *Mars* trilogy and the developing scientific and cultural dialogue surrounding notions of planetary adaptation. This dialogue is still developing and is increasingly infiltrating discourses outside sf, suggesting that the terraforming narrative will continue to be transformed in ways that may rival the aesthetic achievements of the narratives of the 1990s. Two debut novels, Karl Schroeder's *Ventus* (2000)[152] and Liz Williams' *The Ghost Sister* (2001),[153] were published in the early 2000s. *Ventus* recasts Gaia as sentient nanotechnology designed to terraform a planet that has been forgotten by the interplanetary society known as the Archipelago, while *The Ghost Sister* contrasts two visions of Gaia that emerge as a consequence of terraforming. Both narratives situate their terraformed planets far from the solar system and their societies as "future primitivists". Sargent published the final volume of her *Venus* trilogy in 2001, preceded by a short story set in the same universe, "Dream of Venus"

[151] Jack Williamson, *Terraforming Earth* (New York: Tom Doherty Associates, 2003).
[152] Karl Schroeder, *Ventus* (New York: Tom Doherty Associates, 2000).
[153] Liz Williams, *The Ghost Sister* (New York: Bantam Books, 2001).

(2000).[154] The second volume of Baxter's *Manifold* trilogy, *Space* (2000),[155] contains many examples of terraforming conducted by approaching aliens, while Laura J. Mixon's *Burning the Ice* (2002) tells the story of a colony of clones and their efforts to terraform the moon Brimstone.[156] Benford's "The Clear Blue Seas of Luna" (2003) alludes to and incorporates much science from the pages of Fogg's *Terraforming* (to whom this story is dedicated) and Oberg's *New Earths*, thus demonstrating the crucial link between sf and scientific discourse that had by this time become clearly established in terraforming narratives.[157] Larry Niven and Brenda Cooper's *Building Harlequin's Moon* (2005) is reminiscent of Robinson's utopian terraforming narrative and relates a community's efforts to terraform Harlequin's Moon after having become lost in space and unable to locate their rendezvous point with a larger fleet.[158] *Black Man* (2007) by Richard Morgan resonates with Miller's "Cruxifixus Etiam"; in this story Mars has been terraformed and is used as a prison planet.[159] Finally, James Cameron's blockbuster film *Avatar* (2009) recapitulates the tradition of red-green terragouging narratives such as Le Guin's *The Word for World is Forest* and is an indicator of the discursive drift into popular spheres of the related terraforming and Gaian themes.[160]

1.5 The Lay of the Land

Who speaks for the land and for our relation to it? Who has the right to evaluate, judge and initiate a terraforming project that would alter a whole planet and have repercussions for its inhabitants and those involved in and affected by the economic, social and political relationships between that planet and Earth? Terraforming narratives often entail a consideration of economic, social, political and cultural relationships and strategies for negotiation and decision making. Issues of voice, of political and cultural relationships and of the legacy of colonial history are central to the subject matter of

[154] Pamela Sargent, 'Dream of Venus', in *Worldmakers: SF Adventures in Terraforming*, ed. by Gardner Dozois (New York: St. Martin's Griffin, 2001), pp. 394-416.
[155] Stephen Baxter, *Space: Manifold 2* (London: Voyager, 2000).
[156] Laura J. Mixon, *Burning the Ice* (New York: Tom Doherty Associates, 2002).
[157] Gregory Benford, 'The Clear Blue Seas of Luna', in *The Year's Best Science Fiction: Twentieth Annual Collection*, ed. by Gardner Dozois (New York: St. Martin's Griffin, 2003), pp. 313-338.
[158] Larry Niven and Brenda Cooper, *Building Harlequin's Moon* (New York: Tor, 2006).
[159] Richard Morgan, *Black Man* (London: Gollancz, 2007).
[160] *Avatar*, dir. by James Cameron (Twentieth Century Fox, 2009).

terraforming narratives which, through different permutations within and between texts, establish spaces that allow political-cultural issues to be expressed and examined. Ursula K. Heise notes that considerations of place have become increasingly concerned with issues of globalisation, postnationalism and cosmopolitanism and argues for what she defines as an eco-cosmopolitan perspective toward a range of human politics of place that can embrace the "more-than-human-world".[161]

Behind the stories discussed above is a will to transform planets according to a predetermined vision, often one that is homeworld-centric in that new planets are terraformed against a blueprint derived, most frequently, from ecosystems on Earth. This perhaps follows from the definition of terraforming since its proposed goal is to adapt planets to colonising peoples. *The War of the Worlds* exemplifies the exception: the red weed transforms Earth into a new Mars in an act of areoforming. Alternatively, however, and more in line with contemporary scientific knowledge regarding the possibilities of terraforming, planets are transformed according to the possibilities and constraints inherent in their environments: a compromise between the alien and indigenous is reached (often reflected by the entrance of pantropy into the narrative, as in the *Mars* trilogy). Underpinning both cases is a vision that determines the path that this transformation takes.

Given that terraforming is concerned with environments and land use, texts that explore terraforming may draw on environmental concerns and philosophy, especially as it bears on the domain of environmental ethics. Robinson's *Mars* trilogy does this explicitly. On closer examination, however, explorations of environmental ethics in terraforming have much in common with ethical exploration of a range of discourses of othering (racial, gender and socio-economic, for example). All are concerned with reconsidering traditional dualisms, the relationships between moral and political communities and with the project of articulating suppressed voices. Such issues are central to Val Plumwood's *Ecofeminism and the Mastery of Nature*.[162] Environmental ethics wrestles with the dilemma caused by the conflicting needs of communities and with the appropriate relationships between human worlds and nature. Postcolonialism, postnationalism, globalisation and

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[161] Ursula K. Heise, *Sense of Place and Sense of Planet: The Environmental Imagination of the Global* (Oxford: Oxford University Press, 2008), pp. 60-61.
[162] Val Plumwood, *Feminism and the Mastery of Nature* (London: Routledge, 1993).

cosmopolitanism wrestle with the conflict between communities on Earth in the light of a history of colonialism and nationalism. The effects of bringing diverse communities into proximity, groups whose relationships are economically uneven and politically fraught, take on a unique character against this wider historical background and contemporary technological context. Drawing from diverse cultural philosophies that interrogate and offer alternative relationships to the traditional colonial acquisition of land as resources, sf texts incorporating environmental ethics often illustrate an overlap with human discourses of place. Examples include explorations of Native American attitudes to the land and Tibetan, Zen and other forms of Buddhism by Le Guin and Robinson.

This link is also given greater resonance in the context of geoengineering. When we allow that attempts to alter Earth's landscape are also aspects of terraforming it becomes clear that terraforming touches on a major element of all human civilisation. The concept of landscaping relates to terraforming in a direct way under this broader definition. Robinson himself considers terraforming in this vein when, in the final autobiographical short story in *The Martians*, the narrator considers the trees planted alongside the Californian street as '[t]erraforming at its finest'.[163] The ability to alter the landscape and the ethical dilemmas this poses always point toward the future. The fundamental question asked is "How do we want to live?", and it grows from the question "Can we continue living this way?", expressions of concern that encode the anxiety of a negative feedback loop relating to harmful social processes and their impact on the environment.

It is this imaginative vision that aligns the theme of terraforming to the utopian imagination. The assumption behind attempts to transform planets is that change is enacted for the improvement of society. The utopian tradition, like some sf, draws on pastoral and romantic treatments of the landscape that also feed into visions of terraforming. Terraforming allows for the convergence of multiple and often competing themes and positions into a single narrative that engages with political and ecological issues, thus making it central to sf. Fredric Jameson draws on Darko Suvin's connection of sf to utopia and Brechtian estrangement to claim that 'terraforming ought to constitute

[163] *The Martians*, p. 456.

the utopian moment par excellence'.[164] It is important then to consider how this theme is treated and how it relates to an ecological and political awareness.

Chapter two, "'A Fantastic Reflex of Itself, An Echo, A Symbol, A Myth, A Crazy Dream': Terraforming as Landscaping Nature's Otherness", examines ways in which terraforming narratives engage with environmental philosophical concepts. These concepts centre on the notion of nature's otherness and establish the philosophical discourse for the literary critical exploration of humanity's relationship to space adopted in this thesis. Nature's otherness refers to the relationship between humanity and features of the external world, and as such it intersects theories of mimesis and (postmodernist) constructivism. Nature's otherness enters into texts via the representation of non-human others, either as abiotic or biotic forms of nature. Exploring how terraforming first appears in the scientific romances of Wells and Stapledon alongside metaphorical proto-Gaian imagery and the depiction of literal living worlds, the first subsection, "Terraforming as a Site for Environmental Philosophical Reflection in H.G. Wells's *The Shape of Things to Come* and Olaf Stapledon's *Last and First Men* and *Star Maker*", views nature's otherness in cosmological terms and connects this to ideas of the sublime. The subsection "Proto-Gaian Themes in Scientific Romance and The American Pulp Cluster" shows how this motif is developed in two further works of scientific romance, Shiel's *The Purple Cloud* and Doyle's "When the World Screamed". Comparing these two stories to Hamilton's "The Earth-Brain", Williamson's "Born of the Sun", and Manning's "The Living Galaxy" helps illustrate the shift in emphasis from the Burkean and Kantian sublime to sf's technological sense of wonder in 1940s pulp sf. The last section of this chapter considers the decline of the proto-Gaian theme during the postwar period by comparing Leinster's "The Lonely Planet" and Bradbury's "Here There Be Tygers" to Lem's *Solaris*. These depictions of alien otherness draw on ideas of the sublime and grotesque to explore alternative conceptions of nature when viewed in a cosmological sense.

Hailwood argues that nature's otherness need not be "alien" nor "unfamiliar", and he defines the value of nature's otherness as extrinsic, relational, non-instrumental and objective.[165] He argues

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[164] Fredric Jameson, '"If I Find One Good City I Will Spare the Man": Realism and Utopia in Kim Stanley Robinson's *Mars* Trilogy', in Patrick Parrinder, *Learning From Other Worlds: Estrangement, Cognition and the Politics of Science Fiction and Utopia* (Liverpool: Liverpool University Press, 2000), pp. 208-232 (p. 220).

that respecting nature's otherness involves recognising its autonomy and no-teleology. These two concepts are taken from philosopher Keekok Lee's three axioms: the Asymmetry, Autonomy and No-Teleology Theses. The assumptions underlying these theses can be unpacked with reference to Plumwood's examination of the hierarchical logic of dualism, which she argues corresponds to classical propositional logic. This hierarchical structuring has served, 'in Rosemary Radford Ruether's words, to "naturalise domination", to make it part of the very natures and identities of both the dominant and subordinated items and thus to appear to be inevitable, "natural"'. One of the reasons Plumwood analyses the historical bases of dualism is that 'the ancient forms do not necessarily fade away because their original context has changed; they are often preserved in our conceptual framework as residues, layers of sediment deposited by past oppressions'. She presents five operations by which 'dualism, the construction of a devalued and sharply demarcated sphere of otherness' is conducted: backgrounding (denial), radical exclusion (hyperseparation), incorporation (relational definition), instrumentalism (objectification), and homogenisation or stereotyping.[166] Instrumentalism in terms of value theory corresponds to Plumwood's instrumentalising dualistic operation; both contravene the Autonomy Thesis. Extrinsic worth is compatible with a relational definition, although in Hailwood's sense it does not involve the backgrounding of nature's otherness or its radical exclusion (nature's otherness can feature as elements of human landscapes).

The next chapter, "The American Pastoral and the Conquest of Space: Consensus Futures of the 1950s Terraforming Boom", is divided into three sections. The first, "The Garden of the World in the Terraforming Stories of the Early 1950s", examines how Bradbury's *The Martian Chronicles*, Heinlein's *Farmer in the Sky* and Clarke's *The Sands of Mars* draw on the intersection between colonialism and the American pastoral to explore ideas of terraforming and independence from Earth. "The Burden of Hope in the Garden of the Chattel: 1950s Consensus Dystopias", shows how Frederik Pohl and C.M. Kornbluth's *The Space Merchants*, Anderson's "The Big Rain" and *The Snows of Ganymede* and Miller's "Cruxifixus Etiam" invert the optimism of space colonisation evident in Heinlein and Clarke's texts by drawing on pastoral and dystopian imagery to depict the failures of

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[165] Simon Andrew Hailwood, *How to Be a Green Liberal: Nature, Value and Liberal Philosophy* (Chesham: Acumen, 2004), p. 35.
[166] Plumwood, p. 42, 32, 43, 41.

colonisation. Encounters with extraterrestrial life are connected to the terraforming motif, though it is not an essential component. Nonetheless, inhabited worlds pose significant philosophical problems for terraforming other worlds. These concerns are not absent from Bradbury, Heinlein and Clarke's texts but they begin to receive a distinctly different emphasis by the late 1950s. Daly and Frodeman note that discussions of natural spaces often turn on questions of intrinsic and instrumental (utilitarian) value, and that a focus on intrinsic value has tended to lead to "ethical extensionism". Ethical extensionism 'depends on human definitions of moral considerability, which typically stem from some degree of identification with things outside us'.[167] Identification with nature opposes a respect for nature's otherness that is based on recognising difference but does not completely exclude viewing nature as other to humankind. Subsection three, "Moral Extensionism in Terraforming Stories of the Late 1950s and Early 1960s", examines the shift in the way in which the ethical insights developed by the early terraforming narratives' investment in the exploration of cultural and political environments is extended to the landscape and the alien otherness of their indigenous populations. This subsection links aspects of the pastoral to environmental philosophical speculation.

"Ecologies and the Growth of Environmental Awareness in the Transitionary 1960s-1970s Terraforming Narratives", chapter four, is split into two sections that build on the themes of chapters one and two. The first reads Cameron's *Avatar* against the proto-Gaian and terragouging narratives of the 1960s-1970s: McKenna's "The Night of Hoggy Darn" and "Hunter, Come Home", White's "Meatball" and "Major Operation" and Le Guin's "Vaster Than Empires and More Slow" and *The Word for World is Forest*. The discussion then shifts to an analysis of ecology and politics in the seminal *Dune* trilogy before moving on to consider Heinlein's *The Moon is a Harsh Mistress* and Le Guin's *The Dispossessed* and their exploration of anarchism and independence as alternatives to the instrumentalising imperialism of *Dune* . In these texts the link between politics, the pastoral and terraforming first shaped by the works of the 1950s terraforming boom undergo a transformation in the light of counter-cultural influences and the popularisation of environmentalism.

This thesis concludes with chapter five, "Edging Toward an Eco-Cosmopolitan Vision in 1980s-1990s Terraforming Narratives", which examine transformations of the terraforming motif that

[167] Daly and Frodeman, p. 140.

are rooted in the wider cultural impact of the modern environmental movement and the increasingly widespread popularisation of Lovelock's Gaia hypothesis. Terraforming as an act of worldbuilding resonates with the utopian impulse to remake socio-political worlds. It lies in tension with the urge to explore space and to further push back human frontiers. Those who choose terraforming must stay and work to create a habitable planet and equitable society, participate in the continuation of damaging forms of socio-political structures or preserve the planet in as much of its original form as possible. Those who leave must abandon these societies indefinitely: Robinson's *Blue Mars* and Pamela Sargent's *Child of Venus* feature characters who confront this dilemma. Beginning with a consideration of Allaby and Lovelock's *The Greening of Mars*, this chapter explores the continued investment in the utopian structure of terraforming and its links with the sciences and environmental philosophy. By comparing Sargent and Robinson's landmark trilogies, this chapter engages with the growing awareness of the philosophical limitations of terraforming. These works articulate a sense of complexity and conflict that accompanies an awareness of the plurality of visions for the future. Ultimately this thesis aims to show how the terraforming motif is used to explore philosophical ideas about culture and politics, habitation and the environment.

2. 'A Fantastic Reflex of Itself, An Echo, A Symbol, A Myth, A Crazy Dream': Landscaping Nature's Otherness in Pre-1960s Terraforming and Proto-Gaian Narratives

The 1960s saw the consolidation of a growing awareness of environmentalism: Rachel Carson's 1962 *Silent Spring* is often cited as the popularising text for the American environmental movement while James Lovelock dates the originary idea for his Gaia hypothesis to 1965. Over the course of the seventies and eighties the writings of these two scientists significantly influenced the developing environmental movement, if not always in ways that Lovelock approved of, yet prior to the 1960s European sf had engaged with ideas anticipating modern environmental philosophy and Gaia. Anna Bramwell, in her history of ecology, traces the growth of ecological awareness from its origins in the 1880s, noting how the scientific romances of writers such as H.G. Wells incorporated ecologically inflected concepts into their narrative explorations of the relationship between nature and politics. Bramwell differentiates between ecologism, which is concerned with global social and economic change, and environmentalism, which diverged from ecologism in the 1930s to focus on specific problem solving at localised political levels. [1] Also anticipated in sf featuring early treatments of the motif of terraforming is the concept of nature's otherness, which directly opposes the interconnectedness implied by deep ecological views of Gaia.

Through the theme of ecological interconnectedness, links have been forged between holist approaches to the physical sciences raised by the Gaia hypothesis and the deep ecology movement of environmental philosophy. Val Plumwood notes that 'dominant forms of deep ecology choose for their core concept of analysis the notion of identification, understood as an individual psychic act rather than a political practice'.[2] Because deep ecology's notion of identification can sometimes obscure nature's otherness, identification with nature poses several philosophical problems when recognition of nature's otherness is factored into considerations of human relationships to non-human

[1] Anna Bramwell, *Ecology in the 20th Century: A History* (London: Yale University Press, 1989; repr. 1990), pp. 230-231, 104-105.
[2] Val Plumwood, *Feminism and the Mastery of Nature* (London: Routledge, 1993), p. 17.

nature. In its weaker formulation, recognition of nature's otherness can be considered a form of deep ecology when it is understood simply as an attention to 'the interconnectedness of the natural world (as in some sense the bearer of non-instrumental value) and humanity's place within it, so as to effect fundamental social change that will bring humanity to its proper place'.[3] Citing Bill Devall and George Sessions' claim that, '"to the extent that we perceive boundaries, we fall short of deep ecological consciousness"', Hailwood argues that stronger forms of holism often associated with the Gaia hypothesis are incompatible with the recognition of difference involved in conceptions of nature's otherness.[4]

This chapter considers terraforming and proto-Gaian themes in the work of four influential writers of scientific romance, H.G. Wells, Olaf Stapledon, M.P. Shiel and Sir Arthur Conan Doyle, before moving on to a consideration of how the American pulp sf of the interwar period borrows and adapts these ideas in specific works by Edmond Hamilton, Jack Williamson and Laurence Manning, three significant shapers of the 1930s space opera. This discussion concludes by moving beyond the interwar period to consider how the themes explored by these writers were taken up during the postwar period by Murray Leinster, Ray Bradbury and Stanislaw Lem. The aim of this enquiry is to ask how sf has explored the concept of nature's otherness and anticipated themes later incorporated into the Gaia hypothesis; specifically how the movement from the scientific romances to the American pulp sf of the 1930s, and the postwar sf prior to 1962, involves a transformation of the status and function of these themes in the context of the investigation into nature and humanity engaged in by specific works.

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[3] Simon Andrew Hailwood, *How to be a Green Liberal: Nature, Value and Liberal Philosophy* (Chesham: Acumen, 2004), p. 36.
[4] Bill Devall and George Sessions, 'Deep Ecology', in *Environmental Ethics: What Really Matters, What Really Works*, ed. by David Schmidtz and Elizabeth Willett (Oxford: Oxford University Press, 2002), pp. 120–125 (p. 121).

2.1.1 Terraforming as a Site for Environmental Philosophical Reflection

Many thinkers have used terraforming as an experimental site for the exploration of science and philosophy. This approach trades on the classic proposal that sf functions as a literature of ideas providing textual spaces for thought experiments in the *conte philosophique* tradition (the philosophical short story). Erin Moore Daly and Robert Frodeman argue that space exploration and environmental ethics were generated from a closely related set of socio-economic and historical factors and that, 'before the launching of Sputnik in 1957, philosophic consideration of space was lodged within the science fiction literature of H.G. Wells, Jules Verne, Ray Bradbury, Arthur C. Clarke, and others'.[5] Daly and Frodeman outline the various ethical positions toward the terraformation of both lifeless (abiotic) planets and planets that support microbial life. In the process they show how this debate tends to orbit notions of intrinsic value, the worth an object has by virtue of its inherent properties.

Both David Grinspoon and Christopher P. McKay support the introduction of life to otherwise uninhabited planets, while Robert Zubrin takes a stronger position by supporting the introduction of life to planets already inhabited by microbial life. Holmes Rolston III contests this view and argues that the habitation of lifeless planets should be avoided while another preservationist, Alan Marshall, strictly opposes any sort of interference whatsoever. Martyn Fogg counters this view by pointing out that such arguments 'are often misanthropic critiques of human nature' or 'sentimental illusions based on out-of-date ecology'; he argues that abiotic nature cannot have intrinsic value because it cannot think, act, or care.[6] While Robert Sparrow notes the 'shocking moral bankruptcy' that terraforming scenarios highlight, the arguments he forwards do not preclude the possibility of terraforming, but rather 'suggest that we examine ourselves and how the project reflects on our character before we undertake it'. He explains that, '[i]f for instance, terraforming were a project undertaken with genuine reluctance, in full knowledge of what was being destroyed, because

[5] Erin Moore Daly and Robert Frodeman, 'Separated at Birth, Signs of Rapproachement: Environmental Ethics and Space Exploration', *Ethics & the Environment*, 13.1 (2008), 135-151 (p. 137).
[6] Daly and Frodeman, pp. 146-147, 147.

no alternative existed for the survival of the human race', such projects would not demonstrate hubris or aesthetic insensitivity and would therefore be a legitimate, if regrettable, action.[7]

Daly and Frodeman point out that while abiotic nature may not have intrinsic value, 'the *relatedness* of nature and natural objects to human beings' may be grounds for a relational, extrinsic value: '[w]e may be confident that rocks do not think, or have values of their own. But humans can nonetheless value rocks for their own sake – they can be experienced as beautiful, sublime, or sacred'.[8] These aesthetic categories are certainly important responses to abiotic nature, and they have traditionally provided an arena for environmental philosophical debate for thinkers such as Allen Carlson, Stan Godlovitch, Yuriko Saito, Thomas Heyd and Patricia M. Matthews. Nevertheless, there are also grounds for arguing that Hailwood's concept of nature's otherness provides for such an extrinsic, relational value to be accorded to both biotic and abiotic nature without relying on appeals to aesthetic value. Hailwood argues in *How to be a Green Liberal* that nature, albeit a social construction, also possesses an aspect that cannot be reduced to the social sphere, what he calls "nature's otherness". Although Hailwood has noted that nature is present '"from the streetcorner to the stratosphere"' and that nature's otherness is therefore a property of familiar, unfamiliar and alien examples of nature,[9] Godlovitch summarises the essence of the relationship when he claims that 'Nature is, for us, fundamentally inaccessible and alien'.[10] Sf's investment in otherness makes this notion particularly useful for critical consideration of specific works from an environmental philosophical perspective. Through the deployment of various iconic sf others, such as the robot, the alien or the adapted human, sf has engaged with the politics and philosophy of otherness from several theoretical positions, including those of feminism, postcolonialism and ecocriticism. In contrast to human centred critiques, sf viewed from ecocritical perspectives interrogate anthropomorphism and can be seen as anti-humanist in McKay's sense of the term: '[h]umans have no special rights or needs

[7] Robert Sparrow, 'The Ethics of Terraforming', *Environmental Ethics*, 21.3 (1999), 227-245 (pp. 239, 240).
[8] Daly and Frodeman, p. 147.
[9] Hailwood 2004, p. 35.
[10] Stan Godlovitch, 'Icebreakers: Environmentalism and Natural Aesthetics', *Journal of Applied Philosophy*, 11.1 (1994), 15-30 (p. 19).

and do not determine the value of the environment'.[11] Nevertheless, there are significant intersections between these positions, and in much sf they often work mutually to support each other.

Keekok Lee uses the example of terraforming to examine nature's value when nature is understood to encompass other parts of the solar system. She notes that many environmental ethicists find it 'deeply problematic to argue that abiotic Nature could have intrinsic value' because it is a property more often accorded to biotic life. Addressing McKay's observation that environmental axioms tend toward a narrowly Earthbound environmental ethics, Lee uses the example of terraforming because 'an environmental ethics informed by features unique to Earth may be misleading and prove inadequate as technology increasingly threatens to invade and colonize other planets in the solar system'. She begins her account by proposing that 'Mars has no organic life and, therefore, it follows, no intrinsic value'. Developing this line of thought, Lee considers that it may be morally permissible to produce biotic life in places where it has undergone degradation; from here it is a short but unwarranted leap to the rhetorical question, 'if such permission [for nature's restoration] obtains on Earth, why not Mars?'. The aim of Lee's account is to explore the necessity for an environmental ethics that 'confront[s] the issue of abiotic or inanimate Nature as a locus of intrinsic value'.[12]

2.1.2 The War on Nature in Wells' *The Shape of Things to Come*

The interwar period hosted a debate between two strands of ecologism. The first is a monism that can be traced back to Ernst Haeckel and his student Hans Dreisch, the latter of whom popularised ecological vitalism in Germany and in a series of lectures in Scottish and English universities till 1913. The other strand derives from energy economics, itself based on recognition of the finiteness of Earth's resources and on notions of entropy, ideas that were often taken to imply a mechanistic view of nature. Bramwell argues that Wells and Stapledon drew from the energy economics prevalent

[11] Christopher P. McKay, '2. Does Mars Have Rights? An Approach to the Environmental Ethics of Planetary Engineering', in *Moral Expertise: Studies in Practical and Professional Ethics*, ed. by Don MacNiven (London: Routledge, 1990), pp. 184-197 (p. 188).
[12] Keekok Lee, 'Awe and Humility: Intrinsic Value in Nature. Beyond an Earthbound Environmental Ethics', *Royal Institute of Philosophy Supplement*, 36 (1994), 89-101 (pp. 90, 89, 91, 91, 92).

during the interwar period and cites Wells as an example of the scientific utopians who preferred strategies of global planning conducted by a scientific elite.[13] Wells was a member of the Fabian society, an organisation that shared with the Monist league (which inspired Haeckel's ecological vitalism) Wells' trust in the utopianism of a cadre of scientists who would bypass the contemporary political process. Wells' *The Shape of Things to Come* (1933) is a future history that recounts an episode of "geogonic planning" during the world state's technocratic management of Earth.[14] This example of terraforming is a form of geoengineering embarked on after a long period of war and global political unification leads toward a scientific utopia. Wells sent a copy of this text to his correspondent and admirer Olaf Stapledon,[15] whose *Last and First Men* (published in 1930 and thus predating Wells' own work) and *Star Maker* (1937)[16] utilise narrative features of the future history within a cosmic context as part of their design as "essays in myth creation".[17] Stapledon incorporated into *Last and First Men* elements of J.B.S. Haldane's scientific paper "The Last Judgement" (1927),[18] which proposes the possibility of terraforming Venus, combining it with J.W. Dunne's speculations on alternative temporalities and prescient dreaming in *An Experiment With Time* (1927).[19] Unlike Wells' reliance on energy economics, Stapledon's texts are indebted to vitalist philosophies that emphasised notions of a life-force underpinning conceptions of nature.

The Shape of Things to Come features episodes of geoengineering representing the culmination of civilisation's effort to address a deep-rooted anxiety toward nature. This anxiety underlies a complex of environmental relations and effects that appear in earlier phases of civilisation's development, such as the colonial appropriation of resources, international war and the dramatic reduction of species diversity and their environments. At a late stage of the world state's growth, Earth is described in a way that justifies the physical mastery of the planet and confirms the

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[13] Bramwell, pp. 54, 65.
[14] H.G. Wells, *The Shape of Things to Come* (London: Corgi, 1967), hereafter referred to as *Shape*.
[15] Olaf Stapledon, Letter to Wells dated 24.4.36 in *The Olaf Stapledon Collection*, Liverpool, Sydney Jones Library Special Collections and Archives, University of Liverpool, OS/H4/3/5.
[16] Olaf Stapledon, *Last and First Men* (London: Penguin, 1966) and *Star Maker* (Connecticut: Wesleyan University Press, 2004), hereafter referred to as *Last* and *Star* respectively.
[17] Brian Stableford explains that these essays in myth creation 'construct imaginary worlds to embody metaphysical theses' (Brian Stableford, *Scientific Romance in Britain 1890-1950* (London: Fourth Estate, 1985), p. 138).
[18] J.B.S. Haldane, 'The Last Judgement', in *Possible Worlds and Other Essays* (London: Chatto & Windus, 1927), pp. 287-312.
[19] J.W. Dunne, *An Experiment With Time* (London: Papermac, 1981).

socio-political system supporting the state: '[f]rom the air on a map it was manifest that the world was still 'governed'. The road system was like a net cast over a dangerous beast'. The endeavour to govern nature by metaphorically ensnaring it with a planetary road system is symptomatic of humanity's fundamental dependence on a hostile environment. An example of such dependence appears in the chapter "1933: Progress Comes to a Halt", where the narrator highlights a representative instance of 'a terrific defeat for [a town near Cardiff] in the war upon Nature'.[20] This event, in which a local mine explodes and kills three hundred people, stands as a microcosm for humanity's dependence on and subjugation to natural forces. The text's fictionalisation of the difficulty of recovering economic and social wellbeing in the wake of the Great War of 1914-1918 enlarges the scope of humanity's vulnerability to nature when the civilisation that is built upon it collapses. These local and international events exemplify civilisation's physical fragility. The threat symbolised by the emblem of Earth as a dangerous beast signifies an uneven human relationship to nature. As a consequence of humanity's "war against nature", civilisation's changing technological abilities allow them to mitigate this dependence on and vulnerability to their environment.

The emblem of the ensnaring road system is a landscape that symbolises progress. The world state's political unification and technological proficiency is seen as the solution to humanity's difficult adaptation to nature. Roads overcome spatial constraints and consequently unify disparate nations by facilitating travel and communication over long distances. In contrast to the Modern World State's saner technological utopia the narrator identifies the underlying reason for the old socio-political order's failure to overcome both nature and civilisation's fragility as a disparity between two forces:

> The great processes of mechanical invention, which have been described in our general account of the release of experimental science from deductive intellectualism, were increasing the power and range of every operating material force quite irrespective of its fitness or unfitness for the new occasions of mankind.[21]

The argument here is that growing technological power unaccompanied by a corresponding increase in the intellect necessary to manage the repercussions of that power lead civilisation to war and socio-political collapse. During the ascendancy of the Modern World State the dialectic between humanity

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[20] *Shape*, pp. 442, 132.
[21] *Shape*, pp. 48-49.

and their environment becomes subject to civilisation's increasing influence, which allows humanity to overcome the failures of the old socio-political order. The application of technologies capable of altering the planet's environments offer opportunities for directed human evolution; the narrator speculates that 'an increase in desirable habitats may bring with it an increase in the variety of desirable human types'. The dialectic underlying civilisation turns on evolution, which governs the relationship between the human and the non-human and which is in turn connected to ideas of progress, 'the essential and permanent conflict in life between the past and the future, between the accomplished past and the forward effort'.[22] The developing world state embodies this conflict as it attempts to redress the imbalances between technological capability and its fit use wrought by the excesses of the old order.

The Transport Control fails to effectively maintain global unity, eventually ceding to an enlightened scientific community capable of better managing Earth's resources. This saner, more reflective humanity is able to resolve many environmental and geopolitical problems. Recapitulating economist Henry George's metaphor of the Earth as a well-provisioned ship sailing through space (itself anticipating the image of Spaceship Earth), which appeared in his 1879 *Progress and Poverty*,[23] the narrator explains that this new government establishes a way of living that shows how '[t]his planet, which seemed so stern a mother to mankind, [was] discovered to be inexhaustible in its bounty. And the greatest discovery man has made has been the discovery of himself'. This vision of nature remains instrumental, as it is considered both a resource and an object for autological speculation, which reflects concern onto the study of the human self. The socio-political sphere is mapped against nature through its structuring as a metaphorical "ecology".[24] As humanity is better able to manipulate the planet

> [h]istory becomes a record of increasingly vast engineering undertakings and cultivations, of the pursuit of minerals and of the first deep borings into the planet. New mechanisms appeared, multiplied, and were swept away by better mechanisms. The face of the Earth changed.[25]

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[22] *Shape*, p. 455, 54.
[23] Henry George, *Progress and Poverty* (New York: Doubleday, 1912) <http://www.econlib.org/library/YPDBooks/George/grgPP.html> [accessed 26 April 2011], para IV.II.21.
[24] *Shape*, pp. 487, 290
[25] *Shape*, p. 413.

Despite these changes and the early exploration and mapping of 'the last *terra incognitae*', Earth for the Second Council was 'a world of promise still to be fulfilled'. An early anticipation of geoengineering appears in a brief chapter titled "Geogonic Planning", in which the '[m]odification of the planet-levels operating in conjunction with the restoration of forests now in progress' is considered. Here, the world state's plans for planetary engineering remain a dream of 'moulding a fire-sprouting, quivering planet closer to the expanding needs of man'.[26] Geogonic planning represents a stage in the development of civilisation in which "deductive intellectualism" directs the use of technology, thus allowing humanity to alter nature to provide ideal foundations for a scientific utopia whose expansion is charged with colonial ideology. In either case the form of progress that is advanced here, evident from the landscaping analysed by the narrator, is a response to the asymmetrical relationship between humanity and non-human nature that disrespects nature's autonomy. Nature in this context is Earthbound and non-human. Human relationships to nature tend to be instrumental, with nature functioning as a resource and background to civilisation. Human dependence on this beastlike non-human nature exacerbates the dangers that nature poses to civilisation, imagined as a sharply demarcated entity. This understanding of nature attempts in part to account for the failure of "The Age of Frustration" to realise its project of progress.

The Shape of Things to Come was adapted into the well-received film *Things to Come* in 1936, which popularised the broad themes of Wells' future history. It portrayed the decline of civilisation after war and the struggle from "barbaric" nation states toward a scientific world civilisation riddled by widespread disaffection with the dominant ideology of progress. This film staged a debate over the worth of science for society and retains a sense of asymmetry between humankind and nature. The rise of the scientific age is preceded by a period of rebuilding described as 'an active and aggressive peace' in which all the Earth's resources are tapped to 'put the world in order'. Theotocopulos, the leader of a rebellion against continuing progress in the year 2036, concedes that this age of 'machines and marvels' had conquered nature and built 'a great white world' of artificially lighted underground cities, thus replacing nature's threatening otherness with a construct rigidly controlled by technology. The conflict in this future age centres on a rebellion against progress

[26] *Shape*, pp. 51, 445, 454, 455.

that is expressed as a desire for the destruction of a "space gun", the world civilisation's first attempt at interplanetary travel and a symbol of continuing scientific progress. Theotocopulos' arguments centre precisely on the Promethean fear that cosmological nature engenders: anticipating further journeys into space that the success of the space gun would portend, Theotocopulos foretells in a public speech that 'the time will come when you and your turn will be forced to take their chance upon strange planets, on dreary, abominable places beyond the stars'.[27] This ideological opposition revolves around the idea of the colonisation and shaping of other worlds in the future, a possibility that is ultimately endorsed by the film's climax. Contesting notions of progress with ideas of freedom, rest and safety, Theotocopulos argues that the effects of the sacrifice of human lives to technological and scientific progress will eventually expand to alter the face of the whole world once again, thus forcing the majority who are content with the current state of affairs to adapt to new conditions. These primarily social concerns are symbolically invested in a confrontation with untamed nature. The conquerors of the old world order, who directed their mastery toward other societies, is replaced by a government that attempts to dominate first local, then increasing scales of nature, before this tendency culminates in an expansion outward toward space. Oswald Cabal, the grandson of the legendary John Cabal who inaugurated the scientific age, argues that any life worth living must continue to advance, and that this advance can only be achieved by facing death, the symbol of which is space. It is only through striving for continual expansion outward toward the stars that living can be made worthwhile.

Lee's Asymmetry Thesis claims that while humans are dependent on nature, nature is not similarly dependent on humanity: '[n]ature's own existence and functioning integrity is independent of human existence'. The Autonomy Thesis builds on this by stating that 'the Earth and its extremely complex biosphere are fully autonomous'. Lee uses the example of human extinction to point out that nature would continue to operate in the absence of humanity. She defines autonomy here as nature's 'ability to exist, to function integratively and well without any reference to, assistance from or reliance on humans'.[28] These works recognise the Asymmetry Thesis by demonstrating humanity's dependence on Earth while representing Earth's existence as independent of humanity, although it

[27] *Things to Come*, dir. by William Cameron Menzies (London Films, 1936).
[28] Lee, p. 93.

does illustrate nature's physical fragility through its devastation by war and humanity's adaptation of its surface. It also shows a disrespect of the Autonomy Thesis and nature's otherness in that Earthbound nature is only valuable instrumentally: as a condition for ensuring human comfort and as a space in which humanity can, narcissistically, reflect on their own mind. While this reflection is not in itself problematic, these works take the extra step of disregarding the way in which these human landscapes do not completely account for nature as an autonomous non-human other, thus contributing to an attitude that leads to its domination. The emblem of Earth as an imprisoned beast and the theme of civilisation's war against nature are reactions against this asymmetry and responses that curtail nature's autonomy. Hailwood suggests that nature's otherness can be usefully predicated on the Autonomy and No-Teleology Theses (the latter discussed below), but that the additional Asymmetry Thesis could lead to a Promethean fear that would justify the domination of nature in order to counter its threatening aspect.[29] This dynamic is amply demonstrated by the notion of progress and its entailments depicted in *The Shape of Things to Come* and its cinematic counterpart.

2.1.3 Nature's Otherness and Terraforming in Stapledon's *Last and First Men* and *Star Maker*

In *The Shape of Things to Come*, relationships to nature are understood in the context of a universalising progress that remained a dominant trend in much sf, especially in the context of terraforming and Gaia. Stanislaw Lem would later attack this theme in *Solaris*, parodying it through Sartorious' account as 'the long historic march of humanity'.[30] The "War on Nature" theme appears again in Stapledon's *Last and First Men*, in which the eighth men's terraforming of Neptune is described as 'the story of man's attack upon his final home'.[31] This attack, following the earlier terraforming of Venus, grows from a similar anxiety toward nature depicted in Wells' text, although nature in Stapledon's is non-human in a cosmological and not Earthbound sense. *Last and First Men* and *Star Maker* examine human nature from vast evolutionary perspectives, thus providing a vector

[29] Hailwood 2004, p. 31.
[30] Stanislaw Lem, *Solaris* (London: Faber & Faber, 2003), p. 167.
[31] *Last*, p. 271.

for considering the various meanings attached to the concept of human nature. The metaphysical theses that Stapledon considers in these works open up spaces that converge with contemporary environmental philosophical speculation.

Stapledon's *Star Maker* engages in significant ways with speculation on cosmological nature's alien otherness. Metaphorical proto-Gaian images appear in *Star Maker*, resonating with Wells' references to Earth as a "beast" and a bountiful mother. When Stapledon's narrator leaves Earth and sees 'a creature alive but tranced and obscurely yearning to wake', he refers to an impression that would accrue symbolic resonance with Gaia. Stapledon uses this image to speculate on "awakened worlds", in which the intelligent population of a planet attains communal consciousness. Representations of stellar intelligences, stars that the narrator learns 'are best regarded as living organisms, but organisms which are physiologically and psychologically of a very peculiar kind' also appear in the narrative.[32] Conversely, the figure of the Star Maker is quite different from these Gaian images: its ability to create worlds and universes align it with terraforming, and in a sense conception of the Star Maker embodies the human dream of worldbuilding seen as a godlike and hubristic endeavour. This notion, which becomes central to many later terraforming narratives, is linked to the concept of nature's otherness and is connected to Stapledon's meditations on spacetime and origins. *Star Maker* magnifies the scale of spacetime portrayed in *Last and First Men*; it extends the consideration of alien civilisations by using the device of a disembodied narrator who eventually merges with the consciousness of other aliens to form a pan-psychic cosmic mind. Their search for the Star Maker ends with a vision of a being of vast power which, over the course of many experiments in universe creation, matures to fulfil its potential. The narrator experiences the sublime when confronting the Star Maker; its presence in the text operates as an emblem of nature's otherness. The narrator's various theories about this being are attempts to encompass its alien otherness with intellectual landscapes.

Stapledon's *Last and First Men*, predating *The Shape of Things to Come* and known to Wells, chronicles two billion years of humanity's fluctuating development 'from savagery towards

[32] *Star*, pp. 15, 271, 194.

civilization'.[33] Human nature for Stapledon is subject to the vagaries of the cosmos, to socio-economic, cultural and political influence and to philosophical ideas that underlie and provide the moral imperative driving civilisation's activity. Against changing physical environments Stapledon explores the beliefs that apparently justify the oppression of both human and non-human others. He traces the intra-human and extraterrestrial conflicts and the ensuing crises that lead to key events determining humanity's future adaptation of nature. Stapledon also raises questions of dominance related to the mastery of nature offered to human civilisations through the development of progressively more advanced forms of technology. As in Wells' book and film adaptation, the overarching philosophical vision explored in *Last and First Men* is important as the later terraforming episodes function as an extension of earlier tendencies exhibited during episodes set on Earth. Stapledon traces the rise and fall of civilisations in a series of cycles to juxtapose each human species' character in abstracted form.

The narrator declares that *Last and First Men*'s aim is to 'help you to feel not only the vastness of time and space, but also the vast diversity of mind's possible modes'.[34] Such vastnesses operate as a conceptual contrast to humanity's relative insignificance, a precondition for the variety of evolved human types, and as a signifier of the sublime. The threat that cosmological nature poses to humanity spurs their search for greater powers of manipulation over the physical universe. The narrator explains that

> [Humanity's] existence has ever been precarious. At any stage of his career he might easily have been exterminated by some slight alteration of his chemical environment, by a more than usually malignant microbe, by a radical change of climate, or by the manifold effects of his own folly.[35]

Terraforming, seen in the context of a history of technologies designed for the purpose of controlling nature, is a technologically sophisticated answer to the Asymmetry Thesis. Wells' *The Shape of Things to Come* shares the theme of civilisation's fragility, prominent in later terraforming narratives and central to stories of ecotastrophe. This sense of human insignificance and fragility, compared to

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[33] *Last*, p. 21, pp. 276-277.
[34] *Last*, p, 17.
[35] *Last*, p. 314.

the vastnesses of cosmological nature, is a major theme of both of Stapledon's texts and raises issues pertinent to Lee's Asymmetry and Autonomy Theses.

The narrator of *Star Maker* begins with some reflections on cosmological nature and human insignificance that bear on the problem of an individual's sense of place within a cosmic schema:

> Considered even without reference to our belittling cosmical background, we were after all insignificant, perhaps ridiculous.
> […]
> Even the cold stars, even the whole cosmos with all its inane immensities could not convince me that this our prized atom of community, imperfect as it was, short-lived as it must be, was not significant.[36]

This cosmological indifference is set against a localised, human significance endued by the community of marriage, that 'intricate symbiosis'. Recognition of nature's indifference thus stated is anti-humanist in McKay's sense, but not misanthropic; it is the first step toward a critical examination of the human individual and community and their place as part of an indifferent cosmological nature. In a reference to *Last and First Men* in *Star Maker*, this theme is again addressed in relation to the largest unit of community: '[a]ll this long human story, most passionate and tragic in the living, was but an unimportant, a seemingly barren and negligible effort, lasting only for a few moments in the life of the galaxy'.[37] The total human community, a category inclusive of alien societies in Stapledon's work, is insignificant from the perspective of the cosmos, thus spurring civilisation's efforts to overcome their limitations.

This feeling of human insignificance motivates humanity's intervention with the physical world in *Last and First Men*:

> For, although they themselves were more long-lived than their predecessors, the Second Men were oppressed by the brevity of human life, and the pettiness of the individual's achievement in comparison with the infinity round about him which awaited apprehension and admiration.[38]

The ambivalent feeling of 'apprehension and admiration' for nature's otherness recognises a nature independent of humanity's needs and desires: non-human cosmological nature is fully autonomous and possesses an asymmetrical relationship to humanity. Alternative readings of 'apprehension' as a

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[36] *Star*, p. 9.
[37] *Star*, pp. 7, 184.
[38] *Last*, p. 147.

synonym for perception leading to appropriation suggest that human responses to nature's otherness combine attempts to understand and control that nature with a respectful admiration predicated on a feeling of the sublime in response to infinity and vastness. Godlovitch suggests that a culture-inspired, centric natural aesthetic is necessarily 'accountable to and acceptable only within the bounds of human perception and human apprehension' and is therefore arbitrary.[39] Stapledon's cosmic perspective allows multiple cultural approaches to nature to be explored while retaining a sense of the contingency and limits involved in the landscaping of nature's otherness.

In keeping with this focus on vast time periods, Stapledon depicts human societies as progressing through several permutations of pastoral, agricultural and industrial stages, and through several types of governments, including medieval and cosmopolitan structures. The second men are envisioned at one point as 'noble savages, [who] then passed rapidly through the pastoral into the agricultural stage'.[40] Each of these stages is marked by crises in which development past a critical point depends on humanity overcoming their natural response to new technologies and socio-political clashes, as well as their ability to flexibly adapt to the physical world and manage natural resources. Nations progress through periods of nationalist, regional, and then world-state governments and, toward the end of the text, a global society turns toward the vast project of colonising space and terraforming other planets. The second men, in contrast to the first,

> were fortunate in their almost complete immunity from the lust of power and personal ostentation (which cursed the earlier species with industrialism and utilitarianism), and though they enjoyed long ages of idyllic peace, often upon a high cultural plane, their progress towards full self-conscious mastery of the planet was curiously slow.[41]

Last and First Men draws major oppositions between industrial stages informed by instrumental values of progress versus utopian or idyllic stages, and between intellectual versus philosophical tendencies. Terraforming is often predicated on attempts to gain mastery over nature, although in *Last and First Men* Stapledon presents another complementary motivation for planetary adaptation.

The fifth men terraform Venus in order to escape the impending collision of the Moon with Earth. This catastrophe forces them to make a choice that will determine the future development of

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[39] Godlovitch 1994, p. 18.
[40] *Last*, p. 139.
[41] *Last*, p. 138.

human civilisation: '[i]t was necessary either to remake man's nature to suit another planet, or to modify conditions upon another planet to suit man's nature'. They deem it impossible to alter any existing human for habitation of either Mars or Venus and decide that terraforming Mars would require them to bring water and air in quantities that would make such alteration near impossible. They therefore opt to terraform Venus rather than alter their own physical and mental characteristics to suit the planet. This decision implies that humanity will bring with them Earth's history when remaking other planets because the tendencies that make up human nature guarantee a cyclical unfolding of Earth's cultural development on Venus, with all its historical oppressions and transient achievements. This is compounded by the fifth men's genocide of the indigenous Venusians. Stapledon's treatment of this episode is highly ambivalent: conflict between horror and guilt competes with the apparent necessity for self-preservation that initially drives the fifth men to terraform Venus. Anticipating Sparrow's concession that terraforming may be morally permissible if conducted to ensure humanity's survival, this episode raises questions regarding the problematic ethics of such survival by portraying the fifth men's intellectual accommodation of the Venusian genocide: the narrator explains that, '[a]s for the murder of Venerian life, it was, indeed, terrible, but right. It had been committed without hate; indeed rather in love'.[42] Given the options for pantropy or the terraformation of Mars, this avowal appears a premature self-justification of imperialism. Commenting on Mark Sagoff's call for 'respect, regard, reverence, affection and love' as appropriate responses to nature, what Godlovitch calls an 'imperialism of respect', he suggests that this 'can quickly degenerate into another nasty form of "respecting thine enemy" with its concomitant call to kill with kindness'.[43] Prior to this episode humanity had engaged in remaking human nature and, later, does so again. The third men realise that '[t]he present type of human being […] was but a rough and incoherent natural product. It was time for man to take control of himself and remake himself upon a nobler pattern'. The fifteenth men on Neptune also 'conceived, as an enduring racial purpose, the will to remake human nature upon an ampler scale'. Given the ubiquity of this theme, the genocide of the Venusians appears a deeply ironic attempt to master both nature and other civilisations. When the

[42] *Last*, pp. 246-247, 247, 253.
[43] Godlovitch 1994, pp. 24, 26.

fifth men successfully occupy Venus the narrator glosses two hundred million years in which 'all [the] main phases of man's life on earth were many times repeated on Venus with characteristic differences', evidence of a repeated history that suggests the lingering presence of intellectual landscapes informing ideas of human nature and the significance of the spaces they inhabit.[44]

2.1.4 Deism, Teleology and Nature's Otherness in Stapledon's Essays of Myth Creation

The eighteenth men are able to communicate telepathically with individuals existing throughout time. They also intuit, but are unable to communicate with, alien intelligences and their civilisations. These insights encourage the eighteenth men to speak of a "spirit" or "the Soul of All", which awakens to conscious apprehension of itself and the universe.[45] In a passage that strongly anticipates Pierre Teilhard de Chardin's discussion of the noosphere in *The Phenomenon of Man* (first published in 1955 but completed in 1938),[46] biblical voices underlie the narrator's explanation that life aims toward consciousness:

> In the beginning there was great potency, but little form. And the spirit slept as the multitude of discrete primordial existents. Thenceforth there has been a long and fluctuating adventure towards harmonious complexity of form, and towards the awakening of the spirit into unity, knowledge, delight, and self-expression. And this is the goal of all living, that the cosmos may be known, and admired, and that it may be crowned with further beauties.[47]

The narrator is fully aware that this belief is contingent. This image combines a pseudo-pantheistic, vitalist view of cosmological nature in which a 'spirit' pervades and constitutes all intelligent entities, and a teleological view in which the development of consciousness, as an example of 'harmonious complexity of form', occupies the end point of evolution. The narrator speculates on the possibility that 'the beautiful whole of things is the work of some mind; nor yet whether some mind admires it adequately as a whole of beauty'. The awakening of the spirit is likened to a vast music in which

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[44] *Last*, pp. 150, 280, 258.
[45] *Last*, pp. 309-310.
[46] Pierre Teilhard de Chardin, *The Phenomenon of Man*, trans. by Bernard Wall (London: Collins, 1959; repr. 1965).
[47] *Last*, p. 307.

'each individual factor is itself determinant, both of that which precedes and that which follows'.[48] Evolution and history are the two shaping factors of cosmological nature which, in *Star Maker*, is the object of sublime aesthetic appreciation. The eighteenth men disrespect nature's otherness insofar as they deny it an existence outside of this "religious" or mystical belief, but the narrator himself admits that it may not adequately represent cosmological nature.

In *Star Maker* the disembodied group mind have long suspected and are searching for a great creator-destroyer-observer that they call the Star Maker. This view of nature's otherness as a being that creates universes for its own inscrutable purposes is teleological, and so does not adhere to Lee's No-Teleology Thesis. This thesis rests on the distinction between teleology and teleonomy. Teleology offers explanations for an object's existence based on the assumption that it is organised in such a way as to develop toward a predefined end point or goal. Because 'Earth (Nature) did not come into existence and/or continue to exist to serve human purposes', it should not be viewed as teleologically oriented toward humanity. Instead, teleonomy is at work: 'there are teleomatic processes in abiotic Nature which simply follow physical laws, such as the law of gravity and the second law of thermodynamics', and '[i]n biotic Nature […] organisms display programmed behaviour, the product being of natural selection'.[49] The No-Teleology Thesis claims that, although biotic and abiotic nature can serve purposes for humans, animals, and plants, neither exist solely for these purposes. In *Star Maker* this thesis is compromised by a teleology oriented toward the figure of the Star Maker. *Last and First Men* appears to satisfy this condition, but the voice of a strong anthropic principle, in which the text's view of the cosmos suggests that its purpose is to provide the background for the full realisation of a human "spirit", goes some way to negating this thesis. Nevertheless, the vision of the cosmos in *Star Maker* supports the notion that this apparent teleology is a human interpretation, a landscape that only inadequately approaches a depiction of nature's otherness.

The figure of the Star Maker is in many ways consistent with Hailwood's concept of nature's otherness, yet it also possesses a theistic dimension. It is both the creator and the essence of cosmological nature; its disinterestedness and puissance means that it observes the Autonomy and

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[48] *Last*, p. 312.
[49] Lee, p. 92.

Asymmetry Thesis, if not the No-Teleology Thesis, although an argument could be advanced that nature here is in fact teleomatic. The sf representation of the radically alien re-contextualises the theistic basis of the creator figure as godhead, recasting this image as an embodiment of nature's otherness as 'alien, inhuman, dark'. The Star Maker, however, does not quite capture the essence of a non-teleologic nature, although the narrator's inability to comprehend it opens up this potential: 'if he is nothing, if the stars and all else are not his creatures but self-subsistent, and if the adored spirit is but an exquisite creature of our minds'. As the narrator's experiences with the myriad inhabited worlds increases, he becomes more and more inclined to view the Star Maker teleomatically as 'unreasoning Creativity, at once blind and subtle, tender and cruel, caring only to spawn and spawn the infinite variety of beings, conceiving here and there among a thousand inanities a fragile lovliness'.[50]

The image of nature as cruel is also present in *Last and First Men*, where the third men engage in the torture of 'lower animals' through biological engineering. They formulate a belief system based precisely on the conceptual surplus of nature's otherness, but join this to a religious concept of 'Life as an all-pervading spirit, expressing itself in myriad diverse individuals':[51]

> The worship of Life, as agent or subject, was complemented by worship of environment, as object to life's subjectivity, as that which remains ever foreign to life, thwarting its enterprises, torturing it, yet making it possible, and, by its very resistance, goading it into nobler expressions. Pain, it was said, was the most vivid apprehension of the sacred and universal Object.
> The thought of the third human species was never systematic. But in some such manner as the foregoing it strove to rationalize its obscure intuition of the beauty which includes at once Life's victory and defeat.[52]

Worship offers a mode of relating to nature's otherness that allow the third men to account for the environment's significance in human terms, even if nature thus conceived remains opposed to life. They take as a blueprint for human/non-human relationships a view of evolution as a dialectic in which abiotic nature functions as a background that shapes the development of life. The narrator notes that this "backgrounding", in which dependence on the environment is denied, unsystematically emphasises physical pain as the chief aesthetic approach to nature. Emphasis on pain reflects a

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[50] *Star*, pp. 96, 99, 135.
[51] *Last*, pp. 193-194.
[52] *Last*, p. 194-195.

conception of evolution as "nature red in tooth and claw", what the eighteenth men call 'Life's victory and defeat'; elevation of pain leads to the uneven worship of 'Life' (or, more specifically, sentience/consciousness) over the environment (nature's otherness insofar as it is non-sentient), which the narrator describes as a form of 'sadism' in itself.[53]

This situation is grounded in the third men's disrespect of one aspect of nature's otherness: by landscaping sentient nature as "lower" manifestations of their pseudo-pantheistic concept of Life (consciousness), and by complementing this belief with a philosophy that takes as a lesson from nature an emphasis on pain, they conclude that torturous biological manipulation leads to the closest possible apprehension of nature. As they believe themselves the highest expression of consciousness, they take it upon themselves to raise lower animals to their status. It is here that the contradiction between nature's otherness and landscaped nature recalls the theme of terraforming as the human duty to bring life to other planets. This episode parallels genetic engineering and terraforming, demonstrating how both endeavours grow out of similar beliefs about humanity's relationship to nature's otherness.

The narrator calls his vision of the Star Maker and the cosmos 'a fantastic reflex of itself [its nature], an echo, a symbol, a myth, a crazy dream, not wholly without significance', which points toward the impossibility of grasping the concept of nature's otherness outside of the human landscapes imposed upon it.[54] The Star Maker embodies the godlike power of creation; its ability to create universes of worlds parallels the aspiration behind the human endeavour to create new worlds via terraforming and, at greater levels of adaptation to the landscape, astrophysical engineering. The Star Maker can therefore be seen as the astrophysical engineer *par excellence*, although this would not only apply a particular landscape to a concept that retains a surplus of otherness, but would limit the Star Maker's status as a vector for nature's otherness by characterising its actions as an extension of human engineering. Restriction to such identities would thus represent an instance of disrespecting a cosmological nature's otherness. Connected to this point is an observation made by the narrator that

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[53] *Last*, p. 194.
[54] *Star*, p. 232.

parallels Wells' notion of a divorce between deductive intellectualism and mechanical invention and which demonstrate Stapledon's sympathy toward vitalism:

> intelligence, which led on the one hand to the mastery of physical force and on the other to intellectual subtlety, might, if divorced from spiritual sensibility, cause disaster. The mastery of physical force often produced a mania for power, and the dissection of society into two alien classes, the powerful and the enslaved.[55]

In contrast to Wells, Stapledon emphasises the spiritual as a necessary counterbalance to an exclusive reliance on a materialism that leads to a mastery of (mechanistically conceived) nature. When the narrator returns to Earth as the individual at the narrative's beginning, his experiences lead him to critique not only the limitations of a science and philosophy that would pretend to a mastery of the world, but a complete knowledge that would manifest this disrespect of nature's otherness:

> Man's science was a mere mist of numbers; his philosophy but a fog of words. His very perception of this rocky grain and all its wonders was but a shifting and lying apparition.[56]

'Man's science' provides a global sense of place that is completely constituted by human knowledge; it is a landscape that denies the presence of nature's otherness. The narrator contrasts this sense of place with 'the astronomical and hypercosmical immensity' and the smaller unit of community that his marriage represents, affirming the latter as the appropriate space for his limited human existence.[57] He does not deny the presence of nature's otherness; it is his spiritual experience of the cosmos and the Star Maker that lead him to affirm this unit of community as the fundamentally appropriate perspective available to human existence.

The narrator's journey in *Star Maker* takes him through many worlds, over the course of which he joins with other minds into a group consciousness that eventually extends into a cosmos spanning mind. Yet, despite knowing 'the whole extent of space and time' the I of the cosmical mind 'look[ed] about me with the same overpowering awe, the same abashed and tongue-tied worship as that which human travellers in the desert feel under the stars'. When this cosmic mind confronts the Star Maker, the history of intellectual landscaping, in which notions of deities are used to explain the universe, serve to help conceptualise the awesome presence of this entity. The narrator imagines the

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[55] *Star*, p. 246.
[56] *Star*, p. 259.
[57] *Star*, p. 258.

Star Maker and its vision of creation as a 'fantasy that my cosmical mind conceived' in order to comprehend just a small part of an experience that exceeds the narrator's ability to landscape:[58]

> I, too, sought to capture the infinite spirit, the Star Maker, in an image spun by my finite though cosmical nature […] this image, this symbol that my cosmical mind had conceived under the stress of inconceivable experience, broke and was transformed in the very act of my conceiving it, so inadequate was it to the actuality of the experience.[59]

Awe is joined to love as the creation's response to the creator. The cosmic mind is rejected by the Star Maker, and the narrator realises as a consequence that '[f]or the creator, if he should love his creature, would be loving only a part of himself; but the creature, praising the creator, praises an infinity beyond himself'.[60] This is an early articulation, albeit from a position that struggles with a religious/non-religious conception of the cosmos, of nature's otherness and the aesthetic response appropriate to it. Nature's otherness is the object of the cosmic mind's love. Love flowing in the opposite direction would be narcissism. However, the narrator can only love the Star Maker as he conceives it, in an intellectually landscaped form that does not represent it accurately as subject nor object. In *Last and First Men*, the sublimity of cosmological nature is apparent through a different context: the narrator of that text argues 'that we regard the cosmos as very beautiful. Yet it is also very terrible'.[61] This amounts to a recognition of the sublime and ungraspable aspects of a terrifying cosmological nature's otherness.

Wells and Stapledon engage with the materialist/vitalist debate that dominated ecological thinking during the interwar period. Unlike Wells, Stapledon's vision of the cosmos retains a strong element of vitalism. Environmental narcissism, the image of nature as a reflection of humanity, is a major theme explored by terraforming narratives such as Ray Bradbury's *The Martian Chronicles* (1950)[62] and Kim Stanley Robinson's *Mars* trilogy (1992-1996).[63] Terraforming disrespects nature's otherness insofar as it takes human landscapes to fully represent nature. In *The Shape of Things to Come*, humanity's physical mastery of nature is a direct expression of the urge to overcome their

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[58] *Star*, pp. 212, 225.
[59] *Star*, p. 227.
[60] *Star*, p. 228.
[61] *Last*, p. 309.
[62] Ray Bradbury, *The Martian Chronicles* (New York: Doubleday, 1958).
[63] Kim Stanley Robinson, *Red Mars* (London: Voyager, 1992; repr. 1996), *Green Mars* (London: Voyager, 1993; repr. 1996) and *Blue Mars* (London: Voyager, 1996).

asymmetric relationship to nature's otherness and, in its depiction of an increasingly technologised globalisation and humanity's future plans for terraforming Earth, recapitulates this narcissistic landscaping. *Star Maker* uses the radical otherness of cosmological nature to dethrone ideas of progress and of conquering the cosmos, which often masquerade as a desire for contact with otherness. These ineffable figures act as vectors for nature's otherness and defy attempts to make the alien coherent with a particular anthropocentric paradigm. Examples of nature as cosmological, non-human and alien fundamentally undermine the protagonists' view of their relation to the cosmos, forcing them to re-evaluate their relationship to this new conception of the universe. By realigning these relationships Stapledon does not emphasise humankind's connectedness to nature so much as he foregrounds the differing scales of otherness that various beings occupy in relation to them. Stapledon makes use of this dynamic of confrontation to consider the philosophy that underpins conceptions of human nature and cosmological nature's otherness. One suggestion made by the narrator in *Star Maker* points toward the sublimity of cosmological nature and its impact on attitudes to Earth: 'perhaps the attempt to see our turbulent world against a background of stars may, after all, increase, not lessen, the significance of the present human crisis. It may also strengthen our charity toward one another'.[64]

2.2.1 Pre-1940s Proto-Gaian Living Worlds

A cluster of three American pulp sf short stories that featured proto-Gaian living worlds or galaxies was published between 1932 and 1934. Hamilton's "The Earth-Brain" (1932),[65] Williamson's "Born of the Sun" (1934)[66], and Manning's "The Living Galaxy" (1934)[67] are examples of what Mike Ashley calls "cosmic sf", which he traces to F. Orlin Tremaine's advocacy of the "thought experiment" in 1933. Ashley argues that the thought experiment variety of sf 'took space opera to its

[64] *Star*, p. 4.
[65] Edmond Hamilton, 'The Earth-Brain', in *The Horror on the Asteroid and Other Tales of Planetary Horror* (London: Philip Allan, 1936), pp. 129-183.
[66] Jack Williamson, 'Born of the Sun', *Astounding Stories*, 12.1 (1934), 10-38, hereafter referred to as 'Born'.
[67] Laurence Manning, 'The Living Galaxy', *Wonder Stories* 6.4 (1934), 436-444.

better extremes, considering not just the exploration of space but the nature of time, space and the universe'.[68] Tremaine provided an epigraph to Williamson's story in which he claimed it as an example of the thought experiment that he was advancing in *Astounding*. The connection between Stapledon's use of cosmic scales to enlarge the scope of human perspectives and these proto-Gaian thought variants are suggestive of a critical element involved in imagining alternatives to conceptions of cosmological nature. Manning's *The Man Who Awoke* (1933)[69] was also published in the same year as *The Shape of Things to Come*. Echoing Wells' account of the scientific management of the environment, this story reflects on the industrial overuse of natural resources and explores, using the language of ecological resource management, the shape of a future arboreal society. Manning's presentation of a planetary environment that has been actively forested and managed according to ecological principles positions this story as an early geoengineering text. Both Williamson and Bradbury, the latter in his Martian stories and the late living world story "Here There Be Tygers" (1951),[70] wrote terraforming and proto-Gaian narratives, thus highlighting a connection between these two motifs.

This cluster of proto-Gaian pulp sf stories were themselves preceded by two scientific romances that Wells and Stapledon were familiar with. Shiel's *The Purple Cloud* (1901),[71] which Stapledon cites in his notes on "Science and Fiction" as an exemplar of '"serious science fiction"', features an early instance of the living world motif.[72] Hamilton's "The Earth-Brain" echoes elements of *The Purple Cloud*, establishing one of the early dialogues opened up by the living world. Doyle was increasingly interested in the occult and spiritualism by the time he published "When the World Screamed" (1929)[73] twenty-eight years after *The Purple Cloud*; that Shiel, Doyle and Hamilton's stories considered here are in various ways connected to the supernatural as well as sf suggest a link between Gaia and spiritualism that Lovelock was unwilling to completely dissociate from the Gaia

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[68] Mike Ashley, *The Time Machines: The Story of the Science-Fiction Pulp Magazines from the Beginning to 1950* (Liverpool: Liverpool University Press, 2000), p. 231.
[69] Laurence Manning, *The Man Who Awoke* (New York: Ballantine, 1979).
[70] Ray Bradbury, 'Here There Be Tygers', in *R is for Rocket* (London: Pan, 1972), pp. 119-133.
[71] M.P. Shiel, *The Purple Cloud*, *Project Gutenberg* (1901) <http://www.gutenberg.net/1/1/2/2/11229/> [accessed 4 December 2009].
[72] Olaf Stapledon, "Science and Fiction" lecture notes dated October 1947, in *The Olaf Stapledon Collection*, Liverpool, Sydney Jones Library Special Collections and Archives, University of Liverpool, OS/F8/5.
[73] Sir Arthur Conan Doyle, 'When the World Screamed', *Forgotten Futures III* (2000) <http://www.forgottenfutures.com/game/ff3/wscream.htm> [accessed 20 March 2011].

hypothesis. Jon Turney highlights Doyle's scientific romance as a potential precursor to Lovelock's Gaia hypothesis and, though it is not certain he read it before 1965, Doyle's popularity and Lovelock's avowed love of sf suggest that it is likely.[74] "When the World Screamed" situates the living Earth within the scientific paradigm of a hollow world but, in contrast to Shiel's connection of Earth's processes to mythic themes, Doyle's use is scientific (or rather it parodies scientific progress) and more clearly resembles later pulp sf. The hollow world, already an outdated scientific hypothesis when *The Purple Cloud* was published, is reopened through the speculative element of the text to offer an alternative to the dominant view that 'the centre of the earth is liquid heat'.[75] In these scientific romances and the early 1930s cluster of cosmic pulp sf stories, cosmic horror and a sf sense of wonder, both connected to Romanticism and the Burkean and Kantian sublime, are the dominant responses to confrontations with threatening living worlds. These texts tend to situate their proto-Gaian living worlds within the bounds of the last of the *terra incognitae*, at the Arctic in Shiel and Hamilton's case and, in Williamson and Doyle's, at the Earth's centre.

2.2.2 Proto-Gaian Scientific Romance: M.P. Shiel's *The Purple Cloud* and Sir Arthur Conan Doyle's "When the World Screamed"

Shiel portrays the Earth as monstrous, thus associating horror with the little known Arctic, an oft occurring fin-de-siècle motif of a landscape at the limits of scientific knowledge in 1901. *The Purple Cloud* echoes both Shelley's *The Last Man* and *Frankenstein*:[76] Adam Jeffson recounts his experiences as one of two survivors left on Earth after a catastrophic cloud of gas expelled by volcanism kills sentient life on its surface. Consequently much of this apocalyptic narrative develops the theme of isolation and offers a redemptive Adam and Eve myth set against the living planet motif, creating a space to focus consideration onto human responses to non-human nature. Jeffson encounters a lake at the pole, 'the old eternal inner secret of the Life of this Earth, which it was a most

[74] Jon Turney, *Lovelock and Gaia* (New York: Columbia University Press, 2003), p. 77.
[75] Sir Arthur Conan Doyle, 'When the World Screamed' (1929) <http://www.forgottenfutures.com/game/ff3/wscream.htm> [accessed 22 November 2009].
[76] Mary Shelley, *The Last Man* (Peterborough, Ont: Broadview Press, 1996) and *Frankenstein, Or, The Modern Prometheus* (Oxford: Oxford University Press, 1998).

burning shame for a man to see […] this fluid was the substance of a living creature'. He vaguely recalls 'a creature with many dull and anguished eyes' and 'the appalling nightmare and black abysm of sensations' that this confrontation affects. Resonant with but unlike Stapledon's *Star Maker*, in which the narrator comes to terms with the presence of an inscrutable alien other, Jeffson relates his experience to 'fancy', an 'impression, or dream, or notion', and finally to '[his] madness', in an attempt to deny its existence.[77] This vision occurs after Jeffson crosses a boundary into a world aligned with darkness, nightmare and horror, establishing the structural theme of trespass. The creature itself is composed of fluid, which complements this trespass and potential breakdown of spatial boundaries with that of indeterminate monstrous form. The theme of the infinite ('eternal') and silence ('secret') are central to Jeffson's response to the living Earth.

Description of the creature draws significantly on the sublime. Burke locates the origin of the sublime in objects that excite a sense of self-preservation and which therefore turn on feelings of pain or danger; he claims that 'terror is in all cases whatsoever, either openly or latently the ruling principle of the sublime'.[78] Shiel firmly associates the creature with supernatural terror, intensifying such associations by situating Jeffson's confrontation in the Arctic. The unfamiliarity of the landscape and the uncertainty of Jeffson's description tap into Burke's observation that obscurity enhances the terror of the sublime: Burke remarks that '[w]hen we know the full extent of any danger, when we can accustom our eyes to it, a great deal of the apprehension vanishes'.[79] This insight connects the search for comprehensive geographical knowledge, essentially a scientific and colonial quest of discovery and exploration, with the desire to encompass the obscure and to familiarise and therefore reduce the terror and the sublimity of these unknown landscapes. In this sense it bears affinities with Stapledon's *Star Maker* and illustrates how the Gaian motif functions to landscape nature's otherness.

Jeffson's encounter occurs in the supernatural context of a Manichean struggle between cosmic "Powers" of light and darkness, a duality that is literalised by the Powers' internal struggle for Jeffson's soul. The catastrophe underscores humankind's fragility compared to nature, which Jeffson

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[77] Shiel.
[78] Edmund Burke, 'A Philosophical Enquiry into the Origin of Our Ideas of the Sublime and Beautiful', in *A Philosophical Enquiry into the Sublime and Beautiful: And Other Pre-Revolutionary Writings*, ed. by David Womersley (London: Penguin, 1998), pp. 49-199 (p. 102).
[79] Burke, p. 102.

sees as cruel and heedless. He describes a feminised Earth as 'dark and moody, sudden and ill-fated', who 'rends her young like a cannibal lioness'. In another episode he uses this metaphor again when addressing nature, calling it a 'dark-minded Mother, with thy passionate cravings after the Infinite, thy regrets, and mighty griefs, and comatose sleeps, and sinister coming doom'.[80] George R. Stewart would later echo this theme in a biblical context in *Earth Abides* (1949), which contain passages emphasising Earth's autonomous existence after civilisation's destruction by an unknown plague.[81] These intellectual landscapes associate Earth with the infinite, which Burke identifies as a major source of the sublime; Jeffson's ascription of infinity to the non-human world highlights his sense of an asymmetric relation to the unfathomable otherness of Earth.[82] When Jeffson thinks that 'nothing could be more appallingly insecure than living on a planet', he gives voice to Promethean fears that nature is not neutral but antagonistic to humanity. Conversely he also positively contrasts this intellectual landscape to the ice, arguing that 'the firm land is health and sanity, and dear to the life of man'. Shiel's use of the image highlights a negative, spiritual response to the immensities of Earth and the cosmos, but this relationship is ambivalent: he ultimately realises that the feminised Earth 'is old and wise […] for great is the earth, and her Ages, but man "passeth away'.[83]

On his journey back from the Arctic Jeffson witnesses the effect of the still unknown natural catastrophe and experiences 'that abysmal desolation of loneliness, and sense of a hostile and malign universe bent upon eating me up'.[84] In his less lucid moments Jeffson entertains the fear of indistinguishability; that the boundaries between his individuality and the Earth as a feminised other will dissolve. Without a social context to provide points of recognition or self-definition, Jeffson finds growing difficulty in maintaining his self-awareness:

> more and more the earth over-grows me, wooes me, assimilates me; so that I ask myself this question: 'Must I not, in time, cease to be a man, and become a small earth, precisely her copy, extravagantly weird and fierce, half-demoniac, half-ferine, wholly mystic – morose and turbulent – fitful, and deranged, and sad – like her?'.[85]

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[80] Shiel.
[81] George R. Stewart, *Earth Abides* (London: Transworld Publishers, 1956; repr. 1961).
[82] Burke, p. 115.
[83] Shiel.
[84] Shiel.
[85] Shiel.

What is feared here would later be sought after by others. This passage anticipates deep ecology's transpersonal identification with a transcendent nature in which the subject's ego is subsumed. Voller notes that this is anticipated by 'the Romantic visionary mind', which explored 'an identifying engagement with the numinous perceived to be informing nature'.[86] The theme of being "One" with nature is already implicit in this passage, yet Jeffson's awareness of a connection to the Earth excludes knowledge of this other. He explains that

> [h]er [Earth's] method of forming coal, geysers and hot sulphur-springs, and the jewels, and the atols and coral reefs; the metamorphic rocks of sedimentary origin, like gneiss, the plutonic and volcanic rocks, rocks of fusion, and the unstratified masses which constitute the basis of the crust; and harvests, the burning flame of flowers, and the passage from the vegetable to the animal: I do not know them, but they are of her, and they are like me, molten in the same furnace of her fiery heart.[87]

This view of Earth's natural processes highlights the fundamental recognition that humankind shares its origins with diverse non-human others, thus breaking down the radical separation between the human/nature duality. Yet this passage erects boundaries as much as it offers identification with non-human nature, thus establishing a distinction between humankind and the non-human. Nature retains an otherness that Jeffson landscapes in terms of the feminine and of supernatural terror, itself evocative of the sublime.

While Shiel focuses on the individual's sense of cosmic horror toward the immensities of Earth and the cosmos, he nevertheless assigns to the social sphere responsibility for the projection of intellectual landscapes derived from human experience:

> Man's notion of a Heaven, a Paradise, reserved for the spirits of the good, clearly arose from impressions which the earth made upon his mind: for no Paradise can be fairer than this; just as his notion of a Hell arose from the squalid mess into which his own foolish habits of thought and action turned this Paradise.[88]

An interest in social worlds accompanies portrayals of an individual's experience of cosmic horror. Jeffson's claim that paradisal landscapes are based on experience of non-human nature while its converse is a consequence of culture assigns accountability for nature's asymmetry not only to the

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[86] Jack G. Voller, 'Universal Mindscapes: The Gaia Hypothesis in Science Fiction', in *Mindscapes: The Geographies of Imagined Worlds*, ed. by George E. Slusser and Eric S. Rabkin (Carbondale and Edwardsville: Southern Illinois University State Press, 1989), pp. 136-154 (p. 138).
[87] Shiel.
[88] Shiel.

human management of Earth's resources, but more generally to their politico-cultural attitudes. Jeffson landscapes the planet as a terrestrial ship, a significant motif that also literally provides transport for the Arctic expedition and Jeffson's later international travel. His experiences during these solitary years lead him to orient himself toward civilisation's ruin and nature as the only other sources of interaction. He metaphorically extends his phenomenal experience of the world to Earth's processes; by relating the eruption of the purple cloud in language that ties it to the beating of waves against his ship he establishes a relationship of microcosm-macrocosm between his journey and 'this planetary ship of earth', using this model to understand the catastrophe as 'a wave rather which she [the Earth] had reserved, and has spouted, from her own un-motherly entrails...'.[89] In this context the catastrophe itself can be read as a punishment for civilisation's transgressions.

The image of the Earth as a ship sailing through space foregrounds the planet's fragility and contributes another dimension to Jeffson's anxiety toward nature. This metaphor of the 'planetary ship of earth', like Wells' reference to an abundant Earth opened up by geoengineering, echoes Henry George's metaphor, in *Progress and Poverty* (1879), of Earth as a well-provisioned ship, and with popularised images of Buckminster Fuller's Spaceship Earth.[90] Everett F. Bleiler notes Shiel's adaptation of George's concepts in his novel *The Lord of the Sea*, highlighting Shiel's interest in the socio-economic ramifications of human responses to Earth.[91] George's metaphor highlights the human exploitation made possible by an elite's possession of a planet's abundant resources and reveals his arguably justified faith in Earth's material ability to sustain the human population in 1879, a state of affairs that is maintained in Shiel's text at the beginning of the twentieth century.

In Doyle's "When the World Screamed", George Edward Challenger, the distinguished if intolerant professor of *The Lost World*, sets out to prove his hypothesis that Earth is an organism whose skin is the eight mile crust of the planet's surface. Challenger contracts the narrator Mr. Peerless Jones to complete the final stage of a drilling project designed to pierce the flesh of the

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[89] Shiel.
[90] George, para. IV.II.21.
[91] Everett F. Bleiler, 'Shiel, M(atthew) P(hipps)', in *The Encyclopaedia of Science Fiction*, ed. by John Clute and John Grant, 2nd edn (London: Orbit, 1999), pp. 1101-1102 (p. 1102).

uncovered organism. Challenger considers this project 'one of the greatest experiments – I may even say the greatest experiment – in the history of the world', and explains that:

> 'the world upon which we live is itself a living organism, endowed, as I believe, with a circulation, a respiration, and a nervous system of its own.'
> Clearly the man was a lunatic.[92]

Challenger's thesis anticipates the concept of planetary homeostasis, while Peerless' reaction prefigures the resistance Lovelock faced from the scientific community upon first proposing the Gaia hypothesis. Lovelock retrospectively claimed James Hutton as one of the precursors of Gaia theory, a Scottish scientist who argued in 1785 that 'the Earth was like an animal and that its proper study should be by physiology'. The French physiologist Claude Bernard first recognised organisms' self-regulating properties as the 'wisdom of the body', which Walter Cannon referred to in the 1930s when he coined "homeostasis".[93] Lovelock calls the study of Earth as Gaia geophysiology, which draws together this combination of the physiological and geophysical sciences and echoes what is literalised in this story: traditional literary images of a personified or zoomorphic Earth that act as intellectual landscapes prefiguring a colonial approach to physical space.

Challenger's ostensible motivation is the search for scientific knowledge: he points out that '[t]o know once for all what we are, why we are, where we are, is that not in itself the greatest of all human aspirations?'. Behind this lies a narrative of conquest which informs his language: 'I propose to let the earth know that there is at least one person, George Edward Challenger, who calls for attention – who, indeed, insists upon attention'.[94] Having dominated the academic sphere and amassed a fortune his ambition escalates, but his declaration suggests that underlying this disinterested scientific inquiry is an infantile desire for recognition and attention. His desire, as two of the characters point out, is coupled to a general lack of care and respect and is overlaid with personal aggrandisement, qualities that contribute both to his notoriety and the appeal of his entrepreneurial individualism.

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[92] Doyle.
[93] James Lovelock, *The Ages of Gaia: A Biography of Our Living Earth*, 2nd edn (Oxford: Oxford University Press, 1995), pp. 9, 18-19.
[94] Doyle.

Edward Malone calls Challenger 'a primitive cave-man in a lounge suit', but clearly admires his achievements, also calling him 'the greatest brain in Europe, with a driving force behind it that can turn all his dreams into facts'. The scientific pursuit of knowledge, joined to a disregard of its effects, is characterised as a fundamental yet primitive trait of human nature. Despite many lawsuits Challenger continues to show little respect for the environment. In an episode that exhibits an early interest in issues of environmental respect, Malone reports how Challenger '[s]aid [the machinery] was one-tenth of an inch out of estimate, so he simply chucked it by the wayside'. Expressive of fears that the British countryside would be despoiled by the whim of entrepreneurs and industrialists, mistreatment of social and natural worlds by the wealthy and independent pioneering scientist is explicitly aligned when the narrator explains that '[a]n audience after one of Challenger's harangues usually felt as if, like the earth, its protective epidermis had been pierced and its nerves laid bare', which emphasises Challenger's capacity for confrontation and mastery by his ability to get under an eight mile thick skin.[95]

Peerless, an expert in Artesian borings, actualises the relationship of dominance Challenger poses to Earth. Challenger internalises the gap between himself and others, describing Peerless in unflattering terms as a mechanical instrument to be directed by his intelligence and will. He naturalises this relationship when he claims that '[a] certain analogy runs through all nature':[96]

> You, sir, represent the mosquito. Your Artesian borer takes the place of the stinging proboscis. The brain has done its work. Exit the thinker. Enter the mechanical one, the peerless one, with his rod of metal. Do I make myself clear?.[97]

This insect analogy anticipates Hamilton and Williamson's use and is reiterated in many later living world narratives, standing as a model of human asymmetry in relation to the planet. It is here connected to another prevalent symbol, the drill, often gendered and opposed to the feminised Earth. Upon seeing the Earth's flesh Peerless exclaims, 'Good Lord! […] And am I to plunge a harpoon into that beast!', thus paralleling Challenger's hubristic domination of the landscape and Ahab's attempt to dominate the sea and its eponymous denizen in *Moby-Dick*.[98] The narrator's closing words, that '[i]t

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[95] Doyle.
[96] Doyle.
[97] Doyle.
[98] Herman Melville, *Moby Dick; Or, The Whale* (London: Oxford University Press, 1963).

has been the common ambition of mankind to set the whole world talking. To set the whole world screaming was the privilege of Challenger alone', situate Challenger at the forefront of civilisation's progress. This is made possible by an ethically vacuous science and technology and does not in itself represent any progress in human nature but an extension of basic human responses to the non-human. Peerless refers to the living planet as 'Mother Earth' when he credits Challenger with an ironised panegyric at the successful conclusion of the project: 'Challenger the super scientist, Challenger the arch-pioneer, Challenger the first man of all men whom Mother Earth had been compelled to recognize', and reports that 'nowhere did the injured planet emit such a howl as at the actual point of penetration, but she showed that she was indeed one entity by her conduct elsewhere'.[99] The image constructed is of a scientist raping the world, an action supported by a self-centred application of technology.

Peerless witnesses a scene that indexes an alternative mode of relating to nature's otherness. A system of elevators from the Earth's surface to its unshielded flesh operate as a metaphorical time machine through geologic time. The strata revealed by the borings are a sign of the Earth's age, and Peerless' reaction to this signifier of the infinite is one of wonder: '[t]he archaic rocks varied wonderfully in colour, and I can never forget one broad belt of rose-coloured felspar, which shone with an unearthly beauty before our powerful lamps'.[100] 'Unearthly' is a strange adjective to attach to the earth, which paradoxically constructs our native planet as alien and reveals the extent of the limits to intellectual landscapes when confronted with the Earth's strata, a spatial geography in which temporal estrangement increases the further down you go (down is back in time). Peerless' sense of awe and wonder toward the alien beauty of Earth's geology and age offers an alternative to Challenger's antagonistic attitude toward nature's otherness. It also suggests that the familiarity of Earth is itself due to intellectual and physical interactions between the human and non-human which elide Earth's alien otherness. Despite Fogg's complaint that the term terraforming describes the task of adapting planets to resemble Earth and so cannot be applied to it, the phrase 'an unearthly beauty'

[99] Doyle.
[100] Doyle.

in this context highlights the longstanding human project of adaptation, in which the Earth has been landscaped both intellectually and physically in order to shape it to humanity's needs.

2.2.3 The Pulp SF Proto-Gaian Cluster

Hamilton's "The Earth-Brain" describes the otherness encountered by explorers at the far regions of the Earth. Landon recounts to Morris (the frame narrator) his expedition to the Arctic, where he discovers a mountain that literally houses the Earth's brain. Despite the general dismissal of their sherpas' warning of a mythic prohibition on approaching the mountain, one of the expedition members entertains the possibility of its truth:

> Why couldn't earth be a living organism instead of just a mass of inanimate matter? It seems an inanimate mass to us, it is true, but so must a human being seem an inanimate mass to the microbes that live on and in that being. Earth might be a living organism, all the planets might be organisms, of scale and nature so different from us that we mites who swarm upon it cannot even comprehend it. And if it is living it could possess consciousness and intelligence, perhaps intelligence operating on planes and for ends entirely alien to us.[101]

Both Lovelock and his collaborator Lynn Margulis employ the same analogies concerning the relationship between macrocosm and microcosm, between Earth's Gaian system and its constituent parts. Speculative questioning extends the living world and the scope of *terra incognitae* throughout the solar system. The assertion that the human cognitive faculty cannot encompass this larger system reinforces the asymmetry thesis by fuelling a sense of cosmic horror, itself a form of Promethean fear toward the cosmos. Important to this view is the notion that non-human nature is not inert matter that can be explained in mechanistic terms, but an organic creature in its own right. Nature's status is disputed with this challenge to the rational-mechanistic landscape that Yanarella argues underlies later treatments of the Gaia hypothesis.[102]

In contrast to a worldview that promises a coherent and complete knowledge of nature, Morris emphasises humanity's endemic lack of knowledge when he warns the reader that, 'in your

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[101] Edmond Hamilton, 'The Earth-Brain', in *The Horror on the Asteroid and Other Tales of Planetary Horror* (London: Philip Allan, 1936), pp. 129-183 (p. 144).
[102] Ernest J. Yanarella, *The Cross, The Plow and the Skyline: Contemporary Science Fiction and the Ecological Imagination* (Florida: Brown Walker Press, 2001), pp. 250-251.

unbelief remember this – that of all things in the universe we men know least really of this earth we live upon'. The expedition discovers truth behind the myth when they encounter 'a giant ovoid of light or force that towered there at the cone-cavern's centre'. This meeting echoes the confusion attendant on confronting the supernatural entity in *The Purple Cloud*. It inspects and subdues the interlopers with 'senses having nothing to do with any senses we knew but operating on planes entirely different'; Landon relates how '[t]he impact of that will was tangible, overwhelming. It seemed partly to replace, to usurp, my own will and mind'.[103] This subversion gives him a brief psychological connection with the alien intelligence, and through the resulting human/non-human duality of mind he is granted an awe inspiring vision of the universe:

> My great body was racing at awful speed through vast leagues of infinite space! Far off across those immensities of space I was aware of other living earths, other planets, some larger and some smaller than I , but each living in the same vast way as I lived, each with its own great brain!.[104]

Communication with a planetary alien intelligence appears (in this exclamation studded passage) in embryonic form where contact involves an asymmetric non-human dominance of the channels of communication. As in *The Purple Cloud*, human consciousness approaches indistinguishability from the Earth-Brain, leading to a model of the transpersonal self in which the overcoming of one's ego is inverted to become an undermining of that ego. This scene taps into the sense of cosmic horror through the image of a universe populated by unfathomable living planets, symbols of nature's otherness on a cosmic scale that confound the expedition's search for scientific knowledge. The explorers attempt to gain a measure of control over nature by temporarily occupying it through exploration and subsuming it under their scientific schema, thus annexing it to the human sphere and reducing its otherness to an identity.

The expedition's ethnocentrism is challenged through a contrast of their worldview with "traditional" knowledge from other cultures, which undermines the stability of the expedition members' understanding of the universe and results in a critique of their faith in reason and science. A critique of colonial tendencies informs this aspect of the text, as the sherpas take on the role of

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[103] Hamilton, pp. 137, 157-158, 160, 163.
[104] Hamilton, pp. 164-165.

representatives of a primitive society unclouded by faith in the comprehensiveness of scientific knowledge. This contrast implicitly extends the text's scope to include other ideologies underpinning notions of Western civilisation and progress. They are guides and harbingers of an ancient and dangerous knowledge, warning of 'the forbidden mountain at the earth's top-shunned by all our race!', but they are also ciphers whose role is to provide a foil for notions of a Western science allied to a dogmatic view of the non-human.[105] When the Earth-Brain kills the other two members of the expedition Landon fires at it in self-defence. His action is described as a sin against nature, a transgression of the mythic prohibition spoken of by the sherpas:

> Colossal anger emanated from it at the same moment like a wave of destroying force, and as that cosmic wrath swept through me I knew that I had committed blackest sin against the universe in daring to attack the brain of the living earth-body upon which dwelt I and all my tiny race!.[106]

It exacts retribution for Landon's violence, which is a reaction against the asymmetrical relationship between cosmological nature and humankind, by pursuing him across the planet with earthquakes. This plot development suggests the theme of humanity's regulation as part of a system and assigns this responsibility to the Earth. The living planet operates in this capacity as a check to human domination, with tremors operating as a sublime symbol of Earth's retribution. Morris implies as much when he warns that 'we who consider ourselves masters of all are not but a race of microscopic parasites dwelling upon the vast and strangely living body of that Earth-Brain'.[107]

"Born of the Sun" marks a negotiation of the boundary between cosmic horror and the sf technological sublime. Earth and the other planetary bodies are eggs, their parent the sun, which 'expands and contracts in the rhythm of the sun-spot cycle, with a beat like the pulse of a living thing'. Descriptions of the Moon's hatching, which prefigures Earth's fate, relate dread and majesty when characterising the living world as 'more than anything else like the eldritch, gorgeous streamers of the Sun's corona',[108] thus tapping into the language of weird fiction through the adjunct 'eldritch',

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[105] Hamilton, p. 142.
[106] Hamilton, p. 170.
[107] Hamilton, p. 181.
[108] 'Born', pp. 16, 25.

used frequently by Lovecraft and meaning '[w]eird, ghostly, unnatural, frightful, hideous'.[109] Further description of '[a] body, both horrible and beautiful' and reference to '[t]he shadows it cast, inky-black, green-fringed, were uncanny – dreadful', show an ambivalence that accompanies revelation of nature's alien otherness and subverts dominant understandings of Earth.[110] Williamson connects the sublimity of the living world to beauty, two concepts that Burke considers separately as centring respectively on pain and pleasure. Beauty for Burke is a social quality that attracts humans into an engagement with the other. Unlike the sublime it is founded on the submission of the object to the subject: 'we submit to what we admire, but we love what submits to us; in one case we are forced, in the other we are flattered into compliance'.[111] This tension between the sublime and beauty is an important cognitive structure that forms one of the axis by which sf examines the human relationship to the non-human. Ultimately, it suggests that beauty as an aesthetic response to nature is complicit in domination of nature's otherness and cannot offer aesthetic grounds for ecologically sound relationships to the non-human.

Barron Kane is another explorer figure who discovers and brings knowledge of the Earth's nature to his nephew Foster, an inventor figure and the protagonist of the story. Kane has infiltrated a mysterious Sect where he discovers 'that oriental insight had seen the truth hidden from our dogmatic western minds', echoing Hamilton's use of sherpas as homogenised foils for Western (rational scientific) landscapes.[112] Against the sect's fatalistic belief that all humanity should die in Earth's catastrophic birth Foster and his Uncle, accompanied by Foster's fiancée June and a selection of colonists, hasten to construct a functioning spaceship to escape Earth's destruction. Social responses to the catastrophe are subordinated to Foster as heroic individual. Viewing the Moon's destruction, Foster and June affirm the importance of the smallest unit of community as a response to individual insignificance:

> 'It was lovely – and horrible –'
> […]

[109] 'Eldritch', in *Online OED* <http://www.oed.com.ezproxy.liv.ac.uk/view/Entry/60208?redirectedFrom=eldritch#eid> [accessed 22 January 2012].
[110] 'Born', p. 25.
[111] Burke, p. 147.
[112] 'Born', p. 16.

> 'Our world must go-that way, dear-' he breathed; and her shivery tiny whisper finished: 'But we have-each other-'.[113]

Community is conveyed by romantic cliche, but Foster's status and the masculinist heroism of the text emphasises his individualism and hubris. He is elevated from the group in a version of the transpersonal self when, '[i]n a moment of crystal vision, he saw himself not as one man fighting for his own life, but the champion of humanity, battling for ultimate survival'. Barron Kane supports Foster's vision when he says '[i]t's up to you, now, to save the seed of mankind', and he evokes the Adam and Eve myth also utilised in *The Purple Cloud* but transplants it to the geography of space: '[t]he children of Foster and June will conquer space, to the farthermost one of you!'[114]. The obligation to remain independent of the planets is incompatible with this colonial urge to conquer space. Foster's attempts to combat both nature and the mobs incited by the sect enact the struggle between submitting to and forcing the (cultural) other into submission.

Invention gives humanity a way to free themselves from their dependency on nature. The spaceship, christened the *Planet*, 'can sail on forever, Barron. It's a little world, itself, independent of the Sun'. The insect metaphor is revisited in conjunction with this theme when Foster realises that, because of his anti-gravity invention, 'Men will now be small parasites no longer, to be crushed like vermin by any chance tremor of the beast that bears them'. The machine grants an affective response opposed to the helpless awe they experience when seeing the moon crack, '[a] kind of lofty elation' and 'a sense of triumphant power that lifted him far above any human concern'. This allows Foster to transcend his ego and attain 'the supreme tranquility of a god […] It was sublime, awful Nirvana. He had forgotten even June'. This alternative to cosmic horror means that humankind can now begin to occupy a position of dominance in relation to nature. Foster's recognition of humanity's dependence on the planets, each with an autonomous existence independent of humankind, implies a moral dimension suggestive of obligation toward, and an opportunity to achieve hyperseparation from, nature: '[y]ou're alive, all of you. We owe our lives to you – we've been parasites on your kind. But we aren't any longer. We're beginning all over again, on our own'.[115]

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[113] 'Born', p. 25.
[114] 'Born', pp. 20, 38.
[115] 'Born', pp. 22, 38, 33, 33, 38.

Meeting this obligation coincides with the promise of a new, utopian society represented by the crew of the *Planet*, '[s]ix hundred picked men, representing every race and every craft and every creed, with their wives and children. Two thousand all told – and the very cream of humanity'. There are problems with this basis for a new humanity which is especially evident when contrasted to the orientalised Eastern sect opposing them, members of which are described as 'yellow-visaged demons armed with the weapons of a secret science'.[116] The sentence's syntax also invests only the six hundred men, not their wives (the only women aboard) with representative power for humanity's cultural diversity. The selection process, however, is suspiciously elided. The sect's manipulation of human fears during the tremors presaging Earth's traumatic cracking allow them to muster an army to confront and kill the colonists; their death again elevates Foster and June's personal relationship to a place of prime importance.

Laurence Manning's "The Living Galaxy" prefigures Stapledon's extension of the living world trope to galactic scales, suggesting a series of macrocosmic levels for the colonial extension of Earthbound life throughout cosmological nature. The central story is narrated as a history lesson for a child of the far future and relates with some uncertainty an explorer's encounter with a potentially living galaxy, along with contextualising information about a now ancient and mysterious Earth. An initial frame narrator contemporaneous with the implied reader begins with an apology and a request: '[i]t is impossible for me, as author, to write their story so that it is complete in itself; I must ask you, as reader, to lend a hand to the work'.[117] This device calls on an implied reader to imaginatively assume the identity of a child at a history lesson in the far future while engaging a critical stance toward the events related during the second frame narrative of the history lesson. The narrative's discussion of colonial expansion throughout the galaxy, anticipated with wonder by Foster in "Born of the Sun", is destabilised by Manning's positioning of this second frame in the far future and contributes to the irony directed toward notions of technological progress.

Manning's awareness of ecology, demonstrated a year earlier in "The Man Who Awoke", is directed in this story toward principles central to the technical aspects of terraforming. The narrator of

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[116] 'Born', p. 22, 28.
[117] Laurence Manning, 'The Living Galaxy', in *Wonder Stories* 6.4 (1934), 437-97 (p. 437).

"The Living Galaxy" notes that Earth 'possessed by nature a climate and an atmosphere suitable to human existence without any artificial aide' and 'was deserted by thousands of explorers who settled down on the five remaining planets of the solar system. These were not habitable without artificial air and heat'.[118] Manning's interest in planetary environments and his knowledge of ecological issues stems from his interest in space colonisation and his involvement in pioneering early space rocketry. He was one of the founding members of the American Interplanetary Society, which changed its name to the American Rocket Society and merged, in 1963, with the American Institute of Aeronautics and Astronautics (AIAA).[119] As the editor of the American Interplanetary Society's journal *Astronautics*, Manning was well informed with regard to the technical aspects of spaceflight and the maintenance of contained environments. In the mid-1940s Manning retired from the organisation, an event that marks a shift toward the professionalisation and legitimation of rocket science as a field for scientific and technical enquiry. Manning also wrote a book, *The How and Why of Better Gardening* (1951), from which could be inferred a link between space flight and garden landscapes. In "The Living Galaxy" early terraforming themes are connected to the colonisation of space which, as in Williamson's text, is reliant on technology for realisation. Colonisation is seen as a case of 'steady, peaceful expansion' made possible by 'two great inventions' and cosmological geography: the release of atomic power and atomic synthesis (anticipating Williamson's CT Stories), and the abundant space and resources available throughout the galaxy.[120] This latter idea alludes to histories of the colonial acquisition of resources and territories, a relation that is strengthened by the pedagogic narrative frame. However, the initial narrative device, by highlighting its textuality and the uncertainty of the fictional historical events, engages the implied reader in an ironic unmasking of the official story, thus calling into question notions of colonial expansion.

Bzonn's encounter with what he believes is 'a gigantic creature rooting dangerously with a tentacle among the stars that housed the human race' show that despite this ideology of peaceful expansion, a meeting with nature's alien otherness provokes a violent reaction. The narrator, whose authority is already compromised by his temporal distance from these events, asserts that '[i]t must be

[118] 'The Living Galaxy', p. 438.
[119] Along with fellow sf writers G. Edward Pendray and David Lasser, amongst others.
[120] 'The Living Galaxy', p. 438.

borne in mind that Bzonn felt no doubt that the star-mass composed a living intelligent creature'. The teacher's professional scepticism leads him to consider various opposing theories but the structure of the narrative manipulates the reader into support for Bzonn's theory that 'the protuberance was a creature of life in some form which utilized solar systems after the fashion of atoms'. Bzonn's destruction of the galaxy in perceived self-defence means that certainty can never be attained, much to the implied detriment of humanity. The story's "Afterword" sees the return of the initial frame narrator but is narrated in second person, toward an implied reader who retains their imaginative assumption of the schoolchild's identity. This final device works to construct a complex set of relations between colonial expansion and the curiosity and wonder of a child toward grand historical events that are untainted by a subtext that is critical of this expansionist ideology. In addition, the narrator conflates the supposed ideological position of the implied reader and this member of the far future when describing how '[y]ou are one of those who cannot wait for the next day to bring what it will – you must peer into the next chapter, driven by curiosity. For long hours you sit there over the book and I would give anything to know what you read there!'.[121] The frame narrator, implied reader and child of the far future all have a stake in the knowledge and wonder of the future, and yet this intergalactic imperialism is undercut, thus placing this story in opposition to the faith in technology evident in Williamson's "Born of the Sun".

This discussion highlights a link between early terraforming, ecological catastrophe and proto-Gaian narratives, namely an asymmetry that Yanarella identifies as a 'profound indifference' toward the fate of individual species, a characteristic that he sees as implicit in the Gaia hypothesis.[122] In his essay "Supernatural Horror in Literature" (1927), Lovecraft describes the fear of the unknown as productive of cosmic horror, an experience that, like Promethean fear, fundamentally encodes an awareness of the asymmetrical relationship between the human and non-human. Lovecraft's contributions to *Weird Tales*, in stories such as "The Dreams in the Witch House" (1933) and "At the Mountains of Madness" (originally written in 1931 but rejected by *Weird Tales* and published in

[121] 'The Living Galaxy', pp. 442, 442, 441, 497.
[122] Yanarella, p. 227.

Astounding in 1936), and his short story "The Colour Out of Space" (*Amazing Stories* 1927),[123] all present cosmic horror in relation to aspects of a previously unsuspected cosmological nature. The echoes of Shiel's text in Hamilton's treatment of the living world and their use of cosmic horror further support the case for the dialogic exploration of proto-Gaian themes in scientific romance and early pulp sf. Proto-Gaian themes are connected to journeys of discovery, a structure that opposes known and unknown spaces as an emblem for scientific discovery, itself a method of negating nature's otherness. Williamson's text offers the technological sublime as a counter to the sense of human insignificance in the face of a sublime cosmos, whereas the discovery of the proto-Gaian entity in other stories challenge the capacity for scientific enquiry and colonial projects of acquisition and mastery to erase nature's otherness.

2.2.4 The Decline of the Living World Motif during the Emergence of Terraforming Narratives in 1950s American Pulp Sf

Few living world stories appear in the late 1930s-1950s, a period overlapping with the development of the first phase of fully fledged terraforming stories. Nevertheless, this motif sporadically resurfaces during the postwar period, illustrating the continuing influence of the pre-1940s development of the living world motif and terraforming themes, but situates them ever more firmly in the American pulp sf tradition. As the discussion above has shown, terraforming and living world stories are fertile spaces for enviro-ethical reflection. The relationship between nature's otherness and the theme of interconnectedness, which forms a major part of the Gaian texts influenced by Lovelock's hypothesis, have already been anticipated by episodes in which the identity between human and non-human nature is blurred, as in *The Purple Cloud* and "The Earth-Brain". Two of the few living world short stories published after *Star Maker* and before 1962, Leinster's "The Lonely Planet" (1949)[124] and

[123] H.P. Lovecraft, 'The Dreams in the Witch House' (1933) <http://www.hplovecraft.com/writings/fiction/dwh.asp>, 'At the Mountains of Madness' (1936) <http://www.hplovecraft.com/writings/texts/fiction/mm.asp> and 'The Colour Out of Space' (1927) <http://www.hplovecraft.com/writings/texts/fiction/cs.asp>, *The H.P. Lovecraft Archive* [accessed 14 January 2012].
[124] Murray Leinster, 'The Lonely Planet', *Thrilling Wonder Stories* 35.2 (1949), 80-97.

Bradbury's "Here There be Tygers" (1951), refigure the theme of identification with a living world and is indirectly answered in 1961 by Stanislaw Lem's *Solaris*, a text that shares affinities with Stapledon's treatment of nature's otherness in *Star Maker*. Despite his influence on Lem's work, Stapledon's (relative) optimism toward the possibility of gaining some understanding of the cosmos, albeit imperfect and problematic, is negated in *Solaris*, which contests the ability for any transformative understanding or revelation on the part of humankind toward nature's cosmological otherness.

In "The Lonely Planet", the living world is set against an interplanetary background, geography already touched on in Stapledon's work and earlier cosmic sf. Through an alien planetary consciousness, Leinster continues his exploration of human-alien contact famously handled in his short story "First Contact" (1945).[125] The living world shifts from a creature at the planet's core to one covering its surface; Alyx is a single living organism that develops consciousness after exposure to humankind. At first its compliance to men's wishes make it 'a living, self-supporting robot, an abject servant to any creature with purpose it encounters', and it is exploited for its labour in mining the valuable rotenite in its crust.[126] This focus on the exploitation of natural resources aligns this text with Doyle's "When the World Screamed" and the instrumental relationship to nature signified by the motif of the drill.

Alyx is perceived as threatening when its superlative scientific and technological progress is discovered to have outstripped humanity's. The Alyx corporation's economic interest in the planet leads them to the view that '[t]he idea of a greater-than-human intelligence [… is] frightening. If it became known, the results would be deplorable'. They decide that 'Alyx had to be killed,' because '[i]t was wiser than men. It could do things men could not do. To be sure, it had served mankind for five hundred years'.[127] Alyx is capable of developing technology incomprehensible to humanity, but their fear leads them to reject opportunities to learn from it. It offers to create a utopia for men on its surface yet, except for a few descended from the explorer who originally identified Alyx as sentient, it

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[125] Murray Leinster, 'First Contact', *Crossroads: The Library* <http://p199.ezboard.com/fthevirtualcommunityfrm16.showNextMessage?topicID=67.topic> [accessed 3 October 2007].
[126] 'The Lonely Planet', p. 83.
[127] 'The Lonely Planet', pp. 85, 90.

is refused. Recalling the orientalised cults in Williamson's "Born of the Sun", the narrator records how

> Cults, too, sprang up to point out severally that Alyx was the soul-mother of the universe and must be worshiped; that it was the incarnation of the spirit of evil and must be defied; that it was the predestined destroyer of mankind and must not be resisted.[128]

These responses are indicative of attempts to explain in religious terms threatening cosmic events, thus connecting the societal confusion caused by a confrontation with nature's otherness to the dialogic aspect of sf, here represented as a thematic element of the text. Several groups adhering to diverging positions attempt to speak for Alyx, thus demonstrating attempts to incorporate the living planet into humankind's intellectual landscapes and downplay its radical alien otherness.

Bradbury develops this theme in "Here There Be Tygers". He presents a world in which the desire for utopia can be satisfied only if Promethean fears toward nature's otherness can be overcome. This story has been enthusiastically received by environmentalists and was the first story to be reprinted by *Mother Earth News* in 1978, who read it as '*a multileveled allegory*'.[129] A group of interplanetary explorers chartered by a resource extraction company encounter a world that grants them their unconscious wishes. The crew see a pastoral utopia whose grass 'was the freshest green colour they had seen since childhood'. The colour "green" is central to Bradbury's utopian discourse, and its use here is an invitation to the colonists to reflect on their lost childhood: '[r]emember how you used to run when you were a kid, and how the wind felt. Like feathers on your arms. You ran and thought any minute you'd fly, but you never quite did'. Unexpectedly (for the colonists), Driscoll does fly, the first indisputable evidence that the planet has been directing itself toward their desires. The landscape is ideally suited to leisure: '[t]he men laughed quietly in the baseball season, in the good quiet wind for tennis, in the weather for bicycling and picking wild grapes'.[130] It is nostalgic and utopian, prefiguring Robinson's use of softball in *Pacific Edge* (1990),[131] but is also homocentric,

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[128] 'The Lonely Planet', p. 94.
[129] Ray Bradbury, 'Here There Be Tygers', in *Mother Earth News: The Original Guide to Living Wisely* (1978) <http://www.motherearthnews.com/nature-community/here-there-be-tygers-ray-bradbury-zm0z78zhun.aspx> [accessed 22 January 2012].
[130] Ray Bradbury, 'Here There Be Tygers', in *R is for Rocket* (London: Pan Books, 1968), pp. 119-133 (pp. 120, 122, 122).
[131] Kim Stanley Robinson, *Pacific Edge* (London: Unwin Hyman, 1990).

highlighting a masculinist aspect to the use of the pastoral utopia. Nature's otherness is effaced as the planet acts as a mirror reflecting the expedition's fantasised notions of childhood.

Chatterton, the company's representative, sees a devious world whose games are not the innocent leisure activities of youth. For him '[i]t's too green, too peaceful', and his anxiety toward the planet is apparent when he asks Forrester '[h]aven't you *felt* it? This world's alive, it has a look to it, it's playing with us, biding its time'.[132] He internalises an exploitative position toward the planet and brings guns and an "Earth Drill" to support the conquest of planets with violence, repeating the history enacted upon Earth:

> 'You have to beat a planet at its own game,' said Chatterton. 'Get in and rip it up, kill its snakes, poison its animals, dam its rivers, sow its fields, depollinate its air, mine it, nail it down, hack away at it, […] You can't trust planets. They're bound to be different, bound to be bad, bound to be out to get you'.
> Earth was far away, her system and her sun forgotten, her system settled and investigated and profited on, and other systems rummaged through and milked and tidied up.[133]

These tropes once again relate the image of the drill and mining to masculinity and symbolic sexual penetration. Chatterton contradicts Forrester's impression that, '[i]f ever a planet was a woman, this one is', by masculinising it: '[w]oman on the outside, man on the inside […] [a]ll hard underneath, all male iron, copper, uranium, black sod. Don't let the cosmetics fool you'. He attempts to counter the symbolism of Earth as woman or Mother; identifying masculinity with the planet justifies Chatterton's positioning of himself as antagonist. Conversely, the others respond favourably to the landscape, 'like very young men in the presence of great beauty, of a fine and famous woman'.[134]

Koestler speculates that the world is like "[a] woman who'll do anything to please her guests, as long as we're kind to her". The feminised otherness of the landscape caters to the wish fulfilment fantasies of the male expedition. One of the turning points of the text is a dream in which the crew are informed of a female population inhabiting the planet, a strong motivation for the expedition to stay. Gendered identity becomes a key ideological space in which the text's environmental discourse attempts to negotiate relationships to the landscape in terms of human sexual politics. The theme of resource exploitation recapitulates Doyle's gendered use of the drill in "When the World Screamed"

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[132] Bradbury 1968, pp. 121, 123-124.
[133] Bradbury 1968, p. 119.
[134] Bradbury 1968, pp. 120, 125.

and is represented as a moral transgression, with the narrator explaining that '[s]he [the planet] wanted to be loved, like every woman, for herself, not for her wealth'.[135] The thematic prevalence of resource extraction in these proto-Gaian texts links them with notions of terragouging, the terraformation of a planet 'to facilitate extraction of raw materials for earthly consumption'.[136] The drill symbolises human exploitative relationships to nature, functioning as a metonymy for a civilisation that homogenises nature and landscapes it in terms that oscillate between monstrosity and motherliness. These proto-Gaian narratives disrespect nature's otherness, but include interstices through which recognition of radical otherness enters the text as one voice among others.

2.2.5 The Case of *Solaris*

Stanislaw Lem's 1961 *Solaris* echoes Leinster's use of the alien planet covered by an ocean-like organism. Unlike Alyx it is truly alien; the nature of its consciousness is likely never to be definitively resolved. The planet prefigures Lovelock's view of Gaia, although unlike Earth it 'had reached in a single bound the stage of "homeostatic ocean"' and 'was capable of exerting an active influence on the planet's orbital path'.[137] There is a tantalising echo between Lem's sublime and grotesque depiction of Kelvin's reaction to the eponymous alien planet Solaris and the pan-psychic narrator's reaction to the sublime figure of the Star Maker in Stapledon's work. The problem of analogising nature's otherness and the inexplicable nature of the planet recalls the radical otherness of Stapledon's *Star Maker*. Lem was familiar with Stapledon's work and wrote on both *Last and First Men* and *Star Maker*. Although Lem praises Stapledon's *Star Maker*, calling it 'a completely solitary creation' that 'defines the boundaries of the SF imagination', he nevertheless finds fault with the 'double psychic nature of its ontology'. This flaw rests on the failure to resolve a contradiction between an image of the universe that, as argued earlier, exists teleomatically and possesses intrinsic worth, and one that is transcendental and sanctified by a higher existence (the Star Maker as theistic). Lem explains that this

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[135] Bradbury 1968, pp. 129, 132.
[136] Patrick D. Murphy, 'The Non-Alibi of Alien Scapes: SF and Ecocriticism', *Beyond Nature Writing: Expanding the Boundaries of Ecocriticism*, ed. by Karla Armbruster and Kathleen R. Wallace (Charlottesville: University of Virginia Press, 2001), pp. 263-278 (p. 270).
[137] *Solaris*, pp. 118-119.

theistic view leads to a 'behaviouristic teleology' in which 'we can only reconstruct the axiomatics of choices relevant to the highest values from the Star Maker's behaviour'.[138] The ambivalent figure of the Star Maker symbolises this contradiction between a material and transcendental view of the cosmos.

Despite decades of Solarist Studies that proliferate explanatory theories and scientific literature, the psychologist/protagonist Kelvin reflects that humanity is no closer to understanding the planet: 'our scholarship, all the information accumulated in the libraries, amounted to a useless jumble of words'. This extended confrontation with the alien, as with Alyx in "The Lonely Planet", recapitulates sf's autologic theme. *Solaris* exposes the personification undeniably latent in Lovelock's naming of the Gaia hypothesis as an attendant problem in human responses to nature's otherness. Lem reacts against the American pulp tradition of contact as equal exchange between aliens by portraying the impossibility of contact between the alien and human. Kelvin points out that '[c]ontact means the exchange of specific knowledge, ideas, or at least of findings, definite facts. But what if no exchange is possible? If an elephant is not a giant microbe, the ocean is not a giant brain'.[139] *Solaris* does not offer an insight into a Gaian consciousness so much as it destabilises human attempts to acquire knowledge of the cosmos. It reopens a space for the entrance of nature's otherness into the text by recourse to an aesthetic that Godlovitch calls a 'sense of mystery' in response to nature's elusiveness.[140]

The moment where exchange between humanity and Solaris seems closest occurs through a dream shared by Kelvin and the planet after bombardment of the ocean with X-rays modelled against the human mind's output.

> We discover one another mutually, beyond any effort of will, in an absorbed silence. I have become alive again, and I feel as if there is no limitation on my powers. This creature – a woman? – stays near me, and we are motionless.[141]

This recalls the duality of mind in *The Purple Cloud* and "The Earth-Brain". The impression of gender that this identification with the planet results in indicates an expansion of anthropocentric

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[138] Stanislaw Lem, 'On Stapledon's *Star Maker*', *Science Fiction Studies*, 14.41 (1987), 1-8 (pp. 7, 2, 3).
[139] *Solaris,* pp. 23, 152.
[140] Godlovitch 1994, p. 26.
[141] *Solaris*, p. 187.

value onto nature's otherness in terms of an expanded self model of identification. As such it illustrates an apparently inescapable act of landscaping when confronted with the ineffable. In a passage toward the end of *Solaris*, Kelvin and the scientist Snow discuss a belief in an 'imperfect god', a 'sick god, whose ambitions exceed his powers and who does not realize it at first'. Snow describes this idea as 'an evolving god' and suggests that this notion could apply to humanity, but Kelvin argues that it is 'an anchorite, a hermit of the cosmos, not a god', and speculates that '[p]erhaps he has already been born somewhere, in some corner of the galaxy, and soon he will have some childish enthusiasm that will set him putting out one star and lighting another'. These theistic explanations occur in the aftermath of their failure to understand the nature of Solaris, part of a project of scientific enquiry lasting over a century that yields little in the way of understanding or possibilities for contact with the alien. Snow desperately speculates that 'perhaps it wants to please us but doesn't quite know how to set about the job', which echoes Leinster and Bradbury's depiction of Gaian planets whose agency is directed toward the fulfilment of human desires.[142]

Human responses to cosmological nature, according to Snow, typically disrespect its alien otherness. He explains the metanarrative of space colonisation as a strategy of avoidance of the other on our doorsteps rather than the desire for an encounter with not only alien nature, but the familiar otherness of nature on Earth:

> We don't want to conquer the cosmos, we simply want to extend the boundaries of Earth to the frontiers of the cosmos. […] We are only seeking Man. We have no need of other worlds. We need mirrors. A single world, our own, suffices us; but we can't accept it for what it is.[143]

Failure to accept Earth by extending the boundaries of human identity to crowd otherness out, an expanded self model of deep ecology, is a psychological strategy of colonial imposition. Solaris, however, continually defies not only understanding, but analysis. Spectacular phenomena such as the eruption of formations from the "ocean" perhaps represent complex mathematical equations through the flowering of their architectural structure and directly contravene the laws of physics. Otherness reveals the limits of humankind's explanatory devices; the scientific project is imagined not as a

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[142] *Solaris*, pp. 206, 207, 191-192.
[143] *Solaris*, p. 75.

march toward understanding but a slower 'stumbling, one- or two-step progression from our rude, prehistoric, anthropomorphic understanding of the universe around us'. The planet remains incomprehensible; 'an unbreakable silence' is Solaris' continued answer to any attempt to make contact, thus fostering the many theories that explain it according to 'the widely held notion […] that the 'thinking ocean' of Solaris was a gigantic brain […] a sort of "cosmic yogi", a sage, a symbol of omniscience'.[144] Lem argues that this silence in response to attempts to apprehend the nature of the cosmos is also the ultimate result of Stapledon's treatment of the Star Maker, in which text Stapledon 'directs the traditional drama [of cosmogonic enquiry] by manipulating not-entirely-traditional figures and symbols'.[145] Encounters with non-human others instigate a sense of mystery toward nature that decentres humankind's geocentric perspective.

Lem's *Solaris* offers a critique of the anthropomorphism fundamental to the colonial conquest of space, a theme central to understanding the enviro-ethical engagements that the imaginative spaces of terraforming and living world stories offers. These works offer textual sites for philosophical reflection and are entangled with other treatments and themes as part of the megatextual dialogue of sf. Nature's otherness, a concept designating the relationship of non-human nature to human nature and culture, is conceived of in cosmological terms in the scientific romances, early cosmic pulp sf and the late pulp sf living world stories. Resource exploitation is central to these texts, which relate them to terraforming as instances of terragouging. Lee's Asymmetry, Autonomy and No-Teleology Theses help identify the fundamental environmental attitudes that structure human relations to nature's otherness. Promethean fear, grounded in the axiomatic asymmetry between humankind and nature, is evident in the scientific romances of Shiel and Wells and in the cosmic sf of Hamilton, Williamson and Manning. Such responses are imagined as leading toward an urge to direct humankind's environments and history via technocratic societal management, as in *The Shape of Things to Come*, or through various technological fixes such as the contained spaceship/habitat in "Born of the Sun". When the Asymmetry Thesis is undermined in cosmic sf, Promethean fear is overturned and technology appears to elevate humanity above nature, allowing them to exploit and control the

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[144] *Solaris,* pp. 178, 24.
[145] 'On Stapledon's *Star Maker*', p. 7.

cosmos. Manning's "The Living Galaxy" ironises this development. Nevertheless, as Leinster and Bradbury's late living world stories demonstrate, and as Stapledon's *Star Maker* and Stanislaw Lem's *Solaris* clearly show, sf has offered vectors for considering the challenge to colonial anthropomorphism that nature's otherness offers. Pre-1940s sf and the few living world texts before Carson's 1962 *Silent Spring* deploy terraforming and proto-Gaian themes to explore in various ways civilisation's disrespect of nature's otherness.

3. The American Pastoral and the Conquest of Space: Consensus Futures of the 1950s Terraforming Boom

The first stories that dealt with terraforming as part of their foreground or as their organising motif were published in the 1950s: Ray Bradbury's *The Martian Chronicles* (1950)[1] collected his 1940s short stories into a single volume that portrayed the events of the colonisation and terraforming of Mars; Robert A. Heinlein's *Farmer in the Sky* (1950)[2] was the first novel to dedicate its narrative to an exploration of the terraforming of Ganymede; while Arthur C. Clarke's *The Sands of Mars* (1951)[3] looks with irony at the pastoral romanticism that informs the language of stories of colonisation. These texts are offset by another trend that offered a polar response to the utopianism depicted in these early 1950s stories, one that used the motif of planetary adaptation to explore the inequalities and excesses of human political relations. Such dystopian narratives include Frederik Pohl and C.M. Kornbluth's *The Space Merchants* (1953),[4] Walter M. Miller's "Cruxifixus Etiam" (1953),[5] and Poul Anderson's *The Snows of Ganymede* (1954) and "The Big Rain" (1955).[6] In the late 1950s-early 1960s the narratives of the first terraforming boom began to shift ever more emphatically toward the terraformation of planets inhabited by alien species. The shifting foci of these stories index a corresponding shift of concern in the sf of this period, along with a transformation of the way in which the motif of terraforming is used to comment on society. The worlds imagined in these and other texts helped shape a tradition of consensus toward ideas of the possible futures that might develop from the trends of the 1950s. Central to this image of time is the way in which it was constructed through a dialogue between texts, one whose nature became more sophisticated as it was

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[1] Ray Bradbury, *The Martian Chronicles* (New York: Doubleday, 1958), hereafter referred to as *Chronicles*.
[2] Robert A. Heinlein, *Farmer in the Sky* (London: Pan Books, 1967), hereafter referred to as *Farmer*.
[3] Arthur C. Clarke, *The Sands of Mars* (London: Sidgwick & Jackson, 1951; repr. 1976), hereafter referred to as *Sands*.
[4] Frederik Pohl and C.M. Kornbluth, *The Space Merchants* (New York: Random House, 1953; repr. 1974), hereafter referred to as *Merchants*.
[5] Walter M. Miller, 'Cruxifixus Etiam', in *The View From the Stars* (Hertfordshire: Panther, 1968; repr. 1973), pp. 58-78, hereafter referred to as 'Cruxifixus'.
[6] Poul Anderson, *The Snows of Ganymede* (New York: Ace, 1958) and 'The Big Rain', in *Worldmakers: SF Adventures in Terraforming*, ed. by Gardner Dozois (New York: St. Martin's Griffin, 2001), pp. 1-49, hereafter referred to as *Snows* and 'Rain' respectively.

deployed for the purposes of an inquiry at various levels of social, technological, political and philosophical registers.

These terraforming stories often deployed pastoral motifs and structures to engage in socio-political enquiry. In his essay on novelistic chronotopes, Bakhtin classifies the pastoral a subset of the idyll, which he isolates in four 'pure types: the love idyll (whose basic form is the pastoral); the idyll with a focus on agricultural labor; the idyll dealing with craft-work; and the family idyll', but acknowledges that there are 'mixed types [that] are extremely widespread, in which one or another aspect predominates (love, labor, or family)'.[7] Many terraforming stories, such as *Farmer in the Sky*, connect terraforming to agricultural labour and traditions of American agrarianism. *Farmer in the Sky* also uses the family idyll to explore ideas of community and to parallel the maturation of its protagonist with his efforts to make a new home by transforming Ganymede. Apart from these distinctions of type, Bakhtin also notes stylistic gradations within the same type:

> distinctions in character and degree in the metaphorical treatment of individual motifs (for example, natural phenomena) as they are incorporated into the totality of the idyll, that is, differences in the extent to which purely realistic or metaphorical links predominate, differences in the degree and nature of the sublimation and so forth.[8]

Bakhtin's description of the various dimensions of these pastoral types parallel Andy Sawyer's observation that the pastoral and sf are dynamics rather than genres whose interplay within a given text helps generate its meaning.[9] The combination and variation of elements within and between types, all of which modulate the idyllic chronotope in one of its "pure" forms, suggest a dialogic process at work. Given these variations, Bakhtin argues for a core of common features shared by all examples of the idyll that are made coherent by 'the special relationship that time has to space' in these narratives. The first of these three relationships concern the realistic or concrete portrayal of a community in which time is manifest in 'an organic fastening-down, a grafting of life and its events to a place, to a familiar territory with all its nooks and crannies, its familiar mountains, valleys, fields, rivers and forests, and one's own home'. This representation of time is reflected by a focus on

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[7] M.M. Bakhtin, 'Forms of Time and Chronotope in the Novel', in *The Dialogic Imagination: Four Essays*, ed. by Michael Holquist, trans. by Caryl Emerson and Michael Holquist (Austin: University of Texas Press, 2002), pp 84-258 (p. 224).
[8] Bakhtin, p. 224.
[9] Andy Sawyer, 'Ursula Le Guin and the Pastoral Mode', *Extrapolation*, 47.3 (2006), 396-426 (p. 396).

communities and their experience of the world through a developed sense of local place and the cyclical changes that their environment undergoes. Alternatively, chronotopes may involve representations of the 'basic life-realities [that] are present in the idyll not in their naked realistic aspect [as an 'organic fastening-down'] but in a softened and to a certain extent sublimated form'. These 'life-realities' include '[l]ove, birth, death, marriage, labor, food and drink, [and] stages of growth'; their appearance in 'sublimated form' may result in the representation of idealistic pastoral spaces poised in opposition to a world in conflict.[10]

Sawyer notes the contrast Tom Shippey identifies between the pastoral, understood as '"rural, nostalgic, [and] conservative"', and "fabril" literatures, which are '"overwhelmingly urban, disruptive, future-oriented, eager for novelty"', and centred on the image of the "faber", '"the smith or blacksmith in older usage, but now extended in science fiction to mean the creator of artefacts in general"'. Sawyer builds on this collision between the pastoral and sf, arguing that '[m]uch of what I would call Pastoral in SF is the tension between these two modes: essentially a tension between enthusiasm for and anxiety about the future'.[11] This mixture of anxiety and enthusiasm can be set against a contrast between fabril literatures and Bakhtin's craft-work idyll; both are in some sense concerned with fabrication and production, yet ideas of craft are perceived as wedded to a sense of tradition that is absent in the faber's preoccupation with creation and novelty. The influence of the pastoral on sf allows a contested space to develop in which the productions of the faber are aligned with the craft-work idyll, thus recuperating ideas of technology from the potentially alienating perception of novelty. If the pastoral is understood as nostalgic, the faber or an analogue is already implicit in the tradition as nostalgia assumes some novelty or change from which position the pastoral accrues its sentimentality. A similar dynamic is generated by aligning sf with the agricultural idyll, which brings ideas of terraforming into contact with the familiar domain of agriculture.

Apart from the active incorporation of overt themes into sf texts, Sawyer emphasises another intersection between the pastoral and sf that is centred on the "internal literary effect" generated by the use of specific pastoral techniques. These distinct engagements reflect different definitions of the

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[10] Bakhtin, pp. 225, 225, 226.
[11] Sawyer, p. 402.

pastoral and roughly correspond to Leo Marx's sentimental and complex versions of the American Pastoral. The sentimental pastoral ideal encompasses specific instances of landscaping and sublimation that generate pastoral nostalgia, which could be taken as a direct guide to political action. The pastoral design is a more complex ordering of meaning referring to 'the larger structure of thought and feeling of which the *ideal* is a part'. The pastoral design adds complexity by introducing ambiguity into pastoral chronotopes; it manages 'to qualify, or call into question, or bring irony to bear against the illusion of peace and harmony in a green pasture'. It 'embraces some token of a larger, more complicated order of experience' by 'bring[ing] a world which is more "real" into juxtaposition with an idyllic vision'.[12]

Sawyer connects these pastoral techniques to sf when he argues that 'SF/fantasy writers are reworking tropes once used by writers of the pastoral mode' and draws important analogies between the signifying practices of Elizabethan Pastoral and the coding practices of sf and fantasy to argue that 'the pastoral, fantasy and science fiction are modes which reflect each other'.[13] Drawing on William Empson's argument that the pastoral relies on a "complex to simple" formula involving various textual and linguistic strategies used to compress complex meaning into emblematic images, Sawyer connects the coding practices of the pastoral to the reading protocols of the sf megatext.[14] Sf as an iconic, "emblematic" form of writing parallels the "iconicity" of the pastoral emblem.[15] The wilderness, garden and farm of the pastoral design are complex symbols, what Marx calls ecological images, and can be considered chronotopes insofar as '[e]ach is a kind of root metaphor, a poetic idea displaying the essence of a system of value'.[16] In the terraforming narrative these ecological images intersect with sf discourse, offering conceptual handles for exploring the impact that technology has on human relationships to nature.

Sf narratives of terraforming, as stories of interplanetary migration, colonisation and adaptation, have often drawn from overt elements of the American Pastoral. This tradition is rooted in

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[12] Leo Marx, *The Machine in the Garden: Technology and the Pastoral Ideal in America* (New York: Oxford University Press, 1964), pp. 24, 25, 25.
[13] Sawyer, p. 397.
[14] William Empson, *Some Versions of Pastoral* (London: Chatto & Windus, 1950) p. 140.
[15] Sawyer, p. 404.
[16] Marx, p. 42.

images of America and of new lands depicted in literature, travellers' tales and colonial writing since the Age of Discovery.[17] John Rieder has shown how sf shares these roots and contends that 'colonialism […] is part of the genre's texture, a persistent, important component of its displaced references to history, its engagement in ideological production, and its construction of the possible and the imaginable'.[18] The frequent references to and parallels between the terraforming of alien planets and the colonisation of America suggest a cyclical unfolding of a specifically American experience. Colonial settlement of the American continent can be seen as an expression of utopian longing for a new beginning for communities aiming to create new socio-political foundations by which to live. The language of the American Pastoral was a powerful motivating voice that was consciously used as a form of propaganda to raise support for colonisation. This utopian dimension to American colonisation was thus unstable; the new, unknown lands that promised better alternatives to the society at home could prove a dystopia. In addition, the exploitation of indigenous inhabitants or of a colonial workforce meant that the construction of a pastoral utopia for the minority was achieved at the expense of a dystopia for the majority. Narrative treatments of terraforming have drawn from this convergence of the colonial and the utopian in the American Pastoral to inform their explorations of interplanetary settlement.

Representations of alien planets as wilderness landscapes often utilised what Ernest J. Yanarella has described, following Lewis Simpson's *The Dispossessed Garden: Pastoral and History in Southern Literature*,[19] as the Northern "Garden of the Covenant" experience, which drew on Puritan traditions and parallels between the colonisation of America and the Exile of Israel from Egypt to motivate 'strenuous work and instrumental means to make way for a New Heaven and a New Earth'. The potential transformation of these wildernesses into agricultural land or Edenic gardens directed pastoral longing into the future, thus establishing one of the utopian dimensions that feed into the impulse to terraform. The Southern "Garden of the Chattel" experience offered a utopian vision that involved landscaping America as an Edenic paradise 'where nature's bounties need only to

[17] See Leo Marx and Annette Kolodny.
[18] John Rieder, *Colonialism and the Emergence of Science Fiction* (Connecticut: Wesleyan University Press, 2008), p. 15.
[19] Lewis Simpson, *The Dispossessed Garden: Pastoral and History in Southern Literature* (Athens, GA: The University of Georgia Press, 1975).

be cultivated and harvested'. The labour that enables habitation is sublimated, '[f]or underlying the pastoral landscape of the Southern colonies was the patriarchal plantation society with its system of slavery'. These two garden images eventually shifted toward representations of the Midwest "Garden of the World", which gathered into its orbit images of the pioneer farmer and an agrarian tradition that attracted continued westward expansion. The 'imperialistic impulses of the pull of the Farther Landscape of the Far West' eventually led, in sf, to images of 'a technological garden or engineered millennium of the cosmos' where '[t]he Further Landscape is now outer space, even deep space; and, once again, the garden image serves as an image of imperial expansion and conquest'.[20] The utopian promise embedded in the landscape of the garden or farm played a significant role in structuring the colonial experience of America, landscapes that have continued to feed into the language of terraforming narratives.

The third and final distinctive feature of Bakhtin's idyllic chronotope is the 'conjoining of human life with the life of nature, the unity of their rhythm, the common language used to describe phenomena of nature and the events of human life'.[21] Along with the motif of reciprocity between pastoral spaces and individuals, this "common language" encapsulates one aspect of Ursula K. Heise's eco-cosmopolitanism: that the politics of place must account for the "more-than-human-world".[22] Empson argues that the symbolic use of the pastoral has often been to address human contradictions within communities, an idea reiterated by Tom Moylan in the context of utopian literature when he argues that '[t]he absent course of history is made sense of partly through the operations of the literary texts, for they are symbolic acts that provide imaginary resolutions to real social contradictions'.[23] Negotiation between anxiety and enthusiasm for the future in pastoral sf suggest that a temporal contradiction lies at the centre of the terraforming narrative's social enquiry. The traditional pastoral opposition between the country and the city is subject to change in the context of a technologically advanced industrial-capitalist society, what Bakhtin characterises as 'a great but

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[20] Ernest J. Yanarella, *The Cross, the Plow and the Skyline: Contemporary Science Fiction and the Ecological Imagination* (Florida: Brown Walker Press, 2001), pp. 80-81, 81, 81, 82, 82, 105-106.
[21] Bakhtin, p. 226.
[22] Ursula K. Heise, *Sense of Place and Sense of Planet: The Environmental Imagination of the Global* (Oxford: Oxford University Press, 2008).
[23] Tom Moylan, *Demand the Impossible: Science Fiction and Utopian Imagination* (London: Methuen, 1986), p. 30.

abstract world, where people are out of contact with each other, egoistically sealed-off from each other, greedily practical; where labor is differentiated and mechanized, where objects are alienated from the labor that produced them'.[24] This sense of alienation calls for developing a new awareness of humankind's place in a global complex of social relations within a scientifically understood universe:

> It is necessary to find a new relationship to nature, not to the little nature of one's own corner of the world but to the big nature of the great world, to all the phenomena of the solar system, to the wealth excavated from the earth's core, to a variety of geographical locations and continents. In place of the limited idyllic collective, a new collective must be established capable of embracing all humanity.[25]

This call for a new conceptualisation of a collective sense of place that escapes the boundaries of its local and regional confines to encompass global scales is, in contemporary literature, answered by sf and its use of the terraforming motif to explore and comment upon society. This use of the pastoral is not limited to a global scale; sf is concerned with exploring the new socio-political and ethical relations that advanced technology places us in with regard to Earth and the solar system. Terraforming narratives attempt to create imagined spaces with which to reflect on new visions of the possible relationships between individuals, communities and nature, making use of the pastoral to negotiate between anxiety and enthusiasm for the future.

3.1 The Garden of the World in the Terraforming Stories of the Early 1950s

Bradbury's series of elegiac pastoral short stories, collected with additional stories and vignettes as *The Martian Chronicles*, offers a chronological selection of episodes describing the colonisation and terraforming of Mars. Sawyer points to *The Martian Chronicles* as an example of pastoral sf and notes that the opening vignette, "Rocket Summer" (1950), explores 'ideas of the "small town" (second paragraph) transformed by technology'.[26] These vignettes operate like pastoral emblems; in "Rocket Summer", two ideas of the country town hinge on the metonymic climate change caused by a rocket, which brings the already transformed Midwest town into contact with the technological icons of a

[24] Bakhtin, p. 234.
[25] Bakhtin, p. 234.
[26] Sawyer, p. 401.

wider world. The unseasonable warmth works analogously to Marx's counterforce and signals a displacement of the chronotope of the town into a future in which the space of the "small town" is interpenetrated by technologies with far reaching regional and global effects. The counterforce, Marx's paradigmatic example of which is the whistle of a locomotive heard from the pastoral idyll of the "Sleepy Hollow", dramatises the impact of two distinct worlds of discourse, or in Marx's words 'structure of thought and feeling', by representing technology's intrusion into the pastoral landscape.[27] In sf, the counterforce takes on new character as traditional motifs signifying the intrusion of technology into the pastoral landscape become the locus for nostalgia. Sf futurity reassigns older forms of technology a new valuation as symbols of a bygone, pastoral era. Marx's example of the locomotive whistle as a counterforce therefore becomes an essential icon for a historically superseded technological complex that is integrated into the pastoral landscape. Likewise the Midwestern town, once envisioned as the encroachment of civilisation into the wilderness, is, in Bradbury's *Chronicles*, embedded into the landscape as an essential part of the text's pastoralism.

A spaceport features in the vignette "The Taxpayer" as a possible means of escape from Earth, which the eponymous taxpayer believes is a 'terrible world […] there's going to be an atomic war!'. The pastoral opposition between the country and the city is here restructured as an opposition between Earth and Mars, and the flight from the city to the country becomes the desire for a literal flight from Earth, '[t]o get away from wars and censorship and statism and conscription and government control of this and that, of art and science!'. The pastoral chronotopes and themes that Bradbury utilises in the context of sf futurity tie into the text's background a conflict between anxiety and pastoral idealism. The fundamental strangeness of Mars and its perceived contrast to the 'ordinary Monday morning on the ordinary planet Earth' offers an estranged setting with which to explore fears of unbridled technological and bureaucratic excess. Mars becomes a locus of desire, with the taxpayer drawing on pastoral images of Mars as 'a land of milk and honey'.[28] The foundation for the counterforce to this pastoral ideal has already been established by earlier stories that relate the failure

[27] Marx, pp. 25-26.
[28] *Chronicles*, pp. 48, 47, 48, 47.

of the first three scouting expeditions to Mars; spaceport security mentions the uncertain outcome of these missions in an attempt to deter the taxpayer from his desperate dream of a flight from Earth.

"The Green Morning" and "The Locusts" exemplify the way in which sf works analogously to the pastoral design to reflect critically on terraforming as a mirror of American colonialism. Benjamin Driscoll in "The Green Morning" is inspired by the frontier legend Johnny Appleseed to plant Earthbound vegetation on Mars to transform the planet, not by 'making just fruit for the stomach, [but by] making air for the lungs'. He sees this act of terraforming in militaristic terms as a 'fight against the very thing that might prevent his staying here. He would have a private horticultural war with Mars': by aligning gardening with war, one of the central problems motivating the settlers' journey, Driscoll landscapes Mars in terms of the Garden of the Covenant ideal.[29] This story's counterforce stems, not from Earth's civilisation, but from Mars' alien otherness:

> There lay the old soil, and the plants of it so ancient they had worn themselves out. But what if new forms were introduced? Earth trees […] There was no guessing what mineral wealth hid in the soil, untapped because the […] [Martian] trees has tired themselves to death.[30]

This reference to mineral wealth can be understood as valuable for the chemical properties it offers to Earth's vegetation, but it also compacts within the trope of dying alien life the theme of the colonial acquisition of natural resources and histories of the American gold rush. This signification recasts the pastoral ideal that Mars offers settlers into a form of colonial invasion. Landscaping Mars as an American frontier foregrounds the conflict between the past and future embodied in the opposition between a nature on Mars that derives its value from its age, and a culture perceived in opposition as exuberant and progressive, and therefore suitable heirs to the wealth of Mars.

The Martian Chronicles portrays terraforming as the usurpation of Martian life within a complex of associations in which Mars functions as a sign of futurity as well as anachronism, understood as 'an incongruous co-habitation of the same moment by people and artifacts from different times'.[31] Mars is variously positioned as a locus of primitivist pastoral desire and a mirror of civilisation. 'Mars was a place as unpredictable as time'; the occurrence of an impossible fact within

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[29] *Chronicles*, pp. 97, 98.
[30] *Chronicles*, p. 98.
[31] Rieder, p. 5, and on anachronisms in lost world narratives, pp. 52-53.

the established sf frame, the overnight growth to maturity of the seeds that Driscoll plants, emblematises the pastoral promise of the Garden of the World.[32] This compression of time allows the Mars chronotope to operate as an iconic site of projection that hosts a confrontation between the future and past. Driscoll uses the emblem of the fertile Martian soil to figure the nurture of American pastoral ideals, notions that are entangled with American colonialism. He

> thought of the rich, inky [Martian] soil, a soil so black and shiny it almost crawled and stirred in your fist, a rank soil from which might sprout gigantic beanstalks from which, with bone-shaking concussion, might drop screaming giants.[33]

Deeply ironic, the 'giants' of this metaphor figure the colonists themselves, who 'fall' from Mars when they decide to return to Earth after the long predicted outbreak of nuclear war described in the stories "The Luggage Store" (1950), "The Watchers" (1950) and "The Silent Towns" (1949). At a further level of abstraction, it stands as an emblem of hubris: humanity's faith in technology is undermined because they choose to cultivate misplaced ideals. The Martian landscape figures the raw potential for the realisation of the desires that the colonists choose to nurture in this new space, but it also possesses a dual aspect that threatens a reversal of the pastoral utopianism that the colonists attempt to grasp: rank and, like the carapace of an insect, black and shiny, the ideal of the rich and fertile landscape anticipated by the colonists is overturned. The 'inky' soil suggests that Mars is a space that can be overwritten by the colonists, a palimpsest in which a new history can be devised. However, the dynamism and seeming agency of the landscape, which almost exhibits lifelike qualities ('crawled', 'stirred'), works to rewrite the role of the colonists in this "Jack and the Beanstalk" image of terraforming. Until the impossible occurrence in this story, this image only leans toward literalisation, modulating its emblematic effect by combining the chronotope of the Martian landscape with a temporal dimension that is expressive of utopian desire. The counterforce's most prominent work is to show how, despite Driscoll's attempt to adapt Mars to the settlers, the environment itself works a physical change that gestures toward an alternative to his landscaping of Mars. Driscoll faints when first arriving on the planet, a sign of his difficult adaptation to its alien otherness, and suffers a repetition at the climax of the story when he takes 'one long deep drink of green water air'; he 'felt his

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[32] *Chronicles*, p. 99.
[33] *Chronicles*, p. 99.

rib case. In thirty days, how it had grown. To take in more air, they would all have to build their lungs. Or plant more trees'.[34] The counterforce introduces a choice between modifying the landscape or adapting to the new environment, both physically and ideationally.

"The Locusts" counters the potential for internal change explored in "The Green Morning". This vignette begins with the arrival of rockets which 'made sand and silica into green glass which lay like shattered mirrors reflecting the invasion, all about'. These green mirrors symbolise Earth's eclipsing of Mars' otherness. Drawing from the Southern Garden of the Chattel theme of the pastoral landscape as fertile both to life and the imagination, this eclipsing results in the cultivation of attitudes and desires that ironically threaten a re-enactment of the situation motivating the settlers' flight from Earth. Mars' potential as a pastoral retreat depends on its otherness, the very aspect that is threatened by further colonial waves: 'from the rockets ran men with hammers in their hands to beat the strange world into a shape that was familiar to the eye, to bludgeon away all the strangeness'. Mars' alien otherness is also entangled with notions of racial and cultural difference. In "The Shore", we learn that '[t]he second men should have traveled from other countries with other accents and other ideas. But the rockets were American and the men were American and it stayed that way […] the rest of the world was buried in war or thoughts of war'.[35] In "Way in the Middle of the Air", a black exodus to Mars, opposed by the white racist Samuel Teece, punctures notions of an idealised pastoral town by recalling histories of slavery and lynchings underwriting the Garden of the Chattel images of the Southern American colonial experience.[36] Bradbury's pastoral sf warns of the dangers of landscaping Mars according to an ideal that Marx argues 'was embodied in various utopian schemes for making America the site of a new beginning for Western society'.[37] The utopian landscape that terraforming seems to promise is overshadowed by the ambiguous oscillation between the chronotope of an alien Mars and that of Mars as a duplicate America which reflects contemporary social experience.

"The Million Year Picnic" exhibits many of the features of the pastoral already discussed, spatialising time to construct a primitivist distancing from Earth and the values embodied in its

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[34] *Chronicles*, p. 100.
[35] *Chronicles*, pp. 101, 101, 111.
[36] Yanarella, p. 81.
[37] Marx, p. 3.

representation. As war leads to Earth's final destruction a family escapes 'A million years' into the now deserted Mars.[38] They travel back in time, away from civilisation's legal, economic and political structures, but above all its technocracy:

> I'm burning a way of life, just like that way of life is being burned clean of Earth right now. […] Life on Earth never settled down to doing anything very good. Science ran too far ahead of us too quickly, and the people got lost in a mechanical wilderness, like children making over pretty things […] emphasizing the wrong items, emphasizing machines instead of how to run the machines.[39]

The creation of 'mechanical wildernesses' can be usefully read against Sharona Ben-Tov's argument that '[w]e invest in technology as a means of replacing fallen nature, fixing the past, and returning to the American Earthly Paradise'.[40] Under this rubric terraforming becomes a method of creating via technological means anachronistic worlds rooted in the pastoral ideal. Despite Ben-Tov's claim that because 'science fiction's commitment to the ideologies that produced modern science and technology [is] built into its very structure, there are idols that it cannot break, ideas and attitudes that it cannot subvert', the terraforming motif, as exemplified by Bradbury's pastoral sf, makes use of the megatext and elements of the pastoral mode to generate degrees of ambiguity, ironic detachment or reflection toward these ideas and attitudes.[41] Anxiety and enthusiasm for the future is established through strategies that mirror techniques central to the pastoral design. The text comments on the changes that technology enacts on society while highlighting a complex of concerns experienced in the international context of postwar America, issues that include 'politics, the atom bomb, war, pressure groups, prejudice, [and] laws'.[42]

Heinlein's *Farmer in the Sky* and Clarke's *The Sands of Mars* are the first novels to focus their narratives on terraforming. Responding to the same concerns expressed in *The Martian Chronicles*, they utilise chronotopes that appear in many later terraforming narratives, positioning them in relationships that mirror the pastoral country/city opposition to build worlds that engage with the problems and potential involved in the construction of new social relations. Both make use of

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[38] *Chronicles*, p. 213.
[39] *Chronicles*, p. 220.
[40] Sharona Ben-Tov, *The Artificial Paradise: Science Fiction and American Reality* (Michigan: University of Michigan Press, 1995), p. 55.
[41] Ben-Tov, p. 51.
[42] *Chronicles*, p. 165.

specific coding practices to compress meaning into various chronotopes and of specific allusions to the colonisation of the American continent, through both the protagonist's relationship to their worlds and through narrative representations of the worlds themselves. While it is certainly true that images of the frontier have dominated terraforming stories, they do not simply recapitulate its various aspects (although they do this too) but refigure and reorganise them in accordance with the narrative and linguistic possibilities offered by sf discourse.

Farmer in the Sky is an early juvenile that embodies a semi-primitivist orientation toward the past. The colony's division into 'homesteaders and townies', the latter made up of the planet's professional, political and administrative members, clearly mirrors the pastoral country/city opposition. Archetypal frontier heroes Johnny Appleseed and Daniel Boone are frequently alluded to, along with the American tradition of Scouts established in the spirit of exploration that Boone came to symbolise. This allusive strategy is also present in a more sophisticated form in Bradbury's portrayal of a phantasmagoric Mars and appears with regularity throughout the terraforming tradition. Also significant are comparisons between the colonial ship the *Mayflower* and its futuristic double (the colonial spaceship), scattered references to Christopher Columbus, and the Ganymedean settlement's direct parallel to a frontier town. Other pastoral motifs include the song "*The Green Hills of Earth*", which feature lyrics praising the rocket in terms suggestive of the pastoral hero's journey and return, with new insights, to the city: '*Out ride the sons of Terra; Far drives the thundering jet* – […] *We pray for one last landing on the globe that gave us birth* –'.[43] These direct allusions belie the text's sf futurity and evidence the colonists' landscaping of Ganymede as a new frontier in the tradition of the American Pastoral. This landscape is overlaid with others in the sf world that Heinlein builds, which incorporates the pastoral complex of value into a new socio-political context reflecting contemporaneous postwar anxieties.

Paul du Maurier, the leader of a scouting party prospecting for new areas to settle, recalls Bradbury's use of global warfare in *The Martian Chronicles* but draws from 'mathematical population bionomics' (ecology) to predict that a Malthusian population increase, resulting in atomic war on Earth, is between forty to seventy years away. Heinlein circumscribes the pastoral ideal within the

[43] *Farmer*, pp. 83, 58, 36, 77, 22, 60, 55.

framework of an sf text that connects the scientific principles underpinning ecology to farming and statistics in ways central to the terraforming tradition. These themes demonstrate the continuing influence of energy economics on terraforming narratives, a dynamic that can be traced back to Wells' presentation of a global society managed by a scientific elite. Paul's prediction of war, part of the 1950s consensus future constructed by many works of sf at the time, operates in an ideological space alongside ideas of migration and autarky. Seymour, one of the scouting party, argues that 'Ganymede has got to be made self-sufficient as soon as possible – and then we've got to slam the door!'.[44] Paul argues that self-sufficiency will be important, but that immigration will not disturb political and economic stability on Ganymede simply because Earth will lose the capability for space travel in the certain event of global warfare:

> Building colonies. We [the Earth Commission] think that is worthwhile in itself. The colonies need not be affected by the War. In fact, I don't think they will be, not much. It will be like America was up to the end of the nineteenth century; European troubles passed her by.[45]

Characteristically, interplanetary war is understood in terms of American colonial history by virtue of an apparent geographical analogy. Anna Bramwell argues that the influence of peasant ideology in Europe and America on the energy economists of the early twentieth century was a significant factor in shaping views of the land, which came to be seen as a fixed resource that would be most efficiently worked by peasants on small farms, rather than by larger farms overseen by landowners. Furthermore, Bramwell notes that '[p]easants were seen as the source not only of social cohesion and conservative values but of ecologically sound agricultural improvement'.[46] Ganymede, with its promise of free land, offers not only a landscape of untapped resources but an opportunity for the construction of an economy and a political system based on the myth of the traditionalist peasant farmer, thus bypassing the geopolitical tensions that have developed on Earth. This rewriting of history taps into the Garden of the Covenant ideal to construct an image of the self-sufficient and independent colony sealed off from its centre by an unbridgeable vacuum of space. Portrayals of terraforming in *Farmer in the Sky*

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[44] *Farmer*, pp. 154-156, 153.
[45] *Farmer*, p. 155.
[46] Anna Bramwell, *Ecology in the 20th Century: A History* (London: Yale University Press, 1989; repr. 1990), p. 66-67.

foreground desires for the creation of autonomous worlds in which history can diverge from the path envisaged in the text's imagined future.

The libertarianism of *Farmer in the Sky* gains its impetus from the influence of ideas of entropic processes on energy economics, the implications of which highlighted the finiteness of Earth's resources. The political implications of self-sufficiency – isolationism – are justified in the text by recourse to an ecological awareness of the material limits that Ganymede imposes on colonisation. The motivating impulse to terraform Ganymede is to escape the resource depleted and overpopulated Earth, for which food rationing operates as a synecdoche. Bill Lermer reflects that, '[l]ike most everybody, we had come out there on the promise of free land and a chance to raise our own food'.[47] He complains about the global management of food on Earth in a manner that resonates with some attitudes toward modern anxieties about climate change:

> What's the use in being careful if somebody on the other side of the globe is going to spoil your try? Those darned Chinese ought to quit raising babies and start raising food! Share and share alike, Bill.[48]

Reflecting fears over the increasing internationalisation opened up as a consequence of postwar capitalist expansion, this episode highlights the limits of a global distribution of finite resources and establishes the background for the narrative's advocacy of a pastoral localism made possible through terraforming. Later, Bill describes colonial farms on Ganymede that, unlike productive America, 'remains as primitive as a Chinese farm'.[49] In the context of Ganymede such a relationship emphasises the human labour involved in returning to an agrarian economy based around the image of the colonial farmer. On Earth, China's burgeoning population operates as an icon for Malthusian overpopulation; its lack of a technological (agricultural) infrastructure establishes it as a kind of anachronism, pointing toward an extrapolation from essentialist ideas of primitive cultural otherness.

In contrast to the rationing and the artificial 'Syntho-Steaks' of Earth, Bill's narrative revels in the abundance of food on Ganymede, which includes '*real* ham' and reminds him of Scout camp.[50] Ganymede is no land of Cockaigne, however, but a wilderness that draws more from the pastoral

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[47] *Farmer*, pp. 8, 83.
[48] *Farmer*, p. 9.
[49] *Farmer*, p. 107.
[50] *Farmer*, pp. 8, 78-79.

Garden of the Covenant ideal. Marx's comments on the utopian garden image's 'ancillary notion of the new continent as a land of plenty' may explain the dynamics of this contrast, for he argues that the sixteenth century voyager's notion of '"incredible abundance"' is 'perhaps the most important single distinguishing characteristic of American life. In our time, to be sure, the idea is less closely associated with the landscape than with science and technology'.[51] Anxiety over the capacity of science and technology to supply the abundance that in the past appeared as a fundamental facet of American culture is represented as Earth's failure, in an international context, to supply this abundance to a global population. While the technology that enables terraforming offers a technical solution to this problem, the ideological connotations of a new colony that harks back to the pastoral ideal of an American frontier is coherent with a desire for a return to the superior productive efficiency of the small farming community.

In this context, the various trials through which Bill and the colonials must prove their worth – either as cultural assets, as in the episode where Bill demonstrates the cultural worth of his accordion to a committee, as a Scout on Ganymede, as a settler looking to "prove" land by converting the rocky wilderness into fertile agricultural space, and as a member of a community who, in the face of disaster, remains to rebuild – function as tests of character and evolutionary potential. These trials foreground the role individuals play in creating an independent community worthy of survival. Individuals who unrealistically depend on government promises to support them, or who attempt to manoeuvre Earth into making impossible provisions for the colony, demonstrate their inability to adapt to the new socio-political demands on Ganymede and leave. When he considers returning to Earth with other colonists after a quake kills a third of their community, Bill has in mind those who choose to leave when he tells his father 'I don't *like* being classed with these lugs'.[52] This episode, in which undesirables are winnowed from the colony, valorises the blend of rugged individualism and community spirit that Bill demonstrates by choosing to remain. His struggle toward self-supporting agrarianism mirrors the colony's struggle for self-sufficiency, while the speed with which he reconciles himself to the difficulties of habitation on Ganymede affirms the significance of the

[51] Marx, p. 40.
[52] *Farmer*, p. 22.

colony's own existence. If Paul's claim that atomic war is indeed inevitable, the colonists who leave simply damn themselves to extinction. According to the logic of Social Darwinism established in the text, the values held by Earth's civilisation are evolutionarily unviable while the colony's brand of American colonialism is purportedly otherwise.

Ideas of Social Darwinism are implicit as an explanation for the difficult adaptation of the organism to an unfamiliar environment. Bill's young stepsister Peggy is unable to acclimatise to Ganymede, a development that threatens to make necessary a return to Earth for the family. Peggy, however, dies shortly after being injured in the quake, thus underscoring notions of fitness to habitation involved in terraforming. Bill uses an analogy that relates plants to people, asking

> Have you ever had a plant that refused to be happy where you planted it? It was like that. She belonged back on Earth.[53]

This megatextual compression of meaning demonstrates a convergence between the pastoral simple into complex formula, pastoral themes (the plant analogy itself) and sf oppositions between planets that stand for political positions and ideas that are structurally analogous to the pastoral country/city dynamic. This image parallels the gardener's cultivation of space and the planning of a new society based around the family unit. Significant here is the level of agency ascribed to Peggy in "refusing" to be happy, a case in which the gardener's plans are thwarted by conditions outside of his control. The corollary of this analysis is that the gardener cannot be censured for a failure of the individual plant to thrive. Peggy is uprooted from her environment by the demands of a larger organisational (social) unit, but it is not the fitness of the environment to the individual that is at fault but the individual's failure to adapt to the social and physical realities on Ganymede.

When Peggy dies, Bill reflects that if he had not encouraged her to stay, she would be 'right back in California, not here in this damned place where she couldn't live, where human beings were never meant to live'.[54] Located at the natural boundary of the Pacific Ocean and thus preventing egress for the continued westerly expansion of the pioneers who had travelled across the American continent, the Californian setting is significant as the origin of the new pioneers to Ganymede. That

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[53] *Farmer*, p. 123.
[54] *Farmer*, p. 145.

California is metropolitan rather than rural underscores the centrality of the urban space as a secure home in contrast to the dangers of Ganymede. Bill's pessimism in the light of Peggy's death, his assertion that humankind was 'never meant to live' on other planets, suggests that in order for the colonists to successfully make a home of Ganymede they must struggle with and transcend the limits to their humanity. Peggy's death suggests that this failure to adapt to other planets indicates a more fundamental inability to adapt to the future, a future in which interplanetary colonisation is the only answer to war on Earth. Those colonists who were 'meant to live' are, in Social Darwinist terms, those whose individual qualities are suitable adaptations to the social and physical requirements of the Ganymedean settlement. The contours of an ideology of manifest destiny connecting expansion throughout space to the transcendence of human limitations are thus sketched.

The text's appropriation of elements of the Garden of the Covenant ideal suggests that survival in spite of the hostility of Ganymede's environment is a triumph of individual and social endeavour, and it elevates the type of individual and community who successfully inhabit Ganymede to a pastoral, heroic status. The colonials' farms are less technologically sophisticated than the material infrastructure of Earth, and yet technology is central to terraforming Ganymede (bulldozers and spaceships play an essential role). This semi-primitivist distancing from the technologism of Earth offers a space to dramatise the need for the appropriate distribution of resources amongst the community, which in turn is imagined as a method of forging stronger bonds between individuals based on the necessity of co-operation for survival. In a passage that recalls Driscoll's dilemma in Bradbury's "The Green Morning", one character asks:

> What are we going to make of this planet? We can make it anything we want. Mars and Venus – they had native cultures. We dare not change them much and we'll never populate them very heavily. These Jovian moons are another matter; it's up to us. They say man is endlessly adaptable. I say on the contrary that man doesn't adapt himself as much as he adapts his environment. Certainly we are doing so here. But how?.[55]

The emphasis in *Farmer in the Sky* is not on the material means of terraforming, but on how the use of technology within a community affects individuals and how these experiences scale up to the level of the community. If humankind is infinitely adaptable, notions of a stable human identity are subverted,

[55] *Farmer*, p. 152.

and yet the community portrayed undeniably reflects concepts of American national identity prevalent in the 1950s. The pastoral ideal offered here suggests that smaller, local communities and libertarianism, in contrast to a rigidified bureaucratic system of global resource management on Earth, offer viable answers to international economic structures that manifest inequality in the very attempt to cater fairly to the global population. The question of adaptation raised by Bradbury, which calls for a fundamental change to human nature, is superseded in *Farmer in the Sky* by the question of how the environment itself is being transformed, but the text uses this focus on the agricultural value of space to suggest that a pastoral return to a simpler, American past offers an antidote to the problems and anxieties raised by the extension of democracy to the world.

Echoing Lermer's journey to Ganymede in *Farmer in the Sky,* Clarke's *The Sands of Mars* opens with the journey into space of an sf author whose stories have been superseded by the reality of Mars' colonisation. Gibson's surprise when first meeting with the professional astronauts piloting the spaceship *Ares*, whose ordinariness 'was not fitting at all well into the expected pattern', highlights the constructedness of Earth's landscapes of space and the Martian colony. Explicit comparison of the astronauts to American pioneers is belied by their actuality: '[t]here was no way of guessing that they belonged to a profession more romantic than any that the world had known since the last cowboys traded in their broncos for helicopters'. The re-use of tropes from sea narratives in representations of air travel in stories such as Rudyard Kipling's "With the Night Mail" (1905)[56] also had an analogue in stories of space travel, which were often based on 'the assumption that there would be no fundamental difference between the ships of space and ships of the sea – or between the men who manned them'.[57] Thus space travel is envisaged as sea travel, implying that the colonisation of America parallels that of the colonisation of alien planets. *The Sands of Mars* takes this traditional sf basis for imagining space colonisation and attempts to explore the dissonances raised by uses of the American Pastoral in sf. It engages in an explicit dialogue with the conventions of the 1950s consensus futures in an attempt to negotiate some of these distinctions. By focalising events through the consciousness of an sf writer,

[56] Rudyard Kipling, 'With the Night Mail: A Story of 2000 AD', in *Forgotten Futures* (1905) <http://www.forgottenfutures.com/game/ff1/night.htm> [accessed 20 December 2011].
[57] *Sands*, pp. 17, 16, 30.

Clarke develops a meta-commentary on the science-fictionalisation of (science-fictional) events and self-consciously appraises the refiguration of the pastoral in ways that are absent in *Farmer in the Sky*.

The Sands of Mars explores the important differences between sf and pioneer traditions, noting the discrepancy between romanticised expectation and the reality of astronautics and the Mars colony. During an interview with Mars' Mayor Whittaker, Gibson raises the question of the validity of understanding interplanetary colonisation in terms of historical analogues. Whittaker's response is that '[i]t can't be pressed too far. After all, men could breathe the air and find food to eat when they got to America!'.[58] *Farmer in the Sky* also recognises these fundamental material differences to the accessibility of resources, despite the amelioration of these basic facts by the narrative's modelling against themes related to American colonisation.[59] The relocation of such elements onto other planets highlights a contradiction between the past and the future implicit in the American Pastoral's reworking within the textual space of the terraforming narrative. This contradiction reflects the problems of using past colonial narratives as guides to understanding and responding to the planet in the light of designs for habitation. The tension between these landscapes and the colonists' lived experience of the planet points toward a temporal circularity that underwrites their vision of the future.

The image of the garden is used to playfully undercut the symbolic import of a ceremony held to commemorate the cultivation of an indigenous Martian '"airweed"'. The inauguration of this new method for increasing the planet's atmospheric oxygen is transmitted to Earth, and Mayor Whittaker and Chief Executive Warren Hadfield take the opportunity to propagandise for the terraforming project. Gibson thinks that the airweed 'certainly didn't look as if it could control the future of a planet', while the narrator (focalised through Gibson's perspective) remarks that[60]

> Hadfield had finished his token gardening: someone else could complete the job and fill in the hole. (The planting team was already hovering in the background, waiting for the bigwigs to clear out of the way so that they could get on with their work).[61]

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[58] *Sands*, p. 90.
[59] *Farmer*, p. 85.
[60] *Sands*, p. 192.
[61] *Sands*, p. 192.

This narrative technique plays on Gibson's status as an outsider who, in his official journalistic role as a visitor to the colony, views the ceremony with a detached and (as the parenthetical statement indicates) ironic gaze, thus raising a discrepancy that the text attempts to bridge between the engineering essential to the text's portrayal of terraforming and the process of gardening. This episode relates the political and social dimensions of terraforming to the physical act of adapting landscapes. These landscapes are chronotopes oriented toward the future and to the transformative potential symbolised by the Martian plant, itself able to survive only with difficulty in this unforgiving environment. Like the impossible event in Bradbury's "The Green Morning" and the agricultural cultivation of land in the "Johnny Appleseed" chapter in *Farmer in the Sky*, this event operates as an emblem that activates an allusive network of pastoral associations within the sf futurity of the text's imagined world.

The opposition in Clarke's novel between Earth and Mars is more optimistic in tone than Bradbury or Heinlein's stories, yet relations between the newly discovered Martians and the colonists retain a distinctly imperial aspect. Unlike Bradbury and Heinlein's portrayal of the economic stresses caused by conflicts internal to Earth, *The Sands of Mars* focuses debate on Earth's continued economic support for the terraforming project rather than on portents of global warfare. Nevertheless, a political and technical struggle for self-sufficiency structures the plot, providing the motivation behind "Project Dawn" (the technical transformation of Phobos into a sun) and Gibson's own contribution to the colony (by raising awareness on Earth of 'the spirit we've built up here on Mars').[62] Like *Farmer in the Sky*, notions of community establish one axis for the contrast between Earth and Mars:

> Here were men and women united in a single task, driving towards a common goal, each knowing that their work was vital to the community. They had a sense of fulfilment which very few could know on Earth, where all the frontiers had long ago been reached. It was a sense heightened and made more personal by the fact that Port Lowell was still so small that everyone knew everyone else.[63]

Unity of motivation and action are central to this sense of community spirit, which is driven by an internalised ethic of expansion that motivates the decision to terraform. The continued expansion of

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[62] *Sands*, p. 169.
[63] *Sands*, pp. 118-119.

the frontier hinders the development of a local, personal sense of connection to the community. Terraforming appears to offer a solution to this problem, a pastoral flight from Earth and a return to small communities able to exercise political and social self-determination.

Like Heinlein's text, *The Sands of Mars* employs aspects of the family idyll and combines it with a romantic subplot (the love idyll) to underline Gibson's growing investment in the future of the colony. Gibson is integrated into the life of the local community as a result of a change of consciousness; this change of orientation toward the future is emblematised by a promised union between his newly discovered son (Jimmy Spencer) and the daughter of the colony's Chief Executive (Irene Hadfield). If Gibson's official acceptance into the colony and his growing bond with Spencer leaves him with the feeling that, '[f]or the first time in his life, [he] had a future to which he could look forward with interest and excitement – a future which would not be merely a repetition of the past', the text's commentary on sf's colonial inheritance leaves such repetition in tension with the movement toward new trajectories for humankind's future.[64]

A significant intersection between colonialism and the pastoral is developed through the colony's discovery of sentient Martian life. Early evidence of the capacity for these 'beasts' to learn to perform basic tasks, while not proof of intelligence, suggests the potential for its evolutionary development. A new motive joins the terraforming project, that of adapting the planet to create ideal conditions not only for the colony, but for the Martians to thrive: '[t]here was something inspiring in the thought of regenerating not only a world, but also a race which might be older than man'. Echoing the dying Martian life in Bradbury's "The Green Morning", the regeneration of life through terraforming attempts to justify the habitation of Mars and implies that the colony is able to determine the best interests of the Martians and their environment. Human-alien relationships are restricted to interaction with Squeak, '[o]ne baby, less than a metre high, [who] could only be described by the overworked adjective "cute"'. Unlike the adults of its species it appears unusually curious and follows Gibson back to the colony. Although he 'sometimes felt rather like a baby-snatcher who had abandoned his victim immediately after stealing it', Gibson feels no qualms over making use of the

[64] *Sands*, p. 196.

aliens to cultivate Mars.[65] After establishing the chronotope of the colony as a regenerative space in which time unfolds as a process of personal healing and socio-political reconstruction and self-determination, the narrative turns its attention to resolving anxieties over colonial relationships with indigenous cultures by invoking the theme of the discovery of alien civilisations:

> For it was their world, not Man's. However he might shape it for his own purposes, it would be his duty always to safeguard the interests of its rightful owners. No one could tell what part they might have to play in the history of the universe. And when, as was one day inevitable, Man himself came to the notice of yet higher races, he might well be judged by his behaviour here on Mars.[66]

The ideal of contact with "higher" alien civilisations and the external evaluative role that they might play function as a check to the colony's ethical standards. Hadfield reminds the colonists that they are 'making history' and that they are creating the foundations for a future of terraformation to which other generations of humankind will be indebted.[67] The first experiments with terraforming therefore involve attempts to formulate sound ethical relationships within and between species. These ethical considerations offer to underpin a colonial project extending beyond the solar system that struggles to escape a repetition of the record of oppressions visible in Earth's own history.

The colony's recourse to terraforming as an answer to Earth's reluctant economic support for Mars' colonisation is hindered, in Gibson's view, by Earth's own anxiety over the potential loss of their status as imperial centre of a new interplanetary society. Gibson speculates that '[i]t's too wounding to their pride. They want the Earth to remain the centre of the universe' and posits the colony's independence as a threat to Earth's self-image. Norden, one of the astronauts shuttling between Earth and Mars, pinpoints the homogenisation at work in Gibson's theory, noting how 'it's funny how you talk about "Earth" as if it were some combination of miser and bully, preventing all progress here', while admonishing Gibson not to 'forget that everything you've got here is due to the enterprise and initiative of Earth'. Norden's position as an intermediary between Earth and Mars gives him an insight into the root of the conflict between these two worlds, allowing him to point out that the colonists 'take a very self-centred view of things'. Norden's statement shows how Mars' relationship to Earth is mediated by the interests of those directly administering policies for the

[65] *Sands*, p. 150.
[66] *Sands*, p. 200.
[67] *Sands*, p. 188.

colonial government on Mars. One factor preventing a synthesis between the two planets is '[t]he sheer difficulty and expense of interplanetary travel', a condition that inevitably leads to 'some lack of understanding, even intolerance, between Earth and Mars'. These physical conditions encourage a corresponding mental orientation, prompting Gibson to hope that 'these psychological barriers would be broken down and the two planets would come closer together in spirit as well as in time'.[68] The dynamics of this reconciliation mirror to some extent the American pastoral's garden chronotope, which synthesises the emblematic value of the city and the wilderness. In this context the technology of space travel affects this bridging of opposites. The Mars colony, represented as a garden to be extended across the Martian wilderness, is an attempt to forge a new culture where values specific to Mars can be developed independently, before being fed back to Earth. The political reconciliation that Gibson imagines between Earth and Mars highlights social barriers that emerge as a consequence of the realities of physical space and colonial landscapes, barriers that must be overcome through increased contact between the two planets.

Bradbury, Heinlein and Clarke's terraforming narratives foreground pastoral chronotopes and themes of the "sentimental" variety but imbricate them with megatextual sf tropes. In the process they position terraforming in an unstable zone in which oscillation between the past and future speaks of an anxiety toward an imagined technological adaptation of Earth that is driven by political and economic changes in contemporary society. The dissonance between each text's treatment of themes drawn from the American Pastoral and the alien status of the planets undergoing terraforming create a sense of estrangement from Earth's socio-political norms. The similarities between the imagined Earths of these texts are evidence of a consensual future constructed dialogically by the sf of the period, a future that later writers such as Pamela Sargent and Kim Stanley Robinson write against in their constructions of Earth. These three writers use terraforming to express different orientations toward the colonial expansionism informing notions of globalisation. While Bradbury and Heinlein imagine terraforming as a reaction to fears that dwindling resources and an increase in geopolitical contact may lead to global warfare on Earth, Clarke's use of terraforming acknowledges the barriers

[68] *Sands*, p. 202.

to reconciliation that prejudice erects but expresses optimism that the future offers an escape from a repeating human history.

3.2 The Burden of Hope in the Garden of the Chattel: 1950s Consensus Dystopias

Frederik Pohl and C.M. Kornbluth's *The Space Merchants*, Miller's "Cruxifixus Etiam", and Anderson's "The Big Rain" and *The Snows of Ganymede* construct models of dystopian societies that are contrasted with images of Earth to highlight the political and social exploitation underlying the formation of new societies. In this regard they resemble Bradbury's depiction of terraforming in *The Martian Chronicles*. Whereas Clarke and Heinlein's works depict a sense of collective movement toward the instantiation of pastoral landscapes, these dystopian texts locate the pastoral golden time in a sealed away future inaccessible to the colonists. Social arrangements on the colonised planet are frozen into a nightmare cycle of entrapment; these stories expose the exploitation of the inhabitants' labour by a colonial elite, recalling the Garden of the Chattel images of the Southern American experience of colonisation. Although the presence of romantic pastoral motifs of the pioneer tradition is downplayed, such relations are not entirely absent from this group of texts. Examples of sentimentalised pastoral themes are incorporated into the political design of these texts, which work analogously to Marx's pastoral design in order to comment on social exploitation. Earth is established as a political contrast, with sentimental themes appearing only to underscore the inequities that underlie vast societal projects. The imaginary construction of sf landscapes via textual worldbuilding allows additional symbolic meaning to accrue through the juxtaposition and "unveiling" of chronotopes in the text's narrative.

Deserts and wastelands feature prominently in all three of the texts under consideration here. Such landscapes are present in Bradbury, Clarke and Heinlein's narratives and frequently appear in later terraforming stories, such as Frank Herbert's *Dune* (1965)[69] and Ursula K. Le Guin's *The*

[69] Frank Herbert, *Dune* (Kent: New English Library, 1968; repr. 1983).

Dispossessed (1973).[70] Clarke and Heinlein's wasteland chronotopes, while sometimes inhibiting movement, are never as unremittingly stark as the landscapes presented by Miller and Anderson. Furthermore, the harshness of the wasteland presented by Clarke and Heinlein is mitigated by a supportive social framework, while in Miller and Anderson's the repressive society only enhances the negative aspects of the landscape. Such physical landscapes often encode political meaning, with signifiers such as the planet's physical inhospitability and the scarcity of resources emphasised alongside a rigidly hierarchised and repressive society. A certain degree of secrecy and arbitrarily restricted movement also accompanies these representations. The city, the labour camp and the wasteland deny exploration and enforce alienation to both natural and built environments. The claustrophobia of the social arrangements in these texts draw attention away from nature and onto political and individual aspects of the human experience on these worlds.

The Space Merchants was serialised in *Galaxy Science Fiction* as "Gravy Planet" in 1952 before novel publication in 1953. A satire on corporate America and the 'peculiarly American talent of advertising', it uses the planned colonisation and terraforming of Venus to unveil a range of exploitative societal relationships that dominate the Earth of the text.[71] Protagonist Mitchell Courtenay works at Fowler Schocken Associates as an advertising executive (a "star-class copywriter") who has been assigned the task of creating an advertising campaign that would persuade people to apply for the Venus project. The issue of colonisation becomes the site of a struggle between the ideological orientation of corporate America and that of the Conservationists ("Consies"), an underground organisation that opposes the almost total control that the corporations exert over the Americanised Earth. Courtenay is kidnapped, his death is faked, records of his identity are tampered with and he is contracted as a labourer to the Chlorella Corporation in Costa Rica. This Conservationist conspiracy is designed to remove Courtenay from his position as propagandist for the Venus project while simultaneously exposing him to the realities of life as a poor consumer/producer. Courtenay's struggle to regain his position exposes him to the extent of the Conservationist network

[70] Ursula K. Le Guin, *The Dispossessed* (London: Gollancz, 1999; repr. 2000).
[71] *Merchants*, p. 10.

and their plans to establish the Venus colony as an independent settlement founded on Conservationist principles.

Subordinated to the economic (and hence political) prerogatives of the corporate world, the American government in *The Space Merchants* possess severely limited powers. This arrangement anticipates the political engagement with multinationals in post-1970s terraforming texts such as Robinson's *Mars* trilogy.[72] Fowler Schocken of Fowler Schocken Associates claims that '[w]e've actually and literally conquered the world. Like Alexander, we weep for new worlds to conquer', and he proposes the colonisation of Venus as an extension of their corporate mastery of Earth. This expansionist drive is a consequence of Schocken Associates' aim of social control through advertising, which is geared toward maximising profits via 'any act that served our god of Sales'. Illustrative of the power of Schocken Associates is "Indiastries": India has been organised as a cartel, an industrial factory that supplies all its produce to Schocken associates for marketing. In this context Venus represents for Schocken Associates a new industrial complex, a whole planet potentially available for financial speculation and exploitation. The Conservationists, popularly derided as a constituent of the 'lunatic fringe', work in opposition to this hegemonic bloc. Their belief that 'modern civilization was in some way "plundering" our planet' and that 'Nature's way of living was the *right* way of living' contradicts the tenets of corporate America, thus prompting Schocken to dissociate the project from them and to suggest that 'spaceflight and Conservationism are diametrically opposed'.[73]

The visuals for Courtenay's advertising campaign illustrate a fundamental dynamic substrating the idea of terraforming in sf. Courtenay notes how '[t]he airbrush and camera people were having fun sculpting a planet. It was the ultimate in "Before and After" advertising, and they were caught by the sense of history'. This captures the essence of ideas of landscaping, focused here through a sensuous artistic metaphor ('sculpting'). The adaptation of nature via technology possesses a potentially autonomous artistic dimension that is driven by an impulse for improvement, but which is instead subordinated to economic desire. This episode is juxtaposed with another scientific

[72] Kim Stanley Robinson, *Red Mars* (London: Voyager, 1992; repr. 1996), *Green Mars* (London: Voyager, 1993; repr. 1996) and *Blue Mars* (London: Voyager, 1996).
[73] *Merchants*, pp. 8, 9, 19, 16-17, 17.

development pioneered by Schocken Associates' Research and Development team: one researcher notes that Venus has an abundant source of pure energy direct from the sun that can be tapped, a fact that stands in contrast to resource scarcity due to overpopulation on Earth. This direct source, unfiltered by distance, atmosphere and other factors, is a variant of the utopian dream of free energy offered by atomic sources in such works as Williamson's CT stories.[74] The transformative aspect of the "Before and After" images of Venus is tied to a sense of the possible history that could develop on Venus, of change as a process constrained by natural factors but open to the potential of a willed transformation that ties these natural processes to human agency. This sense of time pivots on the results of the actual terraformation of Venus, an event that is absent from the story but which is subject to a struggle for determination throughout the text's narrative.

Although the plot of *The Space Merchants* ends with the arrival of the Conservationists on Venus and hence excludes occurrences of planetary adaptation (apart from the backgrounded terraforming of the Moon and geoengineering of Earth), this text is important to the dystopian tradition of terraforming narratives for the way in which it aligns radical oppositional politics and Conservationism against a satirised Corporate America. The ideological orientation of the corporations and the consumerism that it extols is identified as the cause of the regional effects that threaten the integrity of Earth's environments. Antarctica, a Schocken asset over which a bloody feud with their rivals Taunton Associates is fought, and Cal-Mex, a region encompassing California and Mexico that is subject to severe earthquakes caused by H-bomb testing, are environments affected by the primacy of corporate interests. The Conservationists and their organisation into cells recall fears of an underground communist organisation in America, yet their call for greater education and a general demand for 'planning of population, reforestation, soil-building, deurbanization, and an end to the wasteful production of gadgets' recalls the aims of the early energy economists in most respects bar the Conservationist's pastoral desire for deurbanisation.[75] Portrayal of the Conservationists as a

[74] *Merchants*, p. 55.
[75] *Merchants*, p. 101.

revolutionary underground movement anticipates the Lunarians of Heinlein's *The Moon is a Harsh Mistress* (1966)[76] and radical environmentalists such as the Reds in Robinson's *Mars* trilogy.

In "Cruxifixus Etiam", Miller explores the corporate investment in and exploitation of labour involved in terraforming Mars. This story is focalised through the Peruvian Manue Nanti, who contracts himself to the terraforming project in order to earn enough to return to Earth and retire young. Earth in this text is a world of diverse landscapes alien to Nanti, who 'had seen so little of it that many of its places would be more alien to him than the homogenously ugly vistas of Mars'. Earth as a global chronotope is a series of nested spaces, both natural and artificial, that signify the plurality of the value systems and cultural voices on Earth. In contrast, Mars is a homogenous landscape, 'a nightmare, a grim, womanless, frigid, disinterestedly evil world'. During an episode in which a Catholic priest from Earth visits the colonists to give Mass, Nanti witnesses him spill a drop of wine onto the Martian soil. This event functions as a pastoral emblem: the wine awakens Nanti's imagination to images of 'sunny Sicilian vineyards, trampled from the grapes by the bare stamping feet of children', a landscape that he has only experienced imaginatively. The red wine, Christ's blood but also 'the rich red blood of Earth, soaking slowly into the crust of another planet', stands in for the blood and suffering of the colonists who are remaking Mars. If, as Nanti thinks, '[f]aith needed familiar surroundings, the props of culture', then faith and culture itself are human expressions of a reciprocity between themselves and their environment, a feeling of being at home.[77] On the homogenous landscapes of Mars, where the only environment that the labourers experience is a world of endless toil, faith in the project and in humanity cannot thrive and achieve expression through cultural forms adapted on Earth. "Cruxifixus Etiam" explores the possibility of developing an indigenous Martian culture that will not only allow the colonists to survive, but to eventually make a home of Mars.

Economic and cultural exploitation form the centre of the text's ecocritical engagement. This exploitation is primarily socio-economic as the labourers who appear in the text are apparently of all racial groups: Nanti's co-labourer is Tibetan while Sam Donnell, one of the veteran labourers known

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[76] Robert A. Heinlein, *The Moon is a Harsh Mistress* (London: Gollancz, 2001).
[77] 'Cruxifixus', pp. 58, 61, 66, 66, 67.

colloquially as “troffies”, is presumably American. Nevertheless, Nanti’s position as the protagonist raises the implication of a latent critique of cultural-economic exploitation in South America, and by extension the correspondence between ethnic and socio-economic exclusion. The supervisors who appear in the text, the German Vögeli and the (presumably American) Will Kinley, are of European and American descent and so represent the economic and perceived cultural superiority of the “West”. The relationship between labour and suffering is given emphasis by a visceral sf image of bodily adaptation that resonates with Bradbury’s romantic treatment of Driscoll’s physiological adaptation to Mars in “The Green Morning”, itself a metaphor for psychological and cultural adaptation. Unlike the supervisors who are quartered in environmentally contained habitats that afford them the luxury of living without breathing apparatus, the labourers are surgically fitted with a system of hoses and valves that breathe for them, making natural, physical breathing obsolete. The irreversible impact of this form of pantropy on the labourers is suppressed; the repercussion of this physiological change is an indefinite extension of their three year contract due to the inevitable loss of the use of their lungs. Every labourer must therefore reconcile themselves to exile, to an alienated existence with their own bodily otherness in an alien environment.

Early in the story Nanti wonders, ‘[w]hy should men lose their lungs that after eight centuries of tomorrows, other men might breathe the air of Mars as the air of Earth?’. This disaffection leads him to seek reasons for their sacrifice. When Nanti’s original motivation for contracting himself to the project can no longer be realised, the text’s central theme becomes salient. Kinley offers Nanti a pastoral aphorism, ‘[s]ome sow, others reap’, that turns on the theme of sacrifice and recalls the title of the story. Kinley’s attempt to inspire Nanti with a new reason for joining the terraforming project leads Nanti to see the project as ‘an eight-century passion of human faith in the destiny of the race of Man’. This exportation of Catholic iconography onto Mars offers Nanti an alternative landscape as a means of coming to terms with his future in this new environment, by allowing him to bridge the discontinuity between Earth and Mars with a narrative of sacrifice and faith. In contrast, Donnell offers an economic explanation for the terraforming project that echoes Jean-Baptiste Say’s circular flow theory of economics: that ‘Mars is an outlet for surplus energies, manpower, money. Mars Project keeps money turning over, keeps everything turning over. […] if the Project folded, surplus

would pile up – big depression on Earth'.[78] This Orwellian economic vision sees terraforming as an extension of a capitalist strategy utilising the project as a check to economic collapse on Earth. Representation of economic expansionism draws from colonial traditions which, like the pastoral elements incorporated into the text's structure, offer spaces to critique civilisation's construction of new worlds on the foundations of the forgotten; on the marginalised and exploited members of society. As one of these forgotten, Nanti finds this explanation unsatisfyingly narrow and can only reconcile himself to life on Mars by entertaining a belief in a more expansive sense of purpose underlying the terraforming project.

Believing that 'if he were laboring for any cause at all, it was to build a world so unearthlike that he could not love it', Nanti realises that the pastoral promise of a garden on Mars is fundamentally denied to him.[79] The difficulty of building a new home on Mars is compounded by social inequalities that ultimately proclaim the project to be oriented not toward himself and his peers but toward others who will reap the benefits of their labour. Nanti strikes another labourer during a crucial episode in which a spontaneous and limited rebellion threatens to occur and so negates the possibility of an uprising, but the subordination of his identity, desires and voice in favour of a collective project does not stand unquestioned by the text. An essential aspect of the design of the story is the way in which promises of economic security are combined with pastoral imagery to structure a manipulative relationship between the directors of terraforming and those who actually work to transform the planet. Tragically Nanti accepts his sacrificial role, but only after a psychological struggle with his bodily adaptations emphasise for the reader the severity of the exploitation visited on the colonist–labourers. Terraforming is used in this story, as in later stories of the 1950s, to expose the issue of the controversial foundations from which societies are built.[80]

Anderson's "The Big Rain" and *The Snows of Ganymede* explore issues of nationalism and the contrast between democracy and communism, once again casting Earth as the political centre to which the terraformed planets are measured. Drawing on the Cold War paranoia prevalent in the

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[78] 'Cruxifixus, pp. 75, 77, 78, 69.
[79] 'Cruxifixus, p. 67.
[80] Cordwainer Smith's 1959 short story "When the People Fell" uses the terraforming motif to explore similar thematic territory.

1950s to inform the dystopian elements of its Venusian society, "The Big Rain" is a tale of oppression and espionage set after Venus' declaration of independence. Earth's relationship to the newly independent Venus is one of wariness; Hollister thinks that, 'however peaceful Earth might be, she was still a shining temptation to the rest of the system'.[81] He insists on an interplanetary connection in the form of a United Nations, an expansion of the global sense of social co-ordination to an interplanetary scale. While Venus is far from united globally, the text emphasises its status as a global state and questions its relation to the interplanetary confederation, of which Earth is its central political body. Again Hollister makes explicit that this political clash can be seen in terms of the clash between democracy and communism on the one hand, and the regulation of groups versus the individual on the other. The latter in both instances leads to an unhealthy Cold War paranoia. This anxiety underlies the relationship of the colonies to its centre and highlights an instability underpinning the UN affiliated interplanetary society.

As in *Farmer in the Sky* and *The Sands of Mars*, the harsh landscapes of the planets to be terraformed may justify a certain degree of individual subordination to the group but, Hollister argues, 'that doesn't give anyone the right to collectivize the minds of men'. On the fact of rationing in the capital New America, Hollister believes that Venus' harsh conditions promote a communist ethic: '[h]e reflected that the communist countries before World War Three had never gone this far. Here, everything was government property. The system didn't call itself communism, naturally, but it was, and probably there was no choice. Private enterprise demanded a fairly large economic surplus, which simply did not exist on Venus'. As in "Cruxifixus Etiam", the colonists on Venus exist for the sake of production; their lives have become subordinated to the distant goal of a terraformed planet. This drive toward material production is used by the government to legitimate tools of state control. Those deemed by the secret police to be enemies of the state are sent to the mines at Lucifer where, despite Hollister's argument that '[y]ou could use free men, taking proper precautions, and it would be a lot more efficient and economical of manpower', they are callously overworked and habitually exposed

[81] 'Rain', p. 5.

to radiation.[82] Lucifer's main function as a labour camp is as a deterrent and detention centre for malcontents.

Venus' landscape is accorded only instrumental value, leading to its terragouging in the narrative's past. Hollister's first supervisor, Heinrich Gebhardt, sees an exploitative dynamic at work in Earth's initial imperialist mining of Venus when he explains that 'the so-called democracies often relied on broken men, who could not find vork at home or who had been displaced by var. No, ve owe them notting'.[83] The terms of Gebhardt's rejection of Earth informs Venus' independence and speaks of a desire to escape the exploitative relationships that an imperialist colonisation of the solar system entails. The distances involved and the prohibitive cost of space travel adds a further dimension to this political relationship as

> a military expedition to suppress the nationalists would cost more than anyone could hope to gain even from the crudest imperialism. Also, as long as no clear danger was known to exist, it wouldn't have sat well with a planet sick of war; the dissension produced might well have torn the young world government, which still had only limited powers, apart.[84]

It is not on ethical grounds that the suppression of nationalist independence is rejected but on economic, logistic and political grounds. Secret policeman Captain Karsov explains that one reason for the schism between Earth and Venus, and the latter's refusal to remain a part of the UN, is that 'we are … necessarily … developing a whole new civilization here, something altogether remote from anything Earth has ever seen'.[85] Hollister believes that this attempt to establish an independent culture grounded in nationalism is a propagandistic aid to the systematic oppression of the majority of the colonists. Nevertheless, it exposes a reaction to the political asymmetry between Earth as the colonising centre of an interplanetary government and its peripheral colonies.

This story takes its name from the Big Rain model of terraforming, the metaphorical potential of which scientific model has been returned to in several later terraforming narratives.[86] In "The Big Rain" the colonists distribute seven million "airmakers" over a period of thirty years across Venus' surface. Combined with the manufacture of soil and a series of strategically deployed hydrogen

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[82] 'Rain', pp. 31, 6, 26.
[83] 'Rain', p. 5.
[84] 'Rain', p. 6.
[85] 'Rain', p. 5.
[86] During the conclusion of David Lynch's film version of *Dune* (1984), for example.

bombs designed to initiate volcanism on Venus, it is thought that this project will release enough water into the atmosphere to cause a global downpour of rain lasting ten earth-years, at the end of which

> there would be rivers and lakes and seas on a planet which had never known them. And the soil would be spread, the bacteria and plants and small animal life released. Venus would still be mostly desert, the rains would slacken off but remain heavy for centuries, but men could walk unclothed on this world and they could piece by piece make the desert green […] In five hundred years, all of Venus might be Paradise.[87]

This pastoral image compresses the temporal scope of the intermediary stages involved in bringing life to other planets as much as it gestures toward the idea that satisfactory initial conditions form a precondition to future ecologic and spiritual nurture and growth. The physical attributes of other worlds is used to offer an ecological image whose dynamism exceeds the scale of the natural phenomenon of Earth. Through this image the sentimental kind of pastoral theme enters into the text as a politicised form of appeasement for the exploited workers. The event of the Big Rain and the vision of a far future paradise is the subject of humorous songs that cast this future as a land of Cockaigne. An ecology that is geared toward human needs and consumption sits behind this depiction of a land of fantastic abundance where earthly desires are fulfilled. As in Miller's text, however, this landscape is displaced into an inaccessible far future. Indeed, the pioneering spirit involved in romantic representations of terraforming have no place on Venus: Karsov warns Hollister that "'Venus is no place for the rugged individualist [...]. Men have to work together, and be very tolerant of each other, if they are to survive at all"'.[88] What the text leaves us with is not a community driven by a pioneer spirit but a society in which the sentimentalised pastoral is variously co-opted or denied in order to sustain an asymmetric socio-political arrangement designed to maintain the productivity of a workforce in the face of extreme environmental conditions and exploitative social relations.

Anderson's *The Snows of Ganymede* takes place in the same Psychotechnic universe as "The Big Rain". The events occur in a far future in which nationalist political bodies are replaced by global organisations such the monastic Order of Planetary Engineers, whose relationship to Ganymede parallels that of the earlier UN to Venus in "The Big Rain". The history of the initial colonisation of

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[87] 'Rain', p. 13.
[88] 'Rain', pp. 10, 3.

Ganymede by the White American Church recapitulates the pastoral pioneer tradition and mirrors an earlier colonisation of Mars by the Pilgrim Church in the text. The political opposition between the centre and the periphery of the interplanetary society defines a contrast between the oligarchic state descended from this religious organisation and the Order, which is based on the Moon. The Ganymedeans contract the Order to adapt Callisto's environment; like Hollister in "The Big Rain", this allows aspects of the Jovian government to be unveiled in the course of the Order's presence on Jupiter's moon. Their investment in planetary engineering is based on a utilitarian ethic combined with a militaristic pride and spirit of character, ideal characteristics providing moral foundations for the Order's mission 'to make space available for all men, regardless of race, creed, or political affiliations'. The Order declaims political involvement of any kind; their motivations are apparently practical and technical, and their understanding that various methods of planetary adaptation are necessary to cope with the idiosyncrasies of global environments, 'that other worlds were not Earth', suggest a corresponding liberal approach to political groups. However, this motivation is coupled with one that speaks directly to their power as an organisation: it will give them the monopoly they need to ensure their safety in the interplanetary order.[89]

This monopoly seems to contradict the Order's apolitical stance. The Engineers sent to Ganymede must grapple with questions of power and a possible disengagement from politics. On a narrative level these issues are explored and resolved through the consciousness of the protagonist Hall Davenent. Having only ever faced 'the inanimate savagery of planets', Davenent has been shielded from the way in which encounters with human hostility call forth a political response. The Order's aim, 'to keep the scientific spirit alive. To reform planets, not people', is central to this question and would later be interrogated in Robinson's *Mars* trilogy. The Psychotechnics, on the other hand, have developed a range of scientific practices aimed at the reformation of cultures, and so stand in direct opposition to the Order. The insight that environments impact on the development of culture, 'that man necessarily develops a different civilization in every environment if he stays long enough, and that what may shock you is normal, perhaps necessary, on Ganymede', buttresses the relationship between physical and socio-political orientations embodied by the terraforming motif. Davenant is

[89] *Snows*, pp. 15-19, 15, 22, 30.

eventually led on a path that will see him forcing a new government onto Ganymede at gunpoint.[90] Like Hollister's empty promises on behalf of the UN to the rebels of Venus in "The Big Rain", Davenant makes compromises with the terraformers' charter and with ideal channels for establishing new governments and new political relations between members of the interplanetary society.

Intellectual isolationism and its resultant social oppression are the core political issues that Anderson tackles in these terraforming stories. Dogmatic religion is linked to the dystopian government and is used as a symbol of isolationism. Enlightenment science, aligned with the spatial engineers, forms the contrast that underlies the political opposition between Earth and Ganymede. The opposition between the Ganymedean society and a group of outlaws highlights another intersection between politics and the pastoral. This outlaw community lives at the fringes of the Ganymedean society and prefigures similar uses of such groups in *Dune* (the Fremen) and the *Mars* trilogy (the Reds and Zygote). Unlike these later manifestations of the outlaw group, the outlaws of *The Snows of Ganymede* have not been able to develop a sustainable relationship with their environment and have quickly declined to an existence as 'barbarians':[91]

> The psycho-social effect of alien conditions had yet to be measured. Huddling, hiding, waging a doomed war for three or four generations, the hill men would rapidly have forgotten their intricate, highly specialized civilisation. The barrenness and cold of the landscape would have entered their souls.[92]

The narrator exhorts the reader to '[b]ehold the nobel [sic] savage!' when Davenent and Kruse, the two last surviving members of the terraforming expedition, witness the results of this social decline.[93] The outlaws are thus ironically likened to a pastoral, backward looking society, in contrast to the specialised technologies and science that ground civilisation's ability to improve humankind's living conditions. The way in which social trends can be scientifically measured and reconstructed places the Engineers as scientists in a position of political agency and justifies (for them) their use of the outlaws as a revolutionary force with which to establish a new, rational government on Ganymede.

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[90] *Snows*, pp. 34, 52, 48, 16-17, 92-93.
[91] *Snows*, pp. 70-71, 72.
[92] *Snows*, p. 74
[93] *Snows*, p. 77.

3.3 Moral Extensionism in Terraforming Stories of the Late 1950s and Early 1960s

The American sf that deals with terraforming themes in the 1940s and early 1950s develop some of the ideas raised by Wells and Stapledon in their 1930s scientific romances. However, these pulp stories foreground perspectives limited by single characters or groups, and often avoid temporal juxtapositions of a multiplicity of different societies and their attitudes to space. Thus the expansive future history and essays in myth creation that characterise Wells' and Stapledon's use of terraforming is backgrounded in favour of the synchronic juxtaposition of multiple landscapes. Poul Anderson's "Call Me Joe" (1957) uses this dynamic to contrast the sterile spaces of Earth to the wild beauty of a harsh Jovian landscape; between these spaces a monastic scientific research station acts as a middle landscape that mediates between the two.[94] Nevertheless, in the example of Anderson's Psychotechnic series, such broad sweeps of time are generated via an intertextual, dialogic element in which multiple stories portray landmark episodes in the history of an imagined interplanetary society for speculation and commentary on political themes. Furthermore, a temporal juxtaposition between the reader's contemporaneity, the present of the text, the futures imagined in these texts and their narrative past function in a similar manner to these sweeping future histories. The uses of terraforming in the stories of the 1950s reflect ideas that were being developed in a wide range of contexts, but show a distinct engagement with the politics of imperialism, nationalism and utopia. When these themes intersect with the trope of alien life, terraforming is often used to explore the extension of human moral environments toward others, either as analogues for terrestrial flora and fauna or for societies. The latter category is, in an important sense, also nature's otherness: humanity is encompassed by cosmological nature. The intelligent alien or the alien society (scalar levels) offer spaces for reflecting on both nature's (alien) otherness and on cultural otherness. While many alien societies are, in a sense, not other precisely because they are direct analogues for Earthbound societies, many terraforming texts open up ethical debate on issues of responsibility and respect for nature's otherness by depicting encounters with aliens whose possible intelligence remains an

[94] Poul Anderson, 'Call Me Joe', in *Isaac Asimov Presents the Great SF Stories: 19*, ed. by Isaac Asimov and Martin H. Greenberg (New York: Daw Books, 1989), pp. 103-148.

unresolved question. Heinlein's *Farmer in the Sky* and Clarke's *The Sands of Mars*, like Williamson's *Seetee Shock*,[95] include episodes in the latter parts of their narratives that introduce the discovery of alien life into their stories.

The ethics of colonisation are not straightforwardly consistent with environmental ethics. The extension of culture bound ethics risks incorporating the needs and interests of others to the self. As Stapledon and Bradbury illustrate, colonising planets inhabited by alien civilisations raise related engagements with intra-human ethical responsibilities. When these alien civilisations are taken as signifiers of nature's otherness and their cultural status is bracketed out, an environmental ethics that involves consideration of the role of nature's otherness can be brought into contact with the cosmological speculation of the text. These two separate ethical domains, or ways of framing ethical consideration, support each other: moral extensionism highlights similarities between others; nature's otherness emphasises difference. Alien intelligences are often accorded intrinsic value based on their perceived degree of sentience and intelligence. Non-sentient, non-human others are often accorded less or no intrinsic value, while abiotic nature tends to be seen as valuable for extrinsic reasons only: for their provision of the environment necessary for biotic life to thrive.

Anderson's "Sister Planet" (1959) uses the theme of human–alien relations to reflect on alien extermination as part of the terraforming process.[96] This idea received more attention in terraforming stories throughout the 1960s, responding in part to the developing sense of urgency that also inspired the environmental movement. Clarke's "Before Eden" (1961),[97] collected in Dozois' terraforming anthology *Worldmakers*, is a story of environmental contamination (and in retrospect an unintentional ecopoiesis) that broaches themes dealt with in Carson's *Silent Spring*,[98] serialised a year later in *The New Yorker*.[99] While alien life has been correlated with terraforming narratives since the 1930s, an

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[95] Jack Williamson, *Seetee Shock* (London: Mayflower, 1969).
[96] Poul Anderson, 'Sister Planet', in *Get Out of My Sky: Three Short Novels of Science Fiction*, ed. by Leo Margulies (New York: Crest, 1960), pp. 87-128.
[97] Arthur C. Clarke, 'Before Eden', in *Worldmakers: SF Adventures in Terraforming*, ed. by Gardner Dozois (New York: St. Martin's Griffin, 2001), pp. 60-68.
[98] Rachel Carson, *Silent Spring* (Boston: Houghton Mifflin, 2002).
[99] Jon Michaud, 'Eighty-Five From the Archive: Rachel Carson', in *The New Yorker* (2010) <http://www.newyorker.com/online/blogs/backissues/2010/04/eighty-five-from-the-archive rachel-carson.html> [accessed 19 December 2011].

investigation of short stories from the late-1950s to the mid-1960s highlight an increased interest in issues of moral extensionism that inform one facet of the use of the terraforming motif in sf. These engagements, as with the utopian and dystopian traditions discussed above, are informed by and make use of pastoral elements and techniques to frame their engagement with the ethics of colonisation.

"Sister Planet" tells of Nat Hawthorne's return to the research station on the ocean planet Venus where, as a biologist, he studies the ecology of its indigenous life. The research station is supported solely by a trade in firegems, which appear to be a biological product of the dolphin-like cetoid life forms dominating the Venusian seas. Despite human–alien trading relationships with the cetoids, their intelligence continues to be questioned. Hawthorne's close relationship with the cetoid Oscar encourages him to credit them with intelligence, and when Oscar takes him to view one of the cetoids' undiscovered underwater "cities" he becomes convinced that they have developed an advanced culture fundamentally alien to humanity. Dazed by this experience, he finds it difficult to announce his discovery to the rest of the scientific community on Venus until Wym Dykstra, a geophysicist, unveils his analysis of the Venusian core and proposes 'the largest and most significant engineering project of history. […] The colonization of Venus'.[100] Dykstra's proposal entails the cetoids' extinction, which urges Hawthorne to protest and announce as evidence for the cetoids' intelligence his trip to their sunken city. As a result, Dykstra and Captain Jevons agree that terraforming Venus would be unacceptable, and they resolve to bury the results of Dykstra's research because Earth, pressured by overpopulation, would condone their extinction. Hawthorne is dissatisfied with this development and orchestrates a plan to prevent future research from discovering Venus' suitability for terraforming. He bombs the station, killing the rest of the community and, in an echo of the genocide of the Venusians in Olaf Stapledon's *Last and First Men*,[101] indiscriminately kills many cetoids in an assault designed to sow distrust between humanity and the Venusians. With the lucrative trade in firegems sabotaged there is no reason for Earth to continue developing interests there, thus preserving the planet from terraforming.

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[100] 'Sister Planet', pp. 114-115.
[101] Olaf Stapledon, *Last and First Men* (London: Penguin, 1966).

The scientific community's scepticism toward cetoid intelligence is grounded in their failure to achieve cross-species communication, the cetoids' "childlike" attributes (playfulness and innocence), their disinterestedness in books as trade items and the scientists' belief that '[i]ntelligence is supposed to evolve in response to a rapidly changing environment'. All these reasons are based on anthropomorphic assumptions that cast the aliens in the role of primitive, pastoral creatures, while the last, an evolutionary notion, assumes geographic and climatic knowledge of Venus that is in fact incomplete. Hawthorne responds to the cetoids with a mixture of acknowledgement (of their otherness) and identification; he argues that communication has not yet been established because 'our minds are too strange'. This sense of alien otherness is reinforced when Hawthorne sees the cetoids' underwater structure and its 'patterns[, which] were so strange that his mind was not trained to register them'. Alien consciousness becomes the basis for an identification with the alien other, which is grounded in recognising parallels between their intelligence and humankind's. By assuming the fact of their intelligence Hawthorne is able to conceive a metaphorical sense of kinship with the cetoids, leading him to extend human familial relationships to the cetoids by greeting and recognising them in human terms: '[w]elcome, my brother'.[102]

This moral extensionism does not constitute an environmental ethic that can account for an appropriate human relationship to nature's otherness in Simon Hailwood's terms, in which nature is valued extrinsically and relationally by virtue of its otherness. What is outlined instead is a strong version of respect for consciousness (intelligence) and not non-human nature as such. Hawthorne's metaphorical extension of kinship categories to encompass cetoids as brothers disrespects their otherness, but is balanced against his recognition of their irreducible difference. Nevertheless, Dykstra's terraforming proposal shocks him because of the threat to the cetoids who, as intelligent creatures, deserve to be factored into instrumental decisions involving their extermination for anthropocentric ends. Biotic and abiotic non-intelligent nature in this story is valuable only insofar as they provide the background environment for the cetoids' existence. The relationship between the cetoids and the human settlement combines the political opposition between centre and periphery with issues of environmental ethics.

[102] 'Sister Planet', pp. 104, 101, 107, 105.

Hawthorne's decision to sabotage the trading relationship between humans and cetoids is a prime example of Fogg's notion that arguments against terraforming often embody misanthropic critiques. Hawthorne's position could be called "misanthropic despair": he reflects that '*I don't care very much about humankind. It's Oscar I want to save. And how much hate for one race can hide under love for another?*'. This despair is grounded in an outlook that operates by a metaphorical blurring that correlates scientific, aesthetic and ethical values. Hawthorne is able, somewhat unfairly, to claim that '[a]t least we've created one beautiful thing with all our ingenuity–just one, space travel. I'm not sure how much destruction and ugliness that makes up for'. Jevons contradicts Hawthorne, suggesting that not only art, but 'the beauty of science itself' points toward redeeming human qualities and hope for the future.[103] A contrast between Earth as an emblem for socio-political problems, exacerbated by overpopulation and contextualised against an awareness of historic oppression, is compared with the Venusian planet as an aesthetically rich symbol of nature populated by an innocent, pastoral civilisation exempt from the corruption of Earth.

The ocean planet is a place where 'all that you saw would be beautiful'. The research station is located in Venus' Phosphor Sea, so named for the presence of bioluminescence, which signifier cues a response to beauty. The cetoid city in "Sister Planet" is a locus for this luminous aesthetic; Hawthorne describes the city to himself as 'a ragged jumble of spires, bluffs, and grottos, eerie but unorganized beauty', '[a] city of merfolk', which is constructed of 'arches and buttresses of fragile filigree, [possessing] an overall unity of pattern'. He is unable to decide whether it is 'a memorial. An art gallery, or–Hawthorne didn't know'.[104] These structures signify the city's physical fragility and taps into the Burkean notion that delicacy and softness, both physical and visual (which bioluminescence also fulfils), engages a response to beauty in the perceiver that is grounded in the object's submission to the subject, in this case Hawthorne's exploratory gaze.

Before Hawthorne sees this city he entertains the notion that '*by sheer telepathy or something, they* [the cetoids] *build their messages into the crystal structure of stones on the ocean bed*'. This impression literalises the notion that intellectual landscaping shapes the environment. Hawthorne's

[103] 'Sister Planet', pp. 125, 99, 99.
[104] 'Sister Planet', pp. 89, 107.

aesthetic response to the city is therefore directly linked to an ethical appreciation of the cetoids as intelligent beings and underlies his speculation that the cetoids perhaps possess 'more soul – more sense of beauty and mercy and laughter – if you extrapolated their present behaviour'.[105] In the light of his visit to the city Hawthorne comes to the conclusion that the cetoids are intelligent, not because they are able to build structures that suggest the development of an advanced civilisation, but because

> the contemplation of beauty is essential to thinking life.
> […]
> The underwater blending of so much that was constructively beautiful could not be a freak of nature.[106]

Aesthetic responses to nature and art are necessary conditions for the development of intelligence, in Hawthorne's view. That Hawthorne is able to respond aesthetically to the cetoids' landscaping suggests a degree of commonality between human and cetoid intelligence. Just how far does Hawthorne's attribution of beauty reflect his own landscaping of Venus and the cetoids? He has already called the cetoid structure a "city of merfolk", landscaping both the environment and its inhabitants, and he later settles on the reference 'the holy place', which suggests that he is unable to break away from his own intellectual landscapes. Nevertheless, there is room for the recognition of nature's otherness within these spaces, illustrating how the inevitable process of intellectual landscaping and the recognition of otherness can be overlaid onto the same object, thus satisfying Hailwood's condition that nature be respected for its otherness and that particular meanings landscaped onto any space should not be confused with all its meaning. Hawthorne quite clearly demonstrates this when he thinks that '[h]uman senses and human science didn't exhaust all the information in the cosmos'.[107] In this context the pastoral operates as one of these landscapes and structures the cetoids' relationship to the humans according to a traditional country/city opposition. Anderson combines this element of pastoral structure with sf techniques analogous to the pastoral's compression of meaning to comment on the instrumentalism of an imperial attitude to space, but overlays this with a critique of misanthropy embodied by Hawthorne's mass slaughter of the cetoids.

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[105] 'Sister Planet', pp. 104, 105.
[106] 'Sister Planet', p. 108.
[107] 'Sister Planet', pp. 113, 102.

Hawthorne's scheme removes autonomy from the cetoids as much as it does from humankind, substituting instead the monologia of an individual's determination of future human–cetoid relations.

Clarke's "Before Eden" is the story of an expedition's discovery and unwitting destruction of alien life. Ecopoiesis of inhabited planets can be seen as an infection; "Before Eden" is ultimately a parable of contamination. In an italicised concluding passage the narrator reports on the alien's encounter and ingestion of Hutchins' and Jerry's rubbish, from which it '*absorbed a whole microcosmos of living creatures*', a few of which manage to survive and infect the alien; as in *The Martian Chronicles*, '*it carried contagion to all its world*'. The voice of a biblical genesis on Venus is bitterly evoked: '[*b*]*eneath the clouds of Venus, the story of Creation was ended*'.[108] The text invokes ideas consonant with Environmental Stewardship, the belief that humanity could act in a benevolent and wise capacity to preserve aspects of nature (including alien life) in the case of aliens that cannot communicate through language, and yet "Before Eden" ends by undermining humanity's sensitivity to their own harmful acts. Such notions exhibit the hubris latent in Environmental Stewardship and implicitly subvert God's concession to humanity of dominion over life on Earth. The emphasis on the sublimity and wonder of the alien contributes to the tragedy of the loss of the other, as does the loss to the scientific domain of a rare object of study. The naive vision of life's call illustrates the dangers of confusing nature's otherness with a teleological conception of cosmological nature oriented toward humanity's own existential shortcomings. The Edenic paradise that terraforming promises in many of the consensus futures of the 1950s-1960s is in this story the death knell of an idyll exempt from the hubris and corruption of Earth.

Nature's alien otherness is valued extrinsically and on aesthetic grounds through the perceiving humans' relation to the alien life form:

> The transformation was so stunning that neither man could check a cry of astonishment. Gone in a flash was the deep, somber black of the thick-piled velvet carpet at their feet. Instead, as far as their lights carried, lay a blazing pattern of glorious, vivid reds, laced with streaks of gold. No Persian prince could ever have commanded so opulent a tapestry from his weavers, yet this was the accidental product of biological forces. Indeed, until they had switched on their floods, these superb colors had not even existed, and they

[108] 'Before Eden', p. 68.

> would vanish once more when the alien light of Earth ceased to conjure them into being.[109]

Description of the alien evokes a sense of the Burkean sublime, which highlights obscurity and privation as governing factors of nature's otherness in this text ('somber black'). Sudden transition as productive of the sublime, bright colouring and astonishment are also evident in the description of the scientific expedition's first encounter with the alien. The reference to Persia acts as a signifier of opulence and otherness, in this case a cultural otherness that stands in for the alien otherness of the Venusian, thus highlighting a problematic link between aliens as natural and cultural others and issues of moral extensionism. It also contrasts the artificial with the natural and de-privileges the former. The aesthetic superiority of nature as biology over art is emphasised, as is the contingent status that recognition of such beauty is dependent on the presence of an alien force (flood lights) and on intelligent (human) observers capable of perceiving these wavelengths in such a manner. It would seem, then, that this story supports the notion that aesthetic value is contingent upon valuers, who provide the conditions necessary for an aesthetic response to nature.

The text offers other reasons for valuing nature's otherness. The alien does not display any sign of consciousness, let alone intelligence, thus sweeping aside arguments that ethical responsibilities are owed only to intelligent beings. Hutchins' scientific interest offers another reason for valuing aliens extrinsically, on the grounds that they present rare opportunities for scientific discovery. At the narrative's beginning, he argues strongly for the possibility of life on Venus, pointing out that '[w]here there's water, there may be life' and that, even in boiling water,[110]

> There are algae that manage it [survival] on earth. And if we've learned one thing since we started exploring the planets, it's this: wherever life has the slightest chance of surviving, you'll find it.[111]

Lessons derived from knowledge of Earth's biology are extended toward alien environments as arguments trading on science's role as an explanatory tool for understanding the universe and for observing affinities between life forms throughout the cosmos. When they eventually discover alien

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[109] 'Before Eden', p. 66.
[110] 'Before Eden', p. 61.
[111] 'Before Eden', p. 62.

life, the narrator interjects with a statement that highlights an extrinsic value based on a metaphysical conception of nature oriented toward humanity:

> For life called to life, across the gulfs of space. Everything that grew or moved upon the face of any planet was a portent, a promise that Man was not alone in this Universe of blazing suns and swirling nebulae. If as yet he had found no companions with whom he could speak, that was only to be expected, for the light-years and the ages still stretched before him, waiting to be explored. Meanwhile, he must guard and cherish the life he found, whether it be upon Earth or Mars or Venus.[112]

Because this call of life is projected beyond human environments, it works as a justification for space exploration. This is compounded by another motive, the search for proof that human beings are not alone in the universe. This existential question bears upon the theme of the desire for meaning within an indifferent universe, the ultimate aim of which is to achieve communion with other intelligences. This understanding of science acts as a form of landscaping in which nature's otherness is incorporated into human cultural landscapes as a 'promise'. Implicit here is that biotic life is viewed teleologically, as part of a vision of the universe that privileges life precisely because it is rare, and hence abiotic nature's otherness is backgrounded.

3.4 Conclusion

This chapter began with an examination of pastoral elements, structural oppositions and sf language in the consensus futures of the 1940s and early 1950s terraforming texts. The first section focused on the ways in which early 1950s terraforming stories drew from overt pastoral themes and deployed techniques analogous to the Elizabethan Pastoral in the form of an sf megatext to construct a generalised vision of the future as it was conceived in the majority of pulp sf of the 1950s. These texts relied heavily on the tradition of the American Pastoral, which they used to landscape the terraforming of other planets in terms of the colonisation of America. They also highlighted the incongruities between this pioneer landscape and the reality of space colonisation. As the terraforming tradition began to shift from optimistic, utopian visions of interplanetary colonisation and

[112] 'Before Eden', p. 67.

terraforming to more pessimistic reflections on the dystopian aspects of interplanetary isolationism, a space for the exploration of political and economic oppression was opened up. These dystopian visions reflect on the failure of terraforming to realise the pastoral dream of a return to close knit communities in the face of what was perceived as an increasingly alienating and global-scale expansion of space.

This chapter then connects these political issues with environmental ethics in the example of the late 1950s-early 1960s terraforming stories. Terraforming as a form of landscaping is a way of coping with the asymmetry of human relationships to nature and to other human groups. The physical fragility of the natural environment is complemented by an awareness of the fragility of civilisation, as Bradbury demonstrates, but this is also paralleled by an intellectual fragility that makes it difficult to maintain respect for nature. Disrespect of nature's otherness often involves a parallel disrespect of human otherness, which is illustrative of a structural homology whose root can be found in the attitudes of the agent of terraforming toward cultural and natural otherness. The imposition of anthropocentric needs and interests onto nature functions as a precursor to narrowly instrumental relationships. While nature's otherness cannot be directly portrayed in these texts, representation of the human response to the multiple environments and to instances of alien life offer avenues for considering how landscaping as a human response to the environment takes into account the needs and interests of society and nature. Underlying all these uses of the terraforming motif are various uses of pastoral emblems that come to be identified as essential megatextual tropes for the terraforming narratives of later years.

4. Ecologies and the Growth of Environmental Awareness in the Transitionary 1960s-1970s Terraforming Narratives

The 1960s and 1970s "New Wave" of sf was a period of experimentation in which the tropes developed by the 1950s pulp tradition were transformed. Responding to the impact of the 1960s counter-culture, these terraforming narratives began to diverge from the consensus futures of the 1950s. Depictions of proto-Gaian worlds during this period were directly associated with the motif of terraforming and tended to present counter-arguments against planetary adaptation. Ecological concerns became an integral element of the socio-political engagement of the terraforming stories of this period. Although, as argued in chapter two, ecological themes have fed into representations of terraforming since the 1930s, the terraforming stories of the 1960s-1970s were premised on the emergence of new ecological landscapes that reflected a sense of environmental urgency. The scientific aspects of ecology were combined with a strand of mysticism reminiscent of early twentieth century vitalism, but were informed by a growing popular interest in socio-political institutions and practices alternative to those that were ideologically dominant at the time. This change to the register of ecology owes its character to the proliferation of ecologically oriented communes and the growth of "hippie" culture in America, which provided a new context for 1960s-1970s terraforming sf.

Anna Bramwell has argued that the counter-culture of the 1960s was preceded by a distinctive tradition of radicalism that had existed for a hundred and fifty years: 'not only had Utopian communities been founded by native Americans and recent European immigrants, but a strain of Asiatic mysticism and occultism among communards had an equally long history'. If a commune is, as Bramwell argues, a planned social experiment, then the colonies of the 1950s terraforming narratives are communes in this sense. The experimentation involved in transforming the environment is linked to a social experiment whose motives, while certainly ecological, also range across various religious and political dimensions.[1] The Findhorn Foundation, established in 1962 in Scotland, exemplifies the new ecological discourse that was being cultivated in the 1960s. Promulgating a belief

[1] Anna Bramwell, *Ecology in the 20th Century: A History* (London: Yale University Press, 1989; repr. 1990), pp. 94, 92.

in a spirit world underlying the physical and the coming of a "New Age" 'that would be born when men realised their place in nature', such communities re-contextualised the experiment underlying the commune and influenced a multitude of other environmental discourses, which in turn influenced sf.[2] Brian Stableford has argued that the mystical aspects of ecology over the scientific have more often 'forged a crucial bond with the history of utopian thought, helping to redefine notions of eutopia (and hence of dystopia) and eventually necessitating the coinage of the term "ecotopia".[3] Ecology offered an all embracing paradigm that could cater to what Tom Moylan has, in the context of the critical utopia, referred to as an alliance of independent groups and interests converging on autonomy; in ecological terms this autonomy is predicated on an awareness of the interconnectedness between elements of nature.[4] Links between the communes of the 1960s-1970s counter-culture and the utopian and dystopian communities depicted in terraforming narratives since the 1950s illustrate a complex weaving of multiple discourses within the sf megatext.

It was not until James Lovelock's popularisation of his hypothesis during the 1970s-1980s that the Gaia motif became a symbol for the blend of mysticism and science in ecological sf. Nevertheless, stories such as Richard McKenna's 1963 "Hunter, Come Home"[5] and James White's 1971 "Major Operation"[6] depicted the terraforming of proto-Gaian worlds, thus anticipating the important links between these two motifs. The Gaia hypothesis originated from Lovelock's work as an independent scientist at NASA in 1965, but was first popularised in his 1973 *Gaia*.[7] This hypothesis 'views the biosphere as an active, adaptive control system able to maintain the Earth in homeostasis'.[8] According to Lovelock, living organisms actively influence their environment in ways that stabilise climatic fluctuations and help maintain a state of regulation. Lovelock argues that Earth's apparently discrete ecosystems are connected and form a vast planetary system that can be

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[2] See Bramwell, pp. 100-101 and Brian Stableford, 'Science Fiction and Ecology', in *A Companion to Science Fiction*, ed. by David Seed (Oxford: Blackwell Publishing, 2005), pp. 127-141 (p. 132).
[3] Brian Stableford, 'Ecology and Dystopia', in *The Cambridge Companion to Utopian Literature*, ed. by Gregory Claeys (Cambridge: Cambridge University Press, 2010), pp. 259-281 (p. 259).
[4] Tom Moylan, *Demand the Impossible: Science Fiction and Utopian Imagination* (London: Methuen, 1986), pp. 27-28.
[5] Richard M. McKenna, 'Hunter, Come Home', in *Worldmakers: SF Adventures in Terraforming*, ed. by Gardner Dozois (New York: St. Martin's Griffin, 2001), pp. 69-98, hereafter referred to as 'Hunter'.
[6] James White, 'Major Operation', in *Major Operation* (New York: Ballantine Books, 1971), pp. 136-183.
[7] James Lovelock, *Gaia: A New Look at Life on Earth* (Oxford: Oxford University Press, 1987).
[8] James Lovelock, *The Revenge of Gaia: Why the Earth is Fighting Back-and How We Can Still Save Humanity* (London: Penguin, 2006), p. 22.

thought of as a single superorganism. Like a bee's nest, superorganisms are 'bounded systems made up partly from living organisms and partly from nonliving structural material'.[9] This global outlook considers both organic and non-organic processes as parts of a system, necessitating a holist approach to scientific practice.

In 1969 Lovelock's neighbour William Golding proposed "Gaia" for the name of this scientific hypothesis. This suggestion controversially associated the Greek goddess Gaia, a personification of the Earth and related to the pagan image of a Great Mother, to a scientific hypothesis which implied that the Earth itself was like a living organism. This was compounded by Lovelock's own spiritual outlook: he claims in the chapter "Gaia and God" in *The Ages of Gaia* (1988) that '[l]iving itself is a religious experience'. Although he is adamant that his view of Gaia is not religious, that Earth is not analogous to a god and possesses no consciousness of its own, he states '[t]hat Gaia can be both spiritual and scientific is, for me, deeply satisfying'.[10] New Age spiritualism greatly developed the implications of this mythic image of a Great Mother in Lovelock's popularisation of the Gaia hypothesis.

The terraforming texts of the 1960s-1970s can be divided into two groups that develop in parallel: those terraforming narratives that present a clear continuity with the stories of the 1950s in terms of their form, themes and narrative elements, and the proto-Gaian narratives distinctive to this period. A third trend appears toward the end of the 1970s and develops the implications of pantropy in relation to terraforming. Including such stories as John Varley's "Retrograde Summer" (1975),[11] Frederik Pohl's *Man Plus* (1976)[12] and David Gerrold's *Moonstar Odyssey* (1977),[13] these texts will be excluded for reasons of space and because they would be more productively considered in the context of a wider discussion of posthumanism and cyberpunk. One group of narratives engage in dialogue with the earlier 1950s tradition of terraforming stories and look forward to those of the

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[9] James Lovelock, *The Ages of Gaia: A Biography of Our Living Earth* (Oxford: Oxford University Press, 1995), p. 15.
[10] *The Ages of Gaia*, pp. 192, 204.
[11] John Varley, 'Retrograde Summer', in *Worldmakers: SF Adventures in Terraforming*, ed. by Gardner Dozois (New York: St. Martin's Griffin, 2001), pp. 118-133.
[12] Frederik Pohl, *Man Plus* (London: Gollancz, 1976; repr. 2000).
[13] David Gerrold, *Moonstar Odyssey* (New York: The New American Library, 1977).

1980s-1990s. Stories belonging to this group include Frank Herbert's first three *Dune* (1965-1976)[14] novels, Robert A. Heinlein's *The Moon is a Harsh Mistress* (1966)[15] and Ursula K. Le Guin's *The Dispossessed* (1974).[16]

Another group of texts evidences a resurgence in the popularity of the living world motif, which appeared only infrequently throughout the 1950s. These proto-Gaian stories responded to the same factors that inspired the popular environmental movement, which itself influenced the character of sf's ecological discourse. The discourse of the popular environmental movement also provided a context against which the Gaia hypothesis could be understood and its latent mysticism appropriated. Stories belonging to this group include Richard McKenna's "The Night of Hoggy Darn" (1958)[17] and "Hunter, Come Home", Le Guin's "Vaster than Empires and More Slow" (1971)[18] and *The Word for World is Forest* (1972),[19] and James White's "Meatball" (1966)[20] and "Major Operation". Ernest Callenbach's *Ecotopia* (1975), discussed at the end of this chapter, brings to the foreground the widespread impact of ecology during this period.[21] It is with the proto-Gaian texts that this discussion begins. A comparison of these texts with the 2009 film *Avatar* provides a lens by which to examine the contribution that these proto-Gaian stories have made to sf and ecological discourse.[22]

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[14] Frank Herbert, *Dune* (Kent: New English Library, 1968; repr. 1983), *Dune Messiah* (Kent: New English Library, 1972; repr. 1985) and *Children of Dune* (Kent: New English Library, 1977; repr. 1985).
[15] Robert A. Heinlein, *The Moon is a Harsh Mistress* (London: Gollancz, 2001), hereafter referred to as *Moon*.
[16] Ursula K. Le Guin, *The Dispossessed* (London: Gollancz, 1999; repr. 2000).
[17] Richard McKenna, 'The Night of Hoggy Darn', in *Tomorrow x4*, ed. by Damon Knight (Connecticut: Gold Medal Books, 1964), pp. 9-58, hereafter referred to as 'Hoggy'.
[18] Ursula K. Le Guin, 'Vaster than Empires and More Slow', in *The Wind's Twelve Quarters* (London: Granada, 1982), II, pp. 25-59, hereafter referred to as 'Vaster'.
[19] Ursula K. Le Guin, *The Word for World is Forest* (New York: Berkley Publishing Corporation, 1976), hereafter referred to as *Word*.
[20] James White, 'Meatball', in *Major Operation* (New York: Ballantine Books, 1971), pp. 103-135.
[21] Ernest Callenbach, *Ecotopia: A Novel About Ecology, People and Politics in 1999* (London: Pluto Press, 1978).
[22] *Avatar*, dir. by James Cameron (Twentieth Century Fox, 2009).

4.1.1 *Avatar* and Proto-Gaian Worlds

What can be gained by reading these 1960s-1970s works against a text released almost four decades after this period? As a successful film with an extremely wide circulation, *Avatar* introduces to a popular audience themes and images central to the terraforming tradition. It revitalises tropes developed in the sf discourse of the 1960s-1970s and frames these counter-cultural voices in the context of a culture that perceives environmental threat in terms of "risk", "global warming" and "climate change". Sf discourse acts as a cultural repository; *Avatar*'s narrative is an excavation and re-presentation of tropes developed from within the written sf tradition. *Avatar* can not only help illuminate aspects of terraforming and the Gaia hypothesis, but may prime new audiences to the relevance of earlier narratives to contemporary ecological concerns. Using *Avatar* as a thematic reference for considering the contribution of earlier sf in shaping this tradition makes salient the dialogical aspect of the sf megatext. "Influence" should therefore be understood as the use of generic tropes drawn from the sf megatext rather than as issues related to intellectual property; this section is not concerned with examining claims of plagiarism but intends to illuminate the contours of the wider sf tradition from which various themes are appropriated and cinematically re-deployed in new contexts.

Avatar dramatises the conflict between an interplanetary mining corporation and the indigenous alien Na'vi living on the moon Pandora. Set in the year 2154, the narrative follows Sully's experiences as a paraplegic mercenary who accepts an invitation from the Company to take his deceased twin brother's place on the Avatar project. Avatars are expensive constructs modelled against Na'vi physiology. Their neurological structure is mapped against a human controller's, thus allowing the remote control of these bodies. By inhabiting the body of his Avatar Sully is able to move freely on the surface of Pandora, immune to the atmospheric toxins and freed from the physical limitations of his human body. The scientific team employs Avatars to aid in the exploration and research of Pandora and its ecology and to interact with the Na'vi. Peaceful relations with the Na'vi are complicated when Colonel Quaritch offers Sully an expensive regenerative treatment that will heal

his paraplegia. In return, Quaritch demands military intelligence on the Na'vi for use in the Company's efforts to displace them and gain access to deposits of the coveted mineral "unobtainium" that lie beneath the Na'vi settlement Hometree.

James Cameron has acknowledged the cinematic influence on *Avatar* of such films as *At Play in the Fields of the Lord*,[23] *Dances with Wolves*[24] and *The Emerald Forest*,[25] explaining that 'I just gathered all this stuff in and then […] looked at it through the lens of science fiction'.[26] Cameron also acknowledges a debt to sf literature when he notes that '[the idea for *Avatar*] came from all the science-fiction books I read when I was a kid and it just gestated over time'.[27] In the tradition of H. Rider Haggard's *Allan Quatermain* (1885-1927)[28] and Edgar Rice Burroughs' *Barsoom* series (1912-1964),[29] Cameron calls *Avatar* 'an old-fashioned jungle adventure with an environmental conscience. It aspires to a mythic level of storytelling'.[30] Other commentators have noted strong similarities between other works of sf literature, including Poul Anderson's short story "Call Me Joe" (1957),[31] in which a paraplegic scientist employs technology operating on the basis of telepathy to inhabit the body of a five foot slate-blue centaur-like creature designed for the purpose of colonising Jupiter.[32] Anderson's novel *The Avatar* (1978) is also of peripheral interest for its title and use of the avatar motif, its vignettes focalised through animal and plant narrators and for its exploration of nature at ecological and cosmological scales.[33] Parallels have also been drawn between *Avatar* and Le Guin's *The Word for World is Forest*, the Vietnam-era story of a colonising force of Terrans (humans from

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[23] *At Play in the Fields of the Lord*, dir. by Hector Babenco (Universal Pictures, 1992).
[24] *Dances with Wolves*, dir. by Kevin Costner (Tig Productions, 1991).
[25] *The Emerald Forest*, dir. by John Boorman (Christel Films, 1985).
[26] Jeff Boucher, 'James Cameron: Yes, 'Avatar' is 'Dances With Wolves' in Space … Sorta', *Los Angeles Times* (2009) <http://latimesblogs.latimes.com/herocomplex/2009/08/james-cameron-the-new-trek-rocks-but-transformers-is-gimcrackery.html> [accessed 2 July 2010].
[27] John Hiscock, 'James Cameron Interview for Avatar', *Telegraph Online* (2009) <http://www.telegraph.co.uk/culture/film/6720156/James-Cameron-interview-for-Avatar.html> [accessed 2 July 2010].
[28] Beginning with H. Rider Haggard, *King Solomon's Mines* (Oxford: Oxford University Press, 1989).
[29] Beginning with Edgar Rice Burroughs, *A Princess of Mars* (New York: Ballantine, 1963; repr. 1980).
[30] James Rampton, 'James Cameron: King of All He Surveys', *The Independent* (2009) <http://www.independent.co.uk/arts-entertainment/films/features/james-cameron-king-of-all-he-surveys-429268.html> [accessed 2 July 2010].
[31] Poul Anderson, 'Call Me Joe', in *Isaac Asimov Presents the Great SF Stories: 19*, ed. by Isaac Asimov and Martin H. Greenberg (New York: Daw Books, 1989), pp. 103-148, hereafter referred to as 'Call'.
[32] Gary Westfahl, 'All Energy is Borrowed: A Review of *Avatar', Locus Online* (2009) <http://www.locusmag.com/Reviews/2009/12/all-energy-is-borrowed-review-of-avatar.html> [accessed 2 July 2010].
[33] Poul Anderson, *The Avatar* (New York: Berkley Publishing Corporation, 1978).

Earth) who subjugate the indigenous population and deforest the planet Athshe to replenish Earth's deficit of this scarce resource. The Athsheans retaliate and quarantine the colonisers until they can be deported from the planet.

Cameron explains that in *Avatar* '[w]e're telling the story of what happens when a technologically superior culture comes into a place with a technologically inferior indigenous culture and there are resources there that they want'. This colonial narrative is set against what Cameron explains is 'a love story about an awakening of perception through the other person'.[34] This statement highlights the two main narrative threads of *Avatar*. The first is the colonial acquisition of new territory seen only as a repository of resources, which is concomitant with the displacement of indigenous cultures. The second trajectory involves a dramatisation of Sully's change of perspective toward the external world. This change is directly initiated by an affective response toward an environment conceived of as "whole" and "connected", elements of a belief system based upon the Na'vi's spiritual understanding of an entity they call "Eywa". Both narrative threads are closely intertwined in the film and operate as a whole to explore the affective orientation of two cultures toward their environment. *Avatar* combines a critique of imperial colonisation and exploitation with the portrayal of an alternative complex of religio-spiritual and affective perspectives and attitudes toward nature.

4.1.2 Connections

Na'vi spiritualism centres around a being they call Eywa. Dr. Norm Spellman explains to Jake, '[w]ho's Eywa? Only their deity. Their goddess made up of all living things. Everything they know'. Two separate but potentially compatible explanations exist to account for this deity. Na'vi belief in the Great Mother figure Eywa draws from the quasi-pantheistic popularisations of Lovelock's Gaia hypothesis, an intersection between Gaia and terraforming that has one of its roots in the popular environmental politics of the 1960s. Grace Augustine, the leading colonial scientist, draws from the scientific basis of the Gaia hypothesis to explain the Na'vi's connection to their forest environment.

[34] Hiscock.

This blend of mysticism and science is characteristic of treatments of the living world motif and of Lovelock's early discussion of the Gaia hypothesis. The appearance of floating seeds from the Tree of Souls, what Neytiri explains are '[s]eeds of the sacred tree. Very pure spirits', stops her from killing Sully at first sight and compels her to bring him to Home Tree, the village of the Omaticayan clan of Na'vi. Neytiri interprets the appearance of these seeds as a sign from Eywa. Later, she tells Sully '[o]ur Great Mother does not take sides, Jake. She protects only the balance of life'. Images of a Great Mother protecting the 'balance of life' draws from a pseudo-pantheistic vision of energy continuously flowing through discrete bodies of organic life. During the sequence in which Neytiri teaches Sully to behave and think as a Na'vi, he records in his video diary that Neytiri is 'always going on about the flow of energy, the spirits of animals', and that 'I'm trying to understand this deep connection the people have to the forest. She talks about a network of energy that flows through all living things. She says all energy is only borrowed, and one day you have to give it back'.[35]

The theme of energy flowing through an ecosystem draws from a tradition of New Age spiritualism which was influenced in part by a romantic conception of the religious belief systems of tribal cultures, most notably Native American. Le Guin's oeuvre is significantly influenced by Native American culture and belief, including her depiction of the indigenous Athsheans in *The Word for World is Forest*. This interest in Native American culture can be traced back to her father, Alfred L. Kroeber, an influential anthropologist who famously worked with Ishi, the last of the Yahi Native Americans in California. Theodora Kroeber's biography, *Ishi in Two Worlds* (1961), helped shape conceptions of Native American mythology and popularised the idea of their essential connection to nature.[36] Returning to this theme in connection to *The Word for World is Forest* in more detail below, this section first examines another strand that relates to the presentation of an alien world that is a connected, Gaian organism.

McKenna's "The Night of Hoggy Darn" and "Hunter, Come Home" were both published before Lovelock formulated the Gaia hypothesis. They illustrate how certain themes developed by sf influenced the motif of a living world that began to be considered in ecological terms as "whole" and

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[35] *Avatar*.
[36] Theodora Kroeber, *Ishi in Two Worlds: A Biography of the Last Wild Indian in North America* (Berkeley: University of California Press, 1973).

"connected". *Avatar* draws as much from this tradition, which is often combined with that of primitive cultures in connection with nature, as upon cinematic colonial narratives such as *Dances with Wolves* and *Pocahontas* (1995).[37] Connections with *Avatar* include the presence of fluorescent fungi in the forest of "The Night of Hoggy Darn", 'the low gravity [which] always conduces to gigantism' and which, combined with the food on the planet New Cornwall, has 'resulted in an increase in size of the original colonists over generations'.[38] In "Hunter, Come Home", description of the ecologist Miss Ames parallels Grace's conflict with Selfridge Parker in *Avatar*; Ames struggles against the aggressive Mordinmen to prevent them from unleashing a virus that could destroy the planet's ecosystem.

Flinter Cole, the protagonist of "The Night of Hoggy Darn", explains that he is 'an ecologist-that means I deal with everything alive, and the way it all works in with climate and geography. I can use *any* kind of data'. Recognition of the interconnectedness of phenomenon within an ecological system illustrates Cole's holist approach to understanding the planet and the colonists. He links this outlook to the theme of energy flowing through an ecosystem when he says that he must 'make energy flow charts' documenting the interactions between life on the planet New Cornwall. This is very different from the religious and affective response to energy in nature depicted in *Avatar*, borrowing as it does from a tradition of energy economics over a vitalist conception of nature. The text does explore the dimensions of a mythic-poetic response to the central conflict of the text, a genocidal war between humankind and an indigenous dinosaur-like creature known as "stompers". Cole describes this war as 'the greed-murder of species' because he believes the conflict to be motivated by the colonist's trade in stomper eggs, a delicacy that resonates with the similar historical exploitation of now extinct species on Earth (such as many species of giant turtle). Cole learns that the stompers have been feeding on wild and captured humans; the logic of energy flows advanced by the text assigns to their eggs the status of 'human flesh at one remove'.[39]

Two human groups inhabit New Cornwall: the 'subnormals who are so powerfully drawn to run back to the forests' and those colonists who retain a comparatively sophisticated technological

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[37] *Disney's Pocahontus*, dir. by Mike Gabriel and Eric Goldberg (Walt Disney Feature Animation, 1995).
[38] 'Hoggy', pp. 51, 13.
[39] 'Hoggy', pp. 9, 9, 42.

culture and maintain contact with the wider interplanetary civilisation. The subnormals have developed their own spiritual explanation for the conflict between humans and stompers, one which Garth Bidgrass, head of Bidgrass Company, adopts. He describes the subnormals' account of the conflict as 'a strange mixture of poetry and prophecy' and mythologises the colony's struggle with the stompers by casting it as a conflict between the archetypes Grandfather Man and Grandfather Stomper. Cole tells Bidgrass to '[t]hink of a species as one great animal that never dies, of which each individual is only a part'. Bidgrass connects Cole's ecologism to myth when he explains that 'your notion of the greater animal, critical biomass […] [w]e speak of Grandfather Stomper and we are trying to kill him. He is trying to enslave Grandfather Man'. The concept of critical biomass possesses Gaian overtones and refers to the total mass of a particular species; if this mass falls below a critical limit they are unable to maintain a stable population and become extinct. Like Sully in *Avatar*, Cole is caught in a narrative of prophecy, in this instance one that foretells how 'the new Grandfather Man will come naked out of the forest with his beautiful wife and armed with a thigh bone, that will lead us in the even greater task of reclamation that comes after' the death of Grandfather Stomper.[40]

The links between ideas of ecological connectedness, Gaian images of biomass and the foregrounding of archetypal figures illustrate the sf weaving of myth and science that can be seen as a trace in *Avatar*. Against this background it is possible to read the polarisation between the Na'vi and the Company in *Avatar* as a variant of a new mythic archetype, one that sets the Na'vi's ecological spirituality against the Company's narrow, "rationalist" instrumental view of nature. "The Night of Hoggy Darn" uses prophecy to transform Cole's experience of time into a narrative that relates, in mythic terms, a new sense of collective purpose and habitation. The mutual deaths of Grandfather Man and Grandfather Stomper in combat with one another allows Cole the space to establish a new set of relations outside of the cycle of conflict on New Cornwall. As this space comes at the price of the genocide of the stompers, "The Night of Hoggy Darn" accepts as necessity conflict and human conquest, albeit in ways that are problematised. For instance, Bidgrass admits that the early colonists 'killed off the great, stupid herds of darv cattle on which the stompers fed. The stompers that survived

[40] 'Hoggy', pp. 41, 41, 41, 31, 58.

became wary and hostile'.[41] The colonists are clearly the aggressors, which may partly account for why McKenna chose to re-write this story as "Hunter, Come Home". Here, he further develops the chronotope of the forest as a space of interconnection and transformation, demonstrating the development of a motif that is central to the Gaia theme and *Avatar*'s construction of Eywa.

In "The Night of Hoggy Darn", Cole becomes trapped in the forest and begins a 'fantastic journey [that] wound over great gnarled roots and buttresses fusing and intermingling until it seemed that the root-complex was one unthinkably vast organism'.[42] McKenna makes this theme central to the narrative of "Hunter, Come Home". In this story two groups of humans attempt to colonise a nameless planet, the aggressive hunting society of the Mordinmen and the scientific Belconti. The planet is populated by "phytos", which the Belconti Midori explains to the Mordinmen protagonist Craig are 'mixed plant and animal. Life never split itself apart on this planet'. The two groups of colonists attempt but fail to displace the phyto ecology, which leads the Mordinmen to deploy the Thanasis virus in an attempt to sterilise the planet. The Belconti Sidis explains that '[w]ith translocation, *Thanasis* [a deadly virus] can redesign its own free-systems in the field […]. It could come up with something impossible to immunize, something no control virus we know how to make could handle. Then it would kill us and rule the planet itself'.[43] Conflict in this story takes place between a planet's whole ecology and human biological technologies, against which a smaller-scale conflict is played out between the constraining mores of Mordinmen society and the developing love between Craig and Midori.

Sidis notes that 'the phyto stems are all rooted together underground like one huge plant', while Midori explains that '[the phytos] form a kind of biochemical intelligence, almost a mind, and it's learning faster than we are'. Midori connects this visionary insight into the nature of the phytos to the theme of an alien consciousness emerging from the ecological system's interaction with an other: 'just think of the agony and the changings, through all the long years men have been trying to kill this planet. What if something … somehow … suddenly *understands?*'. The relationship between Craig and Midori is analogous to that of Sully and Neytiri in that through love the male protagonist shares

[41] 'Hoggy', p. 38.
[42] 'Hoggy', p. 50.
[43] 'Hunter', pp. 77, 73.

his love object's passion for nature and is awakened to a greater understanding of its form and processes. Midori connects human love to a love of nature in one scene where, as Craig pilots a flyer over the forest, they witness a group of migratory phytos which, in Midori's words, 'stain the air with beauty! […] It knows I love it'.[44] Midori's affective response to nature's beauty in turn awakens Craig to a new appreciation of the phyto ecology.

Human connectedness to nature is literalised at the conclusion of this story through the concept of "resorption". Craig and Midori are exiled from the colonial settlement and, in a variant of reincarnation, become infected with *Thanasis* only to have the phytos recreate their bodies and consciousness at a cellular level, in effect healing them by omitting the plague from their bodies. Earlier Midori tells Craig that 'this planet has never known death or decay. Everything is resorbed and reconstituted. We try to kill it and it suffers but its – yes, its *mind* – can't form the idea of death. There's no way to *think* death biochemically'. The energy flows that appear in "The Night of Hoggy Darn" are thus refigured as Midori and Craig become continuous with alien nature in a version of the expanded self model of deep ecology. This continuity is joined to the theme of wholeness, generated through connections, and love: '[t]his life never split apart, Roy. In wholeness there is nothing but love'. Their rebirth is depicted as a state of Edenic innocence: '[s]he was smiling radiantly. They were both naked. He was not excited and not ashamed'.[45] Midori raises the Romantic period's pantheistic theme of the human observer's role in actualising the universe (as in William Blake's *The Marriage of Heaven and Hell*),[46] which makes humans integral to a nature that can only conceive of itself through others' self-conscious reflection. She explains to Craig that

> [l]ike each littlest phyto, we are thoughts in that strange mind. I think we focus its awareness, somehow, serve it as a symbol system, a form-giver. […] We are its thoughts that also think themselves, the first it has ever had […] [i]t is a great and holy mystery, Roy. Only through us can it know its own beauty and wonder. It loves us and needs us.[47]

Midori privileges beauty and wonder as the two aesthetic responses toward nature most appropriate to human interaction with the phyto ecosystem. Burke and Kant support the link between beauty and love in their discussion of the beautiful, but the connection between wonder and need is more oblique.

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[44] 'Hunter', pp. 72, 77, 87, 86.
[45] 'Hunter', pp. 78, 96, 96.
[46] William Blake, *The Marriage of Heaven and Hell* (Oxford: Oxford University Press, 1975).
[47] 'Hunter, p. 97.

This network of linked impulses constitute 'a great and holy mystery', a state that resonates with Stan Godlovitch's emphasis on mystery as humankind's most prominent reaction to nature's otherness.[48] Echoing the theme of the inconceivable in Stapledon's *Star Maker*,[49] Midori views the ecosystem as evolving toward the use of biotic life as a language to express its own otherness. Midori landscapes these expressions as thoughts, recalling nineteenth century views of personified nature as a divine mind.[50] Like Murray Leinster's "The Lonely Planet",[51] the phyto ecosystem is dependent on interaction with otherness in the form of environed human consciousness to allow it to develop an awareness of its own processes. Humanity provides new symbols in the form of language, thought and emotion with which the ecosystem can continue to shape and express itself.

McKenna was writing at a time when the counter cultural movement in America began to burgeon. Hippie ideals of love and peace, what Sully in *Avatar* refers to as "tree-hugger crap", were popularised and became linked to an early environmental awareness.[52] Le Guin, too, wrote within, and sometimes against, this wider cultural movement. Her short story "Vaster than Empires and More Slow", which references Andrew Marvell's poem "To His Coy Mistress" (1681), features an interconnected Gaian forest that closely resembles the figure of Eywa in *Avatar*.[53] A small group of colonists land on the planet 4470, 'a pure phytosphere'. Mannon argues that the root-nodes of the forest that they have been studying there 'are, indubitably, connections. Connections among the trees. […] they [the trees] are all interconnected, both by the root-node linkage and by your green epiphytes in the branches. A linkage of incredible complexity and physical extent'.[54] This theme can be compared to Grace's unveiling of the scientific basis for the Na'vi worship of Eywa:

> What we think we know is that there's some kind of electro-chemical communication between the roots of the trees, like the synapses between neurons. And each tree has ten to the fourth connections to the trees around it. And there are ten to the twelve trees on Pandora.
> […]

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[48] Stan Godlovitch, 'Carlson on Appreciation', *Journal of Aesthetics and Art Criticism*, 55.1 (1997), 53-55.
[49] Olaf Stapledon, *Star Maker* (Connecticut: Wesleyan University Press, 2004).
[50] Brian Stableford, 'Ecology and Dystopia', pp. 259-260.
[51] Murray Leinster, 'The Lonely Planet', *Thrilling Wonder Stories*, 35.2 (1949), 80-97.
[52] *Avatar*.
[53] Andrew Marvell, 'To His Coy Mistress', *Lunariam: Anthology of English Literature* (2009) <http://www.luminarium.org/sevenlit/marvell/coy.htm> [accessed 29 August 2012].
[54] 'Vaster', pp. 33, 50.

> It's more connections than the human brain. Get it? It's a network. It's a global network and the Na'vi can access it, they can upload and download data. Memories at sites like the one you just destroyed.[55]

The site Grace refers to is the "Tree of Voices", under which the Na'vi dead are buried and their memories absorbed into the wider Gaian network. This description is joined to the language of computing and networks, which separates it from the organic-spiritual epistemology by which this trope was rendered in the 1960s-1970s. The bond through which the Na'vi trade information resembles a braid falling from the back of their heads; through this braid they are able to connect to other lifeforms. This image echoes that of the plugs in *The Matrix* and blurs the boundary between ideas of nature and technology.[56] Such crossings between organic and technological discourse is already implicit in earlier Gaian images. Harfex, a member of the expedition to Planet 4470 in "Vaster than Empires and More Slow", argues that the forest is 'merely a network of processes. […] they must all be capable of transmitting electro-chemical impulses. […] Even the pollen is part of this linkage […] a sort of windborne sentience, connecting overseas […] the biosphere of a planet should be one network of communications, sensitive, irrational, immoral, isolated'.[57] Planet 4470's isolation is a result of its closed global-scale ecological system.

The colonist Osden has Render's syndrome, making him empathic but unable to control his ability to reflect the distorted and strengthened emotions of others back at them. His ability parallels that of the forest itself, which, as an isolated single entity, has never experienced another consciousness. Osden remarks that the forest is 'all one […]. One big green thought'. The other colonists note 'a hypnotic quality in the colors and spacing of the stems and branches' and question whether 'the forest ambiance has a rather troubling and possibly hallucinogenic effect of the perception'. Mannon points out that he 'feel[s] a strong anxiety with a specific spatial orientation […] which the archetypal connotations of the word "forest" provide an inevitable metaphor'. The forest is a space that evokes a primordial terror, but this terror, like the hate and fear that Osden exacerbates, is a reflection of the affective response of the colonists to the alien forest itself. Osden's answer to the positive feedback of this cycle is to sacrifice himself to the forest by submitting to the fear that it

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[55] *Avatar*.
[56] *The Matrix*, dir. by Andy Wachowski and Lana Wachowski (Groucho II Film Partnership, 1999).
[57] 'Vaster', p. 54.

reflects in strengthened form back to the colonists. Thus he hopes to establish communication with the forest and transmit to it another signal based on a structure that, from the human perspective, is implicit at the scale of cosmological phenomenon: '[a] single human brain can perceive pattern on the scale of stars and galaxies […] and interpret it as Love'.[58] Individuals are thus able to translate these vast spaces into terms that can be understood at smaller scales of experience.

Le Guin employs the Gaian forest as a motif to examine processes of othering, which is maintained by a system of dualities. The narrator of "Vaster than Empires and More Slow" explains that Osden 'had given up his self to the alien, an unreserved surrender, that left no place for evil. He had learned the love of the Other, and thereby had been given his whole self'.[59] Val Plumwood discusses one of the axes of the logical process of dualism, radical exclusion, which works 'to maximise distance or separation between the dualised spheres and to prevent their being seen as continuous or contiguous'.[60] Accordingly, Osden's 'whole self' is granted him only when he overcomes the fear and hatred of the other and accepts what is alien. By bridging the distance between dualised concepts, love becomes a strategy for overcoming radical exclusion. In this light, the opposition between humankind and stompers in "The Night of Hoggy Darn", the humans and phytos in "Hunter, Come Home", or between the humans and Na'vi in *Avatar*, can all be seen as expressions and negotiations of this logic of dualism. Important to the notion of dualism is that the dualised terms are different in as many ways as is possible; '[d]ualistic distinction aims to maximise the number, scope, or significance of distinguishing characteristics'.[61] The colonists understand the Na'vi as technologically primitive and irrational and interpret these characteristics as the source of their resistance to the mining operation. The 1960s popular ecological notion of love as it has been incorporated and rendered in Gaian sf stories can be seen as metaphorical attempts to affect a synthesis between hyperseparated terms of a dualism in order to overcome the self-destructive tendencies underlying humankind's approach to nature and other cultures.

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[58] 'Vaster', pp. 54, 38, 47, 55.
[59] 'Vaster', p. 58-59.
[60] Val Plumwood, *Feminism and the Mastery of Nature* (London: Routledge, 1993), p. 49.
[61] Plumwood, p. 50.

4.1.3 Time and the Forest

Othering is central to Le Guin's portrayal of the exploitation of the Athsheans and their planet in *The Word for World is Forest*. Captain Davidson is a character similar in orientation to Quaritch in *Avatar*. He believes that 'primitive races always have to give way to civilised ones. Or be assimilated. But we sure as hell can't assimilate a lot of green monkeys'. He associates nature, primitive cultures and the animal in a network of dualities that for him justifies the exploitation of the forest and the enslavement of the Athsheans. This attitude is shared by many of the other colonists: Colonel Dongh affirms that 'they're not human beings in my frame of reference'. The Athsheans understand the threat posed by the colonists against a religio-spiritual background centred on their practice of "dreaming", a scientifically measurable phenomenon that Captain Raj Lyubov, an anthropologist sympathetic to the Athshean's plight, manages to detect while working with Selver, an enslaved Athshean. Selver explains to his people that '[the colonists] have left their roots behind them, perhaps, in this other forest from which they came, this forest with no trees'.[62] This view resonates with Sully's prayer to Eywa: '[t]hey killed their Mother, and they're gonna do the same here. More sky people [colonists] are going to come. They're gonna come like a rain that never ends, unless we stop them'.[63] Selver concludes that '[n]o one can say certainly whether they're men or not men, whether they're sane or insane, but that does not matter. They must be made to leave the forest, because they are dangerous'.[64] Neytiri's shamanistic mother in *Avatar*, Mo'at, is surer in her analysis of the colonists' sanity when she arranges for Neytiri to teach Sully their ways, warning him to '[l]earn well […] and we will see if your insanity can be cured'.[65] The notion of insanity as characteristic of the colonists' treatment of the environment in contrast to the indigenes' saner, spiritual relationship to the forest works as a critique of the instrumental rationalism underlying the colonist's logic of othering.

Avatar opens with a dream of flying, which is eventually fulfilled when Sully passes his initiation test by taming a dragon-like Ikran. Dreaming is deeply involved in the Athsheans'

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[62] *Word*, pp. 12, 12, 44-45.
[63] *Avatar*.
[64] *Word*, p. 45.
[65] *Avatar*.

perception of time, which in their world is connected intimately to their sense of place in the forest. There is no sharp boundary between dream time and the world's time in Athshean thinking, unlike the colonists' demarcation between these spheres along an unreal/real axis. The space of the forest itself is oneiric and challenges the instrumental version of progress that informs the colonist's terragouging of Athshe. As Lyubov learns more about this aspect of Athshean culture he comes to believe that this sense of time is central to any basic understanding of the Athshean worldview: '[i]t was Selver who had made him understand, at last, the Athshean significance of the word 'dream,' which was also the word for 'root,' and so hand him the key of the kingdom of the forest people'. The words "dream" and "root" are connected semantically, the words "root" and "forest" metonymically and because, as Lyubov claims, '[t]he Athshean word for *world* is also the word for *forest*', their cultural life is intimately connected to their environment.[66]

The clash between Selver and Davidson mirrors the relationship between Sully and Quaritch in *Avatar*, with both characters representing two sides of a dualism that for Selver is self-conscious. During their final confrontation Selver tells Davidson that 'we're both gods, you and I. You're an insane one, and I'm not sure whether I'm sane or not. But we are gods'. This perspective clearly mirrors the self-conscious use of mythic archetypes in "The Night of Hoggy Darn" and invests this clash between cultural representatives with a sense of urgency that accompanies the development of a new cognitive relation to the world. Time becomes compressed as the Athsheans' experience as members of a subject race becomes focused upon Selver. The Athshean word '"*sha'ab*"' for god also means "translator"; through the act of translating dreams into reality the *sha'ab* brings a gift to his people and becomes a god. Lyubov ponders whether Selver '[m]ight […] then be one who could translate into waking life the central experience of vision: one serving as a link between the two realities, considered by the Athsheans as equal, the dream-time and the world-time, whose connections, though vital, are obscure'. The Athsheans are actively involved in dreaming, through which the submerged desires and fears of the people as a whole can be confronted and, given sufficient need, brought into the time of the real world. An old Athshean dreamer claims that '[w]e may have dreamed of Selver these last few years, but we shall no longer; he has left the dream-

[66] *Word*, pp. 100, 72.

time'.[67] The Athsheans have called forth a god in response to the thirty years of colonisation and exploitation that they have endured, one that will translate their new cultural experience into terms they are capable of responding to, primarily by affecting a change in Athshean culture.

Davidson, on the other hand, is a god who is unaware of his power to make manifest his dreams. Selver comments of the colonists in general that '[i]f they are men they are evil men, having denied their own gods, afraid to see their own faces in the dark'. These gods can be understood as cultural tendencies that have resulted in their exploitative treatment of nature and the indigenes. The officers' reports on their impact on the indigenous ecosystem and culture during a conference held between the military authorities and two alien emissaries from the newly formed Council of the League of Worlds demonstrates the extent of this denial. Colonel Dongh insists that '[w]e do not employ slaves, sir. Some of the natives serve a useful role in our community. The Voluntary Autochthonous Labor Corps is a part of all but the temporary camps here'. Lyubov is the only officer to provide an oppositional account of their actions: '[w]e have killed, raped, dispersed, and enslaved the native humans, destroyed their communities, and cut down their forests. It wouldn't be surprising if they'd decided that we are not human'. In Le Guin's Hainish universe all conscious humanoid life on all of the known planets descended from an original Hainish stock, which fact blurs the boundary between the human and non-human sides of the dualism and problematises the related alien/non-alien dualism that underlies the colonists' treatment of the Athsheans. It is significant that Colonel Dongh refuses to accept this idea as 'the historic fact', illustrating another denial of shared characteristics between the Athsheans and the colonists and marking the former from the latter as a dualised other.[68]

As gods, Selver and Davidson operate on one level as avatars that bring into the real world the shared dreams of their respective cultures. The Hindu concept of an "avatar" refers to a manifestation of a god on Earth; Selver and Davidson are manifestations of their culture's orientation toward nature and other cultures. This structure echoes McKenna's earlier use of the mythic figures Grandfather Man and Grandfather Stomper, who are microcosms and cultural representatives of their society and species. Davidson and Selver's roles are instrumental to defining the shape of their future

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[67] *Word*, pp. 160, 106, 34-35.
[68] *Word*, pp. 45, 63, 62, 64.

engagements with the world and each other. Selver explains to Davidson that '[y]ou gave me a gift, the killing of one's kind, murder. Now, as well as I can, I give you my people's gift, which is not killing. I think we each find each other's gift heavy to carry'. Contact with a violent culture has led the Athsheans to adapt by appropriating violence, and once incorporated into their cultural consciousness it cannot be shed. This results in the Athshean's loss of their greatest cultural triumph, which the Hainish emissary Lepannon identifies as '[a] human society with an effective war-barrier!'. This "war-barrier" is overcome at the conclusion of the story as the violence toward and reprisals by the Athsheans establish a positive feedback loop between the Athsheans and colonists. The Athsheans are 'driven by the evil dream [of killing] and only Selver could teach them how to master it'.[69] Selver, however, is doubtful that they can return to a time predating the internalisation of this violence: the clash of cultures has inaugurated a new sense of time that is linked to the beginning of a new phase in the Athshean worldview.

Myth plays a central role in connecting the cultural attitudes and behaviours of groups to that of the treatment of nature in *The Word for World is Forest*. The concept of dreaming here and the prophetic strand in "The Night of Hoggy Darn" resonates with *Avatar*'s use of prophecy and mythic images, which include the introductory dream sequence and the scene in which Sully tames a Toruk, a legendary feat accomplished by only five Na'vi. According to Na'vi myth this act legitimises his position as a leader and grants him the respect necessary to unite the Na'vi and lead them to war against the colonists. Much criticism has been levelled against this theme because of its perpetuation of the assumption that victims of colonial oppression can only be delivered from such exploitation by one of the colonisers. Hernan and Andrew suggest that '[t]his movie is supposedly set on the distant planet Pandora, but it really takes place close to home, for *it opens up the Pandora's box of the American racial unconscious*'. They argue that in *Avatar* '[t]he racial masquerade is another fantasy solution to white guilt in which the white hero crosses over and pretends to be black or native American'.[70] This reading addresses guilt as a response to the historic exploitation of cultures and of

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[69] *Word*, pp. 160, 61, 113.
[70] Hernan and Andrew, 'Dances with Aliens: James Cameron's Avatar Movie and White "Saviours" (Updated)', *Racism Review* (2009) <http://www.racismreview.com/blog/2009/12/30/dances-with-aliens-james-camerons-avatar-movie-and-white-saviors/> [accessed 2 July 2010].

nature. Like the dreamer gods of Le Guin's story, *Avatar* presents the spectator with tendencies implicit in American culture. When considered in the light of the analysis of myth above, and when note is taken that it is a member of the Athsheans themselves who lead them to victory against the colonists in *The Word for World is Forest*, it can be seen that influences in sf can be brought to bear against new narratives to provide a dialogical critique from within sf discourse. *Avatar*'s generic influences enter into dialogue with the film to offer the reader/spectator a vantage from which to question the use of religio-spiritual themes and their relationship to nature.

Why depictions of cultures with strong connections to nature have such broad affective appeal can be illustrated with reference to Poul Anderson's short story "Call me Joe", briefly mentioned in the previous chapter. Although chronologically this story belongs to the 1950s pulp sf tradition, it can be usefully read against both the terraforming narratives of the 1960s-1970s and *Avatar*. This story features Anglesey, a paraplegic scientist who is able to connect to an avatar on Jupiter through "esprojectors". These devices transmit telepathic frequencies that allow Anglesey to inhabit the body of a creature on the surface of Jupiter from the space station Jupiter V. These avatars are not referred to as such, but they resemble the Na'vi in many ways: despite being five foot tall centaur-like creatures designated '*pseudocentaurus sapiens*', they have a 'slate-blue form' and are carefully designed and grown in a vat, a procedure that represents 'an investment of several million dollars and quite a few highly skilled man-years'. Anglesey identifies with Joe (his avatar) and eventually manages to exclusively inhabit this body, eventually adopting the name Joe 'as a symbol of freedom'.[71]

Jupiter is viewed by the other scientists as 'a nightmare planet', but Anglesey, in the body of Joe, sees a beautiful landscape. He views the sky as a 'shout of radiance', 'the ice mountains of the west flashed like blue steel!', while his overall impression is one in which the landscape 'struck him afresh how lovely a place this was'. These descriptions metonymically correspond to Joe's body, whose blue colour matches the mountains while his youthful exuberance, both physical and spiritual, correspond to Venus' weather: 'Anglesey drew the wild morning wind deep into his lungs and shouted with a boy's joy'. Anglesey's existence on Jupiter's surface is laborious and lacks the

[71] 'Call', pp. 123, 103, 106, 147, 120.

technology that is omnipresent on the station but, in contrast to his life aboard the scientific station, it is one in which he is able to thrive. The opposition between Anglesey's paralysis and the freedom of movement granted by Joe's body parallels in obvious ways Sully's experience with his avatar. However, despite the fact that Joe is a product of technology, and that habitation and colonisation of the desolate Jovian surface depends on a high level of technological sophistication, the opposition established in the story is a symbolic one between technology and its lack. The colonists plan to grow more avatars in vats but Anglesey, who eventually inhabits the surface permanently, works toward a minimal use of such population strategies, preferring instead that 'the next generation [of pseudocentaurus sapiens] could be begotten by love and not by machines!'.[72] Machines are inimical to nature; as in McKenna's "Hunter, Come Home" and Le Guin's "Vaster Than Empires and More Slow", love operates as a way to connect with an alien otherness.

This machine/nature opposition underlies the significance of Jupiter for the colonists. They are, like the crew of "Vaster Than Empires and More Slow", in some way alienated from Earth. Cornelius in "Call me Joe" is an expert in psionics who is sent from Earth by the Psionics Corporation to resolve the malfunctioning connection between Anglesey and Joe. Cornelius speculates on the colonists' motives for their willing exile to Jupiter in religious terms: '[t]heir monkish existence had changed them – or did they take what amounted to vows of poverty, chastity, and obedience, because they had never felt quite at home on green Earth?'. Cornelius' first view of Jupiter from the station leaves him awed and stuttering 'I had no idea […] I never thought … I had seen pictures, but-'. His reaction is similar to Sully's affective response to the beauty and sublimity of Pandora's forests and is the first step in a change of outlook toward the natural world. Viken, one of the scientists aboard, confirms his belief that 'Jupiter V is more than a research station […] [i]t is a way of life' and that '[t]hose who reenlist, they must find something in the work, something which Earth with all her riches cannot offer them'.[73] Anglesey is the only individual able to escape from both Earth and the space station itself. Despite the overcoming of his paraplegia that habitation of Joe's body offers Anglesey, his desire to remain on Jupiter is underwritten by a fundamental sense of alienation from Earth.

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[72] 'Call', pp. 120, 118-119, 119, 140.
[73] 'Call', pp. 108, 107, 137.

Habitation of Jupiter is an emblem of freedom, and one aspect of this freedom is the notion that individuals must not only survive within their environments, but be ideally suited to these spaces. Mediated through the perceptual apparatus of an alien body and thus allowing him to appreciate Jupiter's beauty, Anglesey's response to the landscape indexes this ideal fit between the organism and its environment.

The colonists' separation from Earth is only partial. They are dependent on Jupiter V, an extension of Earth; its role as a scientific outpost legitimates their presence in Jupiter's orbit. When Anglesey returns to the space station from inhabiting Joe's body he reflects how, '[a]fter the Jovian surface, it was always a little unreal to find himself here again, in the clean quiet orderliness of the control room'. His experience here is an inversion of Cornelius' first sight of Jupiter as is his orientation toward the space of the scientific station; for Cornelius it is alien, for Anglesey it is an extension of Earth. Cornelius believes that the problems with the esprojectors are caused by Anglesey himself, that his 'subconscious was not afraid to stay on Jupiter – it was afraid to come back'. Through the eyes of his avatar, Anglesey is able to appreciate what from the human perspective is the hellish Jovian atmosphere, a perspective that Cornelius identifies as Anglesey's 'religion'.[74] The sf representation of an alternative world functions here to highlight absences on Earth whose affective impact on the colonists are communicated via the language of religion. *Avatar* works within this tradition by representing an immersive ecological landscape that is understood from a spiritual perspective, in contrast to an Earth that is associated with aggression, exploitation, and the middle landscape of the colonial outpost.

James White's two Sector General stories "Meatball" and "Major Operation" hark back to the 1950s space opera pioneered by Anderson and other writers. They develop terraforming and Gaian themes outside of the network of tropes established by the stories discussed above. Their significance lies not in their contribution to the tropological complex emblematised by the image of the living forest but in an alternative treatment of the terraforming and proto-Gaian intersection during this period. Nevertheless, connections to the chronotope of the forest are raised through description of lifeforms like 'great tracks of living "land" covered with the tiny, long-rooted plants which might or

[74] 'Call', pp. 105-106, 147, 136.

might not serve as the strata beasts eyes'.[75] Sector General Hospital is a multienvironment spaceship specialising in alien medicine; "Meatball" relates an encounter with an alien species on the planet Drambo that appear to act analogously to leucocytes. These creatures maintain the health of the strata beasts, vast creatures the size of continents that have been under attack by indigenous aliens who have recently discovered atomic power. In line with their mission to provide medical care to all sentient life, Dr. Conway of Sector General Hospital proposes a vast project aimed at preserving the life of the strata beasts. "Major Operation" follows from the events of "Meatball" after a surgical operation has been devised that utilises the medical benefits of the alien "leucocytes" discovered in "Meatball". In this story, Conway and the interspecies medical team discover that one of the strata beasts is intelligent.

The surgical procedure envisaged for the strata beast takes the form of an advanced engineering project:

> To a hypothetical observer ignorant of the true scope of their problem this medical treatment could have been mistaken for a very widespread mining operation, agriculture on an even larger scale and mass kidnapping.[76]

This medical treatment of the land resonates with Lovelock's insistence on a science of geophysiology, with scientists operating as physicians aiding the planet to maintain a state of homeostasis. The choice of mining and agriculture as comparable activities to this surgical engineering programme forms a motific series that has shaped the significance and meaning of terraforming throughout the tradition. Conway remarks that 'surgery on this scale will mean that the operation will be military rather than surgical', which raises questions over the relationship between the military and medical institutions, along with issues of scale and the capacity for human institutions to cope with projects of great magnitude.[77] Association with the military raises several ethical dilemmas over the methods used to complete the project, while reference to 'mass kidnapping' in the quote above suggests a questionable relationship between humankind and the various aliens on Drambon.

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[75] 'Meatball', p. 124.
[76] 'Major Operation', p. 152.
[77] 'Meatball', p. 118.

These ambivalences extend to the motivations underlying the operation. The altruistic provision of medical assistance, along with the opportunity to make contact with and perhaps learn from and teach other intelligent aliens are initial justifications, but the project accelerates when it is discovered that there is an unknown intelligence able to manipulate the shape and function of "tools" with their thoughts. These thought malleable tools represent a resource of almost limitless application. It is soon discovered that the strata beast undergoing surgery is deploying them in self-defence, and only Conway's chance encounter and communication with the alien prevents further deaths amongst the humans. As "Major Operation" ends, Conway struggles with guilt over the casualties caused by the project:

> A rather supercilious cultural contact specialist had tried to make it very simple for him by saying that difference, whether it was cultural, physiological or technological, was immensely valuable. They would learn much from the strata creature and the rollers while they were teaching them. Conway, with some difficulty, accepted that.[78]

Conway's guilt raises an issue that substrates the use of the terraforming motif for both politico-cultural and environmental philosophical speculation. Such guilt has already been discussed above in relation to the colonial guilt over the extermination of Native Americans that resurfaces in *Avatar*. These Sector General stories explore the limits and values of peaceful contact with alien others, while the terraforming motif is used to call into question the status of the values that accompany humankind's intervention in alien affairs. The suggestion of resource exploitation and the potential military rather than medical application of these tools makes peaceful human–alien relationships ambiguous.

[78] 'Major Operation', p. 182.

4.1.4 Conclusion

These texts exemplify a complex of motifs that frequently co-occur in ecological sf and that are re-deployed in *Avatar*. Proto-Gaian themes developed by Mckenna and Le Guin represent one way in which sf explores confrontations with a living landscape. Another is the radical exclusion of indigenous populations from the values associated with a colonial culture. In *The Word for World is Forest* Le Guin explores this theme in an aspect closely related to the representation of the Na'vi in *Avatar*, although such relations between the coloniser and colonised are complicated in "The Night of Hoggy Darn" and "Call Me Joe". McKenna depicts a mythic struggle between colonisers that have lived for generations on an alien planet and the indigenous and recognisably non-human stompers that inhabit it. Anderson depicts the beginnings of a non-human society whose genesis lies in a divergence from humankind's history. In contrast to the pattern of conflict that dominates American sf, White explores the problems that arise as a consequence of peaceful yet potentially fraught contact with alien others. The intersection of the Gaia theme and the trope of indigenous alien life as the object of an affective response creates a space in which these motifs are flexibly deployed to explore human relationships to the non-human world in a variety of contexts. Underlying many of these stories is a religio-spiritual orientation to landscaping the non-human. Indigenous alien societies or living worlds are often exemplars of a pseudo-pantheistic religion through which a connection to nature's otherness has been made.

Alongside these indigenous populations and colonial cultures are characters living on the fringes of their social groups. This outsider theme can be seen in the narratives considered here: Sully in *Avatar*, the crew and, at a further remove, Osden in "Vaster than Empires and More Slow", and Anglesey in "Call Me Joe". As outsiders, they come into contact with the indigenous as the site of projected values that are seen as absent from Earth and its societies. This lack perhaps explains the strong positive response experienced by some audiences to *Avatar*. It is in the space created by the clash between cultural systems that this individual is brought to a heightened awareness of the beauty and sublimity of the non-human world. Affective responses leading to spiritual modes of perceiving

and characterising nature are adopted by these individuals. Sf thus develops a language that puts into conflict religio-spiritual and rationalised exploitative modes of understanding the world to explore a non-human nature that exceeds its status as a resource to be used or a space to be colonised. Scientific modes of perceiving the world, connected to but distinct from rationalised exploitation, works to support these spiritual conceptions of nature.

Avatar's international success reflects the global dispersal of environmental and sf themes and images. Within sf, terraforming and the Gaia theme have developed in dialogue with a wide range of texts, debates, and influential scientific ideas. These terraforming and proto-Gaian stories have also tapped into sf's frequent appropriation of religio-spiritual language within a scientifically inflected perspective in order to develop a series of ecological narratives that explore alternative conceptions of nature. Important for this ecological branch of sf is the development of Gaian motifs and the representation of alien cultures modelled in part on technologically unsophisticated tribal societies on Earth. These two themes are set in opposition to a future human colonial culture; the resulting dynamic constitutes *Avatar*'s narrative trajectory. *Avatar*'s portrayal of nature spirituality draws significantly from the language of sf literature, operating almost as a metaphorical compilation of ecologic sf traditions that have gained wider currency in a culture that, since the 1980s, has been developing ways of relating to nature in response to the threat of global climate change.

4.2.1 Terraforming in the 1960s-1970s

Herbert's *Dune* sequence, Heinlein's *The Moon is a Harsh Mistress* and Le Guin's *The Dispossessed* use the terraforming motif to explore aspects of the political landscapes developed by earlier terraforming stories, re-considering them in the light of the wider cultural shifts of the 1960s-1970s. Proto-Gaian themes are not foregrounded in these three texts; rather they present a clear continuity with the 1950s terraforming texts discussed in the previous chapter. As in those works, the harsh landscapes of the planets targeted for terraforming encourage the formation of tightly knit communities in which co-operation plays a central role for survival. There is a struggle between this

sense of community and the perception and use of these planets as prisons or sites of oppressive governmental control, as is dealt with in Anderson's nightmare vision of closed communities as isolationist dystopias in his 1950s stories. Each of the texts considered here centre around a political contrast that demonstrates how the planetary landscapes featured in these texts are subject to contestatory voices. In *Dune*, this society is a vast interplanetary empire constituted by ducal fiefdoms; in Heinlein's *The Moon is a Harsh Mistress* this society is limited to a contrast between a colonising centre and the terraformed moon. In Le Guin's *The Dispossessed* the political opposition between a colonising centre and the moon undergoing terraforming is complicated by the fact that this moon (Anarres) was given to the rebel Odonians in order to prevent further political destabilisation at the centre (Urras). Reminiscent of *Dune* and the trend for the depiction of interplanetary societies in the space opera of the 1950s, Le Guin situates this exploration of terraforming and politics in the context of her Hainish universe, thus offering further contrasts with a wider group of worlds and their political agendas.

These texts fall outside of the discursive space opened up by popularisations of Gaia, yet they make use of ecological principles in ways that connect scientific ideas to society, establishing an ecopolitical context that later terraforming stories would develop. *Dune* was reviewed in Stuart Brand's first *Whole Earth Catalogue*[79] in 1968, an influential ecological publication, while Le Guin wrote several articles for its successor, *The CoEvolution Quarterly*.[80] The relationship between ecology and politics and the notion that human landscapes form a necessary part of ecological thinking is now widely accepted in environmental philosophy and was already prefigured in the work of Aldo Leopold, Pierre Teilhard de Chardin and other environmental philosophers and scientists. This cluster of texts illustrates a shift in the character of the political engagement of stories dealing with terraforming, suggesting a response on the writers' part to the political assumptions of earlier sf. All of these texts, like those of the 1950s, borrow from the utopian tour (itself borrowing from the journeys that formed an essential element of travellers' tales), in which an alternative society is

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[79] 'Dune', *Whole Earth Catalogue* (1968), 42. <http://www.wholeearth.com/issue-electronic-edition.php?iss=1010> [accessed 23.04.2012].
[80] Ursula K. Le Guin, 'The Space Crone', *CoEvolution Quarterly* (1976), 108-111. <http://www.wholeearth.com/issue-electronic-edition.php?iss=2010> [accessed 23.04.2012].

explored from an outsider's consciousness as they integrate into it. This can clearly be seen in Herbert and Le Guin's narratives. While Heinlein's main character, Manuel Garcia O'Kelly, is already integrated into this society, the first person address makes the target of this initiation the implied reader.

The theme of interconnectedness has a political aspect that was anticipated by Wells' connection of the physical landscape to human nature on the one hand, and by the interest in population binomics in Heinlein's *Farmer in the Sky* on the other. The transformations that social governance affected on culture and the environment, often abstracted into ecological issues such as overpopulation and resource scarcity, continued to be popular. Ecology, in both its physical science and social aspects, is central to the landmark *Dune* sequence, *The Moon is a Harsh Mistress* and *The Dispossessed*. All three deal with the terraforming of desert planets, although treatments of these landscapes vary between texts. The development of terraforming themes that were distinct from the Gaian texts of the period show that these two concepts had not yet been as explicitly intertwined as they would be in the later terraforming texts of the 1980s. Nevertheless, they explore ecology and terraforming in ways that would impact on later connections between these themes, incorporating aspects developed by earlier 1950s terraforming stories while rejecting some facets of those earlier texts in their struggle with the political and environmental conceptions expressed therein. The manner in which these texts resemble and differ in their approach to issues of nature's otherness and the connection between politics and landscape is explored in this section.

4.2.2 Terraforming and Ecopolitics in the *Dune* Sequence

Herbert attributes the initial inspiration for the *Dune* trilogy to an uncompleted magazine article, "They Stopped the Moving Sands", which focused on the US Department of Agriculture's project involving the use of poverty grass to bind sand dunes in Florence, Oregon.[81] Martyn Fogg writes in his preface to *Terraforming* that the Nebraska Sand Hills, having undergone a similar treatment, provides a '*marvelous metaphor* [...] *for terraformers*', and he speculates: '[w]*hat if we could engineer the sand seas of Mars*'?[82] These connections between geoengineering and terraforming, between transformations of Earth and other planets, are typical of the ecological concerns of this type of narrative. Herbert goes on to write 'I could begin to see the shape of a global problem, no part of it separated from any other' and that '[a] new field of study rises out of this like a spirit rising from a witch's cauldron: the psychology of planetary societies'.[83] As one of the most influential examples of ecological sf, its treatment of nature, science and society have fed into sf discourse and wider society, helping to shape sf's ecological vision.

Dune begins with the ducal family Atreides, who take possession of the Arrakeen feudal house, the political centre of the planet Arrakis and its spice mining operations. It articulates a politico-economic struggle over control of the planet, fought between the interplanetary Empire and the indigenous Fremen (led by Paul Atreides). Throughout the *Dune* trilogy the spreading growth of plant life on the desert planet stands as an emblem for Fremen dreams of freedom, abundance and vitality. As Arrakeen's influence grows after becoming the centre of the Empire at the end of *Dune*, this dream is threatened by the destruction of an older form of spiritual cohesion and reciprocity with the planet, itself emblematised by the threatened disappearance of the deep desert, the sandworms and the superlatively valued spice. As *Dune* concludes, Paul imposes his vision of a future Arrakis onto the Emperor he has overthrown:

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[81] Frank Herbert, 'They Stopped the Moving Sands', in *The Road to Dune* (New York: Tor, 2005), pp. 203-210.
[82] Martyn J. Fogg, *Terraforming: Engineering Planetary Environments* (Warrendale: SAE International, 1995), p. xii.
[83] Frank Herbert, 'Dune Genesis', in *Dune: The Official Website* (2007) <http://www.frankherbert.org/news/genesis.html> [accessed 27 Feb 2012].

> 'The Fremen have the word of Muad'Dib,' Paul said. 'There will be flowing water here open to the sky and green oases rich with good things. But we have the spice to think of, too. Thus, there will always be desert on Arrakis ... and fierce winds, and trials to toughen a man'.[84]

This image encapsulates the contrast between the wilderness of the present Arrakis and the promise of a pastoral synthesis between civilisation and nature. Paul's oath is a political act that focuses the inhabitants' efforts toward the shaping of a new future for Arrakis. The wilderness is valued not just as an economic asset but for its role in developing individuals that can be used as tools to enforce Paul's sovereignty. Those who survive on Arrakis do so because of their rigid discipline, subordination to the welfare of the group and their individual strength of character, traits aligned with a heroic militarism imagined as an exclusively masculine domain. James Oberg cites *Dune* as exemplary of the examination of the role of people in terraforming,[85] while the theme of individuals and groups who are used as tools is explored in many other terraforming narratives, including Pamela Sargent's *Venus of Dreams* (1986).[86]

This instrumental view of communities extends toward the planet and its importance as the sole source of spice in the interplanetary Empire. Liet Kynes is the Imperial Planetologist, a position that, under Harkonnen rule, amounted to the use of the '*native labour pool*' to enact the terragouging of Arrakis.[87] Liet recalls his father Pardot describing this political arrangement in economic and hierarchical terms:

> 'Arrakis is a one-crop planet,' his father said. 'One crop. It supports a ruling class that lives as ruling classes have lived in all times while, beneath them, a semi-human mass of semi-slaves exists on the leavings. It's the masses and the leavings that occupy our attention. These are far more valuable than has ever been suspected'.[88]

Pardot's scheme for terraforming Arrakis seeks to tie the Fremen's emancipation to a long term project of world construction that builds multiple levels of physical (the terraformation of the planet) and cultural adaptation (the development of a culture that can support this terraformation) into a single transformative network. Like the physical processes that have shaped the planet, Pardot states that

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[84] *Dune*, p. 462.
[85] James Edward Oberg, *New Earths: Transforming Other Planets for Humanity* (Harrisburg, Pa: Stackpole Books, 1981), p. 120.
[86] Pamela Sargent, *Venus of Dreams* (London: Bantam, 1989).
[87] *Dune*, p. 26.
[88] *Dune*, p. 262.

'[o]ur timetable will achieve the stature of a natural phenomenon […] A planet's life is a vast, tightly interwoven fabric'. The new community that Pardot seeks to develop is subordinated to the directive of the messianic hero Paul and, in the third novel *Children of Dune*, to his grandson Leto II. This is accompanied by a shift in the timescale envisioned for terraforming and emancipation, which falls from geological to generational spans. Anticipating the acceleration that Paul's escape into the deep desert in *Dune* promises for the ecopolitical project, Pardot warns Liet that '[n]o more terrible disaster could befall your people than for them to fall into the hands of a Hero'.[89] This, as Herbert remarks in "Dune Genesis", is the originary concept for the trilogy: 'the messianic convulsions that periodically overtake us'.[90] The Fremen "masses" are subordinated to the agenda of an individual aristocrat. The terraforming project, originally conceived of as a slow growth of a culture in co-adaptation with its environment, is hijacked for the purposes of individual revenge and power. This theme of heroic individualism can be traced back to "Born of the Sun" (1934)[91] and, as Susan Stratton points out, is one of the enduring sf tropes that pose problems for ecocriticism.[92]

Ecology is central to the terraforming motif in *Dune* and provides a conceptual bridge between concern for the natural world and an examination of the groups who inhabit the planet. Plans for terraforming Arrakis are overseen by Kynes, whose father Pardot, as Arrakis' planetologist before him, supplied the ecological vision for the long term terraforming of the planet. Liet continues to hallucinate his father's early teaching on ecological principles when abandoned by the Harkonnens in the deep desert: '[w]e are generalists […] You can't draw neat lines around planet-wide problems. Planetology is a cut-and-fit science'. The title "planetologist" signals a shift away from the specificities of local ecosystems to a focus on the global, including its human inhabitants. Pardot first identified the potential for ecological management offered by the nomadic Fremen, noting that '[t]o the working planetologist, his most important tool is human beings, […]. You must cultivate ecological literacy among the people. That's why I've created this entirely new form of ecological notation'. The importance placed on ecological literacy or awareness in the context of the directed

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[89] *Dune*, p. 263.
[90] 'Dune Genesis'.
[91] Jack Williamson, 'Born of the Sun', in *Astounding Stories*, 12.1 (1934), 10-38.
[92] Susan Stratton, 'The Messiah and the Greens: The Shape of Environmental Action in Dune and Pacific Edge', *Extrapolation*, 42.4 (2001), 303-316.

global modification of a planet links human emancipatory projects to that of an ecological awareness. This vision of an endeavour that includes both natural and cultural worlds, and the possible transformations that can be affected by a global community, is expanded when Liet recalls his father's visionary ambition: '[w]e must do a thing on Arrakis never before attempted for an entire planet, […] We must use man as a constructive ecological force – inserting adapted terraform life: a plant here, an animal there, a man in that place – to transform the water cycle, to build a new kind of landscape'.[93] This passage links a nomadic, globalised movement over the land to a conscious, directed transformation of social and cultural practices. Pardot's call for a new landscape shifts between natural and cultural referents and leaves the realisation of this new landscape ambiguous, demonstrating how such global transformations are dependent on the interrelation of nature and culture.

This focus on planetary ecology strongly anticipates Lovelock's interest in Gaia as a metaphor for considering Earth as a planetary system. When reflecting on how the sandworms' evolution and life cycle impact upon the planet, Pardot notes that 'the near-ideal nitrogen-oxygen-CO_2 balance [is] being maintained here in the absence of large areas of plant cover' and claims that '[t]he Arrakeen environment built itself into the evolutionary pattern of native life forms', both of which echo elements of Gaian processes and effects. It also places humankind in relation to a global environment in which nature is managed for instrumental ends. For Pardot, the Fremen embody 'an ecological and geological force of almost unlimited potential'; like the native life and their homeostatic regulation of the environment, the Fremen are vital tools for the transformation of the planetary ecology toward a new set of regulatory parameters. Liet, who constantly thinks of the Fremen using the possessive pronoun 'my', Pardot, who cares nothing for the individual Fremen over the group and who is content to '[l]et them think anything they wish as long as they believe in us', and Jessica, who speculates that the Fremen 'could be wielded like a sword to win back Paul's place for him', all view the native community in instrumental terms. This social engineering is given the status of an ecological principle: '[m]ovement across the landscape is a necessity for animal life,' Pardot explains. 'Nomad peoples follow the same necessity. Lines of movement adjust to physical needs for

[93] *Dune*, pp. 260, 260, 261.

water, food, minerals. We must control this movement now, align it for our purposes'.[94] The migratory lifestyle that informs the Fremen's culture is, in ecological terms, a flow of energy that can be harnessed to direct intervention with the environment.

This migratory lifestyle is at odds with Kynes' realisation regarding terraforming and its relationship to civilisation: '[a] thought spread across his mind – clear, distinct: *The real warmth of a planet is in its landscape, how we take part in that basic source of civilization-agriculture*'. Agriculture is linked to terraforming and necessitates the development of a rooted culture. Opposing this vision of an agricultural landscape is that of the migratory sandworms who, like the Fremen, embody a vast force aligned with movement: Pardot explains that '[i]t was lines of movement that gave us the first clue to the relationship between worms and spice'. Two cultural forms of habitation emblematised by agriculture and the sandworms are thus opposed, and a synthesis between them explored. These cultural systems are themselves metaphorical ecologies: when Paul is adopted into a Fremen tribe he realises that he 'was surrounded by a way of life that could only be understood by postulating an ecology of ideas and values'.[95] Ecology offers a framework with which to consider both the physical and cultural parameters of a planet and its inhabitants.

Arrakis' global environment, the chronotope of the barren desert wilderness, offers advantages for ecopolitical reflection and the growth of an eco-cosmopolitanism that continues to be explored in other works of terraforming. Arrakis' harsh environment fosters a heightened awareness of the impact of the environment on the body and, at a larger scale, of the constraints to the development of indigenous communities and civilisations. The scarcity of resources on these planets bring the economic basis of humankind's relationship to the environment into focus:

> 'The historical system of mutual pillage and extortion stops here on Arrakis,' his father said. 'You cannot go on for ever stealing what you need without regard to those who come after. The physical qualities of a planet are written into its economic and political record. We have the record in front of us and our course is obvious'.[96]

The wasteland chronotope is ideally suited to highlighting the implications of an economic system that operates by exploiting others for access to an ever dwindling supply of resources. A sense of time

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[94] *Dune*, pp. 261, 467, 263, 304, 261.
[95] *Dune*, pp. 259, 261, 329-330.
[96] *Dune*, p. 262.

geared toward responsibility to future generations is joined to this socio-political outlook, itself a new awareness that can be considered a form of eco-cosmopolitanism that struggles with the repercussions of the human impact on the landscape and the changes to the way in which the landscape signifies for the Fremen. Arrakis' environment does not determine as much as it provides the initial foundations for the economic and political systems that Paul establishes on Arrakis. The character of this ecocological vision is undermined by the dominance of the main heroic narrative and its strong instrumental approach to nature, but it does remain a critical undercurrent in the sequence.

4.2.3 The Garden in *Dune*

Jessica discovers a private garden in the Arrakeen feudal house that gratuitously consumes enough water to support many individuals. This garden signifies to a greater degree than the lack of waterseals on doors and windows as 'a deliberate statement of power and wealth', symbolised by the callous and calculated waste of water on a world that lacks this resource:[97]

> Water everywhere in this room – on a planet where water was the most precious juice of life. Water being wasted so conspicuously that it shocked her [Jessica] to inner stillness.[98]

On one level this garden space is no refuge but a symbolic affirmation of aristocratic power and wealth by the Harkonnens and, by extension, the Empire and its overarching control over Arrakis' future. The garden, however, has been appropriated for other purposes. A note left by the Emperor's proxy, a fellow aristocrat and Bene Gesserit, allows her to locate a hidden message warning of an assassination attempt on her son Paul, who appears with a "Hunter-seeker" before she can act on the warning and, at her direction, destroys the mechanical assassin by plunging it into a pool. The ensuing dialogue between the two constructs another layer of significance that refigures this garden space as a refuge from further threat. This is emphasised by the airlock sealing the garden from Arrakis' arid atmosphere. Its special climate provides a significant contrast to the desert landscape it excludes and shows how the trope of the airlock acts as both a threshold and discontinuity between these spaces. The garden is represented as another world through a series of technologies that allow the climate to be modified, including the airlocks aforementioned, the filter glass that allows a yellow sun to be simulated and the 'clock-set servok', a sprinkler that connects images of technology, water and the garden. Whereas danger is aligned with technology through the hunter-seeker's function as a counterforce, and is symbolically contrasted with the natural through its destruction by water, the garden is itself completely dependent upon technology for its existence.[99]

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[97] *Dune*, p. 72.
[98] *Dune*, p. 72.
[99] *Dune*, pp. 71-74.

This garden landscape is a politically contested space. In contrast to the initial power statement it originally signified under Harkonnen feudalism, the Atreides co-opt the garden to underscore their ideological difference from the Harkonnens and to legitimise their own rule:

> 'My Lord, the Duke, and I have other plans for our conservatory,' Jessica said. She smiled at Leto. 'We intend to keep it, certainly, but only to hold it in trust for the people of Arrakis. It is our dream that some day the climate of Arrakis may be changed sufficiently to grow such plants anywhere in the open'.[100]

Kynes interprets this promise against the Fremen legend of '"the shortening of the way"', the appearance of a mythical hero known as the Kwisatz Haderach, prompting Jessica to wonder, '*Did our Missionaria Protectiva plant that legend here, too?*'.[101] The garden thus becomes an ambivalent symbol for freedom from oppressive feudalism. If the garden came to be mirrored by the wider landscape then the scarcity and control of water on Arrakis could no longer bolster the economic power exercised over the Fremen. However, in a text so dominated by the ceaseless plotting between feudal houses, the co-opting of the pastoral ideal operates as a counterforce that introduces civilisation, aligned with the Empire and its Dukes, into the ideal. The cynicism with which Jessica exploits Fremen legend and the politically charged statement 'hold it in trust for the people', which echoes Arthur C. Clarke's *The Sands of Mars* (1951),[102] works not only to dialogise the different discourses of the text but to draw correspondences to historical events via its metaphorical correspondence to oil, clean air, water and for any other shortages of resource that occur as a result of commerce and overpopulation.[103]

The garden, however, remains alien to Arrakis. As the trilogy develops and it is revealed that free water on the surface of the planet poses the threat of extinction to the sandworms, the pastoral ideal that the dream of a terraformed and free planet offers to the Fremen is gradually undermined in various ways. In *Children of Dune*, the third part of the trilogy, the Atreides retainer Gurney Halleck views the new landscape that Paul's vision has brought to the desert and is able to assess it from the vantage offered by his status as an outsider: '[m]omentarily, he saw the garden through Fremen eyes:

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[100] *Dune*, p. 127.
[101] *Dune*, p. 128.
[102] Arthur C. Clarke, *The Sands of Mars* (London: Sidgwick & Jackson, 1951; repr. 1976).
[103] 'Frank Herbert: Interview on TV', *Youtube* (2007) <http://www.youtube.com/watch?v=BEWM7zIIF9c> [accessed 6 October 2010] and 'Dune Genesis'.

alien, menacing dangerous in its waste of water […] *Both of us are alien here*'.[104] The speed of the planet's physical transformation creates a disjunct between Halleck and his environment, an estrangement that is shared by the garden; like the offworlder who views this landscape, the garden superimposed onto Arrakis is alien to its environment. This sense of alienation can be usefully compared to notions of deterritorialisation that Heise discusses in *Sense of Place and Sense of Planet*, which in the *Dune* trilogy hinge on the cultural importance that the Fremen place on the conservation of water.[105] The danger that Halleck responds to centres round the erosion of discipline and social cohesion that had served as a touchstone of cultural identity tied to the specificities of their environment, helping to bind the Fremen into a tight knit global society.

The change to the environment and the Fremens' culture presented in *Children of Dune* is anticipated in *Dune Messiah*, the transitionary text of this trilogy. Paul reflects on the changes that he has begun to initiate as the new Emporer:

> They hated him. He'd slain the past. And there were others, even those who'd fought for the sols to buy precious water, who hated him for changing the old ways. As the ecological pattern dictated by Muad'dib remade the planet's landscape, human resistance increased. Was it not presumptuous, he wondered, to think he could make over an entire planet – everything growing where and how he told it to grow? Even if he succeeded, what of the universe waiting out there? Did it fear similar treatment?.[106]

The 'shortening of the way', the rapid change to the environment and the social conditions that are constrained by the landscape, is the source of a profound deterritorialisation that is evident to Paul even as he makes these changes. Paul's awareness of the social tensions that his actions precipitate informs his decision to renounce his title as Emporer at the end of *Dune Messiah* and to retreat into the desert and accept his new role as a prophet in *Children of Dune*. In this capacity he stands as a pastoral counterforce opposing the changes that he had himself initiated by establishing Arrakeen as the centre of a new civilisation. The heroic individualism and Machiavellian political self-interest that dominated *Dune* is here profoundly critiqued for its hubris and its perceived extension outward to the universe. Paul notes that Arrakis itself 'fought him, resisted, slipped away from his commands', thus illustrating how the nature of the planet itself resists the imposition of an individual's landscaping

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[104] *Children of Dune*, pp. 334-335.
[105] Ursula K. Heise, *Sense of Place and Sense of Planet: The Environmental Imagination of the Global* (Oxford: Oxford University Press, 2008).
[106] *Dune Messiah*, p. 34.

vision.[107] Nevertheless, the *Dune* trilogy presents this hubris as inescapable, eventually leading to Leto II's transcendent synthesis with the sandworms and complete control over the destiny of the Fremen and the planet. The *Dune* trilogy borrows from ecology and the pastoral to sketch a movement from terraforming seen as a positive physical and socio-cultural transformative force to a problematic symbol of ecopolitical dictatorship and deterritorialisation.

4.2.4 *The Moon is a Harsh Mistress*

Heinlein's *The Moon is a Harsh Mistress* was first serialised in *Worlds of If* from 1965-1966 before novel publication in 1966. In this narrative the Moon (Luna) has been colonised by convicts deported from Earth several generations ago, who labour to satisfy Earth's increasing demand for resources (grain). This economic arrangement is overseen by an organisation (the Authority) representing Earth's interests on Luna, namely the maintenance of a flow of cheap resources to the imperial centre. The plot concerns a conspiracy by a group of "rational anarchists" to unite the people of Luna, overthrow the Authority and declare independence from Earth. This text departs from the political framework of earlier terraforming texts by offering an exploration of libertarian political philosophy as an alternative to the imperial and fascist politics seen in the earlier consensus futures of the 1950s terraforming boom. Many of the themes in this text are developments of ideals of self-sufficiency and ecologically informed economics explored in Heinlein's *Farmer in the Sky*: the revolutionary Professor Bernardo de la Paz exhorts Earth's politicians to

> Send us your poor, your dispossessed, send them by thousands and hundreds of thousands; we'll teach them swift, efficient Lunar methods of tunnel farming and ship you back unbelievable tonnage. Gentlemen, Luna is one enormous fallow farm, four thousand million hectares, waiting to be plowed!.[108]

The political context, with its reference to the American war of Independence and the colonisation of Van Dieman's island, develops themes established by earlier 1950s stories. Significantly it is the poor

[107] *Dune Messiah*, p. 56.
[108] *Moon*, pp. 240-241.

and the dispossessed who are relied upon to abandon their lives on Earth to become colonial farmers, thus hinting at the exploitation involved in terraforming the Moon.

Geoengineering themes are explored in the context of an overpopulated and politically strained Earth which continues to sustain a socio-economic cycle that only exacerbates these ecopolitical problems. The increasing demand for resources on Earth informs the Authority's use of criminals as slave labour on Luna, establishing a terragouging model of terraforming as the primary human relationship to Earth and the Moon's environment. In this regard *The Moon is a Harsh Mistress* bears many similarities to the consensus futures of the 1950s terraforming texts. At its conclusion, the assumption of a terragouging model for approaching other planets is not significantly challenged. As Luna settles into Independence, Mannie considers the terraforming of the asteroids in terms that draw on space as a field of continued conquest, adventure and excitement.[109] The struggle for personal fulfilment outweighs the interest that a continued development of a Lunarian society holds for the text, which eventually turns outward toward space rather than inward toward a development of more equitable social relationships on both Earth and Luna.

In order to combat Earth's exploitation of the Lunarian society for the production of cheap resources, de la Paz argues for self-sufficiency as a step toward a capitalist-libertarian ethic of the free market:

> Every load you ship to Terra condemns your grandchildren to slow death. The miracle of photosynthesis, the plant-and-animal cycle, is a closed cycle. You have opened it – and your lifeblood runs downhill to Terra. You don't need higher prices, one cannot eat money! What you need, what we all need, is an end to this loss. Embargo, utter and absolute. Luna must be self-sufficient!.[110]

De la Paz recapitulates Miller's symbol in "Cruxifixus Etiam" of the wine soaked Martian sand, which stands as an image for the lives of the labourers that have been sapped by an alien environment.[111] This image trades on the connection between ecological energy flows and blood, describing a feedback loop from the colonists to the land. De la Paz's call for a free market is grounded in an awareness of the finiteness of Luna's resources: the scarcity of nutrients and water

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[109] *Moon*, p. 303.
[110] *Moon*, p. 17.
[111] Walter M. Miller, 'Cruxifixus Etiam', in *The View From the Stars* (Hertfordshire: Panther, 1968; repr. 1973), pp. 58-78.

used to grow grain on the Moon makes its ecological system exceedingly fragile. Coupled with the Malthusian population explosion that leaves many countries on Earth (India is the main example) unable to provide living space and food for its populace, the urgency of establishing a free market is intensified. Mannie's friend and co-conspirator, the AI known as Mike, uses a series of statistical scenarios to project a decline on Luna in seven years. De la Paz later argues to the Lunar Authority on Earth that '[d]iscussions of how to augment our shipments must be based on the facts of nature, not on the false assumption that we are slaves, bound by a work quota we never made'.[112] The urgency of this ecological decline scenario leads to the necessity of establishing economic, and hence political, self-determination on Luna.

This call for a scientific outlook that can appreciate and make decisions based on the facts of energy economics is rooted in de la Paz's libertarian political philosophy, "rational anarchism". The political use that discourses of nature are put to in justifying Earth's instrumental relationship to Luna is contested by a philosophy that privileges a certain value of rationalism. Jason Bourget has argued that Heinlein's reformulation of nineteenth century libertarian political philosophy is undercut by a biological determinism that privileges masculinity, thus preventing the realisation of a libertarian utopia in the text.[113] Heinlein's notion of biological determinism elevates masculinist individualism by representing it in terms of a teleological notion of evolution. This is coupled to an insistence that politics suitable to the level of individual interaction can be scaled up to best equip a global society for survival. Rational anarchism locates social responsibility with a specific individual:

> A rational anarchist believes that concepts such as "state" and "society" and "government" have no existence save as physically exemplified in the acts of self-responsible individuals. He believes that it is impossible to shift blame, share blame, distribute blame. . . as blame, guilt, responsibility are matters taking place inside human beings singly and nowhere else. But being rational, he knows that not all individuals hold his evaluations, so he tries to live perfectly in an imperfect world. . . aware that his effort will be less than perfect yet undismayed by self-knowledge of self-failure.[114]

By coupling this political philosophy to notions of biological determism, Bourget argues that 'Heinlein's populist revolution is rapidly transformed into an elitist dictatorship, dominated by a few

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[112] *Moon*, pp. 83-84.
[113] Jason Bourget, 'Biological Determinism, Masculine Politics and the Failure of Libertarianism in Robert A. Heinlein's *The Moon is a Harsh Mistress*', *Foundation: The International Review of Science Fiction*, 104 (2008), 10-22 (pp. 10-11).
[114] *Moon*, p. 51.

charismatic men who assume complete political and economic control over as soon as the Lunar Authority no longer exists'. De la Paz is one such charismatic figure, whom 'Heinlein unwittingly transforms […] from a representative of libertarian thought into a tyrant with a fit belief in the importance of his own masculine individuality'.[115] In many ways the masculinist fascism that de la Paz represents recapitulates the Machiavellian masculinity of Paul and Leto II in the *Dune* series toward the Fremen, thus sustaining a tradition of instrumental relationships toward planetary environments and their inhabitants. In *The Moon is a Harsh Mistress*, the use of grain shipments and rocks from Luna's surface as projectiles with which to threaten Earth is one manifestation of this individualism and instrumentalism.

Rational anarchism represents a backlash against the idea of global governmental systems or, in Anderson's case, an interplanetary UN. It rejects bureaucratic systems and denies a global sense of identity rooted in responsibility to the group. However, as Bourget has shown, this individualism is restricted to those who see it as their duty to ensure their position as leaders directing the course of history. *The Moon is a Harsh Mistress* closes spaces for a libertarianism that allows multiple voices to interact, which would open a dialogue about the meaning and function of a plural community: Mannie finds that the results of the election for a Lunarian council has been rigged by Mike, giving him a seat on the council that he had not been democratically elected for. De la Paz calls this anarchism "freedom", a notion that is revised by Le Guin as freedom to do anything, not a freedom from anything.[116] Heinlein's treatment of a terraformed Moon as an alternative, anarchist political system clashes with the implications of his biological determinism, but it does represent a departure from earlier ideas of global or interplanetary governments and responds to the same counter-cultural opposition that informed the New Wave of sf.

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[115] Bourget, pp. 18, 19.
[116] *The Dispossessed*, p. 108.

4.2.5 *The Dispossessed*

Le Guin's *The Dispossessed* represents an alternative to the masculine politics of Herbert and Heinlein. Published almost a decade after *Dune* and *The Moon is a Harsh Mistress*, *The Dispossessed* is informed by the successes and failures of the 1960s counter-culture. Le Guin's interest in ecology, feminism and colonialism marks her as an early ecofeminist, while her work greatly influenced sf discourse and provided another voice that later writers would inherit.[117]

The Dispossessed makes much of the implications of its subtitle and status as an "ambiguous utopia"[118]; Moylan has analysed this work as a "critical utopia".[119] The terraforming tradition taken as a whole operates analogously to the critical utopia through techniques such as the dialogising relationship established between *The Moon is a Harsh Mistress* and *The Dispossessed*. Le Guin reconsiders anarchism in the light of ecofeminist politics through the consciousness of the protagonist Shevek. Alternating chapters set primarily on the planet Urras and its moon (Anarres) allows the reader to compare the political systems of both societies as seen from Shevek's perspective. While Shevek compares the alien planet Urras against the touchstone of his home planet Anarres, the narrative's structure also allows the reader to consider the faults of the Odonian's political system. This narrative strategy contributes to the ambiguity of the utopian element in the text.

Anarres is an anarchist commune in the sense that it represents a social experiment in anarchist political philosophy. By exploring the nature and the transformations that time affects on its institutions, *The Dispossessed* considers the relationship of a society to their environment, their fellow citizens and to other societies. The Odonian governmental system is designed to escape the shortcomings that have resulted in an uneven set of social relationships on Urras. Aspects of this system, such as its decentralisation, are often associated in the wider cultural sphere with environmental outlooks. In contrast the environmental concerns of A-Io are genuine but socially stratified, primarily working to maintain the economically privileged in a state of luxury. Combined

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[117] See Stratton 2001 on Robinson, p. 306.
[118] Ursula K. Le Guin, *The Dispossessed: An Ambiguous Utopia* (New York: Harper & Row, 1974); the subtitle is absent from the Gollancz 2000 reprint.
[119] Moylan.

with decentralisation is the Odonians' repudiation of tribalism in the name of a broader conception of community. Tribalism, however, is extended to the Odonians as a whole; many reject Shevek's campaign for contact with Urras, preferring instead to operate as a closed, self-sustaining commune. Such separation, however, is already compromised by the fact that Anarres is an Urrasti mining colony.[120] Bramwell argues that 'religious minority groups, such as the Amish and the Doukhoubours, survived because they were transplanted as homogenous groups from their country of origin, and owed their survival to tribal as well as religious bonds, rather than novel experiments'.[121] Such homogenous transplanting is also characteristic of the foundation of Odonian society: generations ago A-Io pre-empted Odonian destabilisation on Urras by ceding them their Moon. Anarresti tribalism draws identity and collective strength from a political text written by the anarchist and spiritual founder Odo, and yet it is this collectivism that has rigidified and become a restraint in Shevek and his supporters' eyes.

One ecopolitical element crucial to the text is the pastoral inversion between Urras and Anarres. The pastoral world and its pairing with capitalist economics and a network of international relations on Urras operate as a literalised abstraction of certain contemporaneous real world perspectives on global politics as experienced from a "Western" point of reference. This is complicated by Shevek's realisation that he has been insulated from the negative aspects of the urban experience in the nation of A-Io. This plot development parallels the use of the pastoral ideal as a rhetorical strategy that cloaks or elides the necessities of everyday life and the dynamics of oppression, recalling Ernest J. Yanarella's discussion of the "Garden of the Chattel" form of pastoral.[122] Shevek's experience of the landscape and of the animals on Urras broadens this pastoral theme by including vectors for the recognition of nature's otherness. Shevek's first sight of a horse and a flock of birds are haunting images; his experience with animals in A-Io enacts a confrontation with the alien but establishes this event as a re-connection.[123] These visions initially appear to offer an

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[120] *The Dispossessed*, p. 79.
[121] Bramwell, p. 93.
[122] Ernest J. Yanarella, *The Cross, The Plow and the Skyline: Contemporary Science Fiction and the Ecological Imagination* (Florida: Brown Walker Press, 2001), pp. 81-82.
[123] *The Dispossessed*, pp. 21, 40, 56, 66.

experience that allows Shevek to reassess his view of Urras and entertain the possibility of a human community spanning the two societies.

Shevek's experience with animals is combined with a thread of moral extensionism that balances his sense of nature's otherness with a solidarity based on recognition of similarity between animal others and himself. This element of moral extensionism soon overrides nature's otherness and is linked to the anarchist ideals explored in the human political context.[124] Human relationships to nature are grounded in the same political philosophy as intra-human relationships. This too has been a dominant strategy for environmental thinkers: by locating an exploitative relationship to nature in the religio-political philosophy of the "West"[125] or in the mechanism of Descartes,[126] these thinkers draw connections between the cultural domain of philosophy and politics and those of "Nature". This shift from nature's otherness to extensionism parallels or even creates the effect Gary K. Wolfe identifies as sf's fundamental movement from the known to the unknown.[127] Anarres and Urras are unveiled during the course of the narrative while the Odonians' anarchism is critically examined, its flaws (through Shevek's eyes) highlighted and a restoration of its basic principles attempted.

Pastoral themes are also present on Anarres. In an episode after Shevek accepts a posting in which he works to plant vegetation engineered for environments on Anarres, he becomes acquainted with a pastoral song sung by the labourers. Shevek's reaction to some of the oblique references in the song illustrates the otherness of the pastoral landscape to the Odonians. Nevertheless, for many of the labourers this song retains an inspirational element that underwrites their efforts to terraform their moon. The first site on Anarres, Ans Hos, can be translated from the Odonian language Pravic into the Ioti language of A-Io as "Garden of Mind" and is known as the Eden of Anarres. The chronotopicity

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[124] *The Dispossessed*, p. 127.
[125] Lynne White, Jr., 'The Historical Roots of Our Ecologic Crisis', in *The Ecocriticism Reader: Landmarks in Literary Ecology*, ed. by Cheryll Glotfelty and Harold Fromm (Athens: University of Georgia Press, 1996), pp. 3-14.
[126] See Plumwood and Kate Soper, *What is Nature?: Culture, Politics and the Non-Human* (Oxford: Blackwells, 1995).
[127] Gary K. Wolfe, *The Known and the Unknown: The Icons of Science Fiction* (Kent: Kent State University Press, 1979).

of this space, as a colonial settlement set in an unspecified future, sits in tension with the pastoral nostalgia that it evokes.[128]

Odonian society avoids the use of unnecessary technology but is not primitivist: they actively reject this pastoral orientation toward an idealised past in favour of something referred to as a "complex organicism". This combination of decentralisation and a low-tech infrastructure, the latter of which faintly recalls the feudal setting in *Dune*, reflects a distrust of large, bureaucratic governments where decision making devolves to an imperial centre. Nevertheless, there are centres on Anarres: Divlab, a centralised computer system, manages the planet's work postings while Abbenay, the capitol of Anarres, is a centre in which, as Shevek's first tutor Mitis tells him, power inheres. This ironically undercuts Shevek's initial impression that, in Abbenay, nothing was hidden.[129] Such contradictions exemplify how *The Dispossessed* works as an ambiguous utopia, the reality of which is less utopic than the ideal.

Nevertheless, the differences between the two governmental and philosophical systems are real. Odonian social philosophy, based on Kropotkin's concept of "mutual aid" and a distrust of rigid social practice, is a significant indicator of a shift in political philosophy in sf that influenced the ecopolitical dimension of terraforming texts such as Robinson's *Mars* trilogy.[130] Anarchism, as Shevek argues, is part of their "nature" as Odonians. In contrast, Chifoilisk, a scholar on Urras, offers a different view of human nature which is clearly representative of a belief in the status of human nature held by Urrasti society. In one episode set in Shevek's youth, he and his friends look up at the distant Urras from Anarres and see a beautiful cosmic body. Tirin suggests that it might be desirable to see what is happening on Urras, arguing that at the very least it would be worth going to see what a horse is. Shevek believes this to be a childish notion, but it does speak of a desire to reach beyond an immediate community to expand ideas of a lived sense of place from global to interplanetary scales. Tirin expresses a desire to re-connect with the other and, in doing so, re-evaluate the immediate

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[128] *The Dispossessed*, pp. 41-42, 46, 80, 76, 180.
[129] *The Dispossessed*, pp. 81, 81, 82, 50, 83-84.
[130] Kim Stanley Robinson, *Red Mars* (London: Voyager, 1992; repr. 1996), *Green Mars* (London: Voyager, 1993; repr. 1996) and *Blue Mars* (London: Voyager, 1996).

community. This re-evaluation allows the potential unmasking of the lies Odonians tell themselves and offers to make overtures toward a positive re-creation of their community.[131]

This re-evaluation of anarchism turns on what Shevek calls the 'nature of existence' and on notions of brotherhood.[132] In an important passage in which Shevek discusses notions of suffering in a group, he contests the idea that suffering is a social disease. Ideas of suffering give the anarchist project of questioning social norms a decidedly existential angst. In contrast to one Odonian's belief that brotherhood begins with love, and combating the notion that centralising ideas of pain makes a cult out of suffering, Shevek argues that brotherhood begins in shared suffering, the very thing another Odonian argues that mutual aid is designed to prevent. While society can work to eliminate unnecessary suffering, there remains an existential question: suffering remains and is, as Shevek argues, part of the nature of existence. Although questionable on the ground that there are other, ineliminable traits that remain part of the nature of existence (one might argue that less commendable human qualities could also have equal claim to centrality, as does Chifoilisk), the connection between suffering and brotherhood makes this trait significant for its social and ecopolitical implications. In the light of this exchange, Shevek's call of brotherhood to a pet otter is a call of solidarity that draws connections between ideas of shared suffering between two distinct species. This can hardly be based on an ontological similarity between the suffering of man and otter, but must be attributed to the roots of this suffering. The common factor linking their experience of suffering is not to be found in their nature as embodied humanity or otter, but on the suffering caused by the shared conditions of their environment. In other words, it is not the quality of their suffering that is the same, but the sources of their suffering. To clarify, this includes their historical relationship as creatures sharing the same world, and the cultural interventions that have had physical repercussions on the way humans and animals live on the planet.

The main narrative arc connects ideas of science to politics through Shevek's attempt to reconcile the principles of Sequency and Simultaneity in order to develop a General Field Theory. Shevek shames Pae by showing contempt for the comparison he draws between the laws of physics (a

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[131] *The Dispossessed*, pp. 40-41, 41.
[132] *The Dispossessed*, pp. 52, 54.

particular landscape) and the uneven political arrangements on Urras. Mathematics undergirds the laws of physics, while thematic similarities between ecology and physics highlights the coherence between their emphasis on ideas of unification and connection in their account of different aspects of nature. Shevek's reading of the ancient Terran scientist Ainsetain (Einstein) is illuminating in this regard, as is his own effort to produce a unified field theory. Mathematics, or "number", is a bridge between psyche and matter. Number is the basis of other modes, and Ainsetain (so Shevek believes) thought of physics and mathematics as an accurate description of reality. If Shevek's understanding of number is correct, this basis in reality is the ground in which all political and ethical systems are rooted. Shevek's mission to discover a unified field theory parallels his desire to establish a connection between Anarres and Urras. This parallel underlies his continued interest in social reform as one example of his attempt to unify separate domains. Shevek makes this clear when, in a discussion at a party on Urras, he claims that reconciling Simultaneity and Sequency would amount to a complexity that embraced not only geometry but ethics.[133] Attempts to balance the physical with the ethical, and hence political, relationship of a society to its environment foregrounds the holism of physics and higher mathematics.

Ecology is not absent from the text, despite the priority given to physics. Shevek's partner Takver is a biologist who specialises in fish genetics. Shevek sees Takver's 'concern with landscapes and living creatures' as something 'much broader than love', and speaks of her as being unweaned from the universe. This view is not quite an identification of Takver with nature so much as it is an overcoming of alienation from nature. Nevertheless, it does recapitulate an expanded self model of identification with nature insofar as nature encompasses Takver's identity. The connection between politics and ecology is powerfully presented via the late appearance in the text of the Terrans and Hainish, to whom Shevek turns for asylum after the brutal suppression of the Ioti rebellion. The Terran ambassador Keng tells Shevek of her homeworld (Earth), which was devastated by their inability to adapt to the new conditions that their own multiplying population and practices affected on their environment. To Keng, Urras, despite its faults, is a world tremendously alive. This contrast appears to mitigate, in Keng's eyes at least, the suppression of the rebellion. Shevek, on the other

[133] *The Dispossessed*, pp. 169, 230, 187.

hand, connects this viewpoint to his own understanding of time, and to his work as a physicist. Speaking from a position informed by the insights of Simultaneity, Shevek argues that you cannot have the present unless you accept both the past and the existence of the future.[134] This dynamic is, as Moylan argues, typical of *The Dispossessed*, which he argues expresses an attitude of *détente*, 'the cooperation of previously contending forces to transcend hostility, suffering, and injustice and work jointly toward a better world for all'.[135] From the point of view of Sequency, Shevek assesses Keng's nihilism as an inability to accept change; that evolution does impact on both human nature and culture. This complex extension of physics into the domain of evolution and ethics points toward a utopian future that is ambiguous because it cannot exist in a static form. Instead, much like Shevek's view of Odonian society as rebellious, the process of evolution is paralleled with that of revolution, both of which are ongoing and permanent.[136]

This process of revolution is first and foremost an individual act, a condition that is reflected by the text's focus on Shevek as the central character of the narrative. This focus on the individual is also one dimension of anarchism and sits in an uncomfortable relation to ideas of community and survival that terraforming narratives traditionally emphasise. As Shevek argues (faintly echoing Poul Anderson's anti-collectivism), any rule is tyranny, including the rule of the group, and if an individual cannot work in solidarity with his community then it is their duty to work alone.[137] The problem of the individual and the group rises to the fore as the main conflict within Anarresti society and remains troublesome for conceptions of anarchism. The theme of heroic individualism, often associated with imperial and patriarchal conceptions of right government, is refigured in less heroic terms and presented as a necessary step toward social change and responsibility. Shevek's brand of individualism differs from conceptions of heroic individualism in that it is balanced by a strong conception of brotherhood as a binding social force.

Shevek reflects on fulfilment as a function of time and uses two conceptual chronotopes, the motif of the locked room and the landscape of time outside this metaphorical locked room. The room

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[134] *The Dispossessed*, pp. 154, 288.
[135] Moylan, p. 93.
[136] *The Dispossessed*, p. 147.
[137] *The Dispossessed*, p. 295.

is a symbol for individual stasis and intellectual imprisonment and appears throughout the text in various forms, most notably as the motif of the wall that opens the narrative. The idea that an act becomes human only when it occurs in the landscape of time, in both the past and the future, is a complex and oblique notion. Loyalty ties the past and the future together, establishing continuity between temporal landscapes; between interpretations of the past and visions of the future. Terraforming is both physical and social, involving a superimposition of physical landscapes and intellectual ones. Time is conceived as an intellectual landscape, loyalty as a political relationship that fuses the physical aspects of the terraforming process with a political aspect oriented toward the future. Reflection on the landscape of the past and an acceptance of change, both physical (the terraformation of planets) and social (the reformation of socio-political landscapes), are brought together in the space of the terraforming text. The terraforming narrative provides a space in which the physical and the political are drawn together; the terraforming motif operates as an emblem for the interanimation of these two domains.

4.3 *Ecotopia*

Ernest Callenbach's *Ecotopia* (1975) is a classic of ecological literature. Although written from outside of the sf tradition, it has been embraced by sf audiences and has been responsible for popularising ecological issues through its utopian form to a wider audience. *Ecotopia* operates more like a catalogue of already existing technologies and an exploration of how they could be utilised within a particular social framework, and in this sense it clearly bears a resemblance to Brand's *Whole Earth Catalogue*. It is also significant that Callenbach situates Ecotopia in the American West Coast, thus contributing to the ecological and egalitarian tradition of green utopias to which Le Guin and Kim Stanley Robinson contribute. *Ecotopia* is part of a discourse of ecologism that connects utopianism with westward expansion: in Robinson's *The Gold Coast* one character argues that 'Orange County is the end of history, its purest product. Civilization kept moving west for thousands of years, in a sunset tropism, until they came to the edge here on the Pacific and they couldn't go any

farther. And so they stopped here and *did it*': they attempted to create a utopia.[138] Californian ecological texts, however, are concerned with connecting history to the future, and in this sense the future of the ecological utopian symbol that is Orange County is open to determination.

Callenbach, like Le Guin, wrote for *The CoEvolution Quarterly*, where he comments that many of the ideas he incorporates into *Ecotopia* were drawn from the popular magazine *Science.*[139] Stuart Brand's influential *Whole Earth Catalogue* and its successors and revivals exemplify the connections between technology and environmentalism that the Californian ecologism of the 1960s and 1970s established, and which fed into terraforming narratives. The *Whole Earth Catalogue* collects a range of articles from reviews of books and technologies, surveys of the work of various thinkers on a range of disciplines, historical primers and other items, all of which are subordinated to the subtitle of the text, 'access to tools'.[140] Among articles on Buckminster Fuller and Tensile Structures (including domes), the first issue reviewed Steve Baer's *Dome Cookbook* (1967)[141] and the geoengineering text *Man's Role in Changing the Face of the Earth* (1956).[142]

The influence of the term "Ecotopia" on sf is evidenced by Robinson's publication of an anthology of short stories titled *Future Primitive: The New Ecotopias* (1997).[143] *Ecotopia* begins with an epigraph that translates the etymology of the term "ecotopia". The root "Eco-", 'from the Greek *oikos* (household or home)', highlights the shared etymological connection between utopia and ecologism. In the context of terraforming, which is concerned with constructing new homes on other planets, this signification is central. Le Guin, too, draws on this relationship between ecologism, utopia and home, most notably in her experimental critical ecotopia *Always Coming Home* (1985).[144] Werner Christie Mathisen sees the connotations of home as implying 'an exemption from difficult choices, and thereby a reduction in individual and social autonomy', although Le Guin, Robinson and

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[138] Kim Stanley Robinson, *The Gold Coast* (London: Futura, 1989), p. 3.
[139] Ernest Callenbach, *CoEvolution Quarterly* (Spring 1979), 79 <http://www.wholeearth.com/issue-electronic-edition.php?iss=2021> [accessed 23.04.2012].
[140] Stuart Brand, ed., 'Whole Earth Catalogue Fall 1968', *Whole Earth Catalogue: Access to Tools and Ideas* <http://www.wholeearth.com/issue-electronic-edition.php?iss=1010> [accessed 30 August 2012].
[141] Steve Baer, *Dome Cookbook*, 5th edn (Corrales, N.M.: Trial and Error, 1996).
[142] William Leroy Thomas, ed., *Man's Role in Changing the Face of the Earth* (Chicago: University of Chicago Press, 1971).
[143] Kim Stanley Robinson, ed., *Future Primitive: The New Ecotopias* (New York: Tor, 1997).
[144] Ursula K. Le Guin, *Always Coming Home* (Toronto: Bantam Books, 1986).

other sf writers have consistently challenged such abdication of personal choice in their narratives.[145] Terraforming, as a literature of habitation, makes ecology central to the realisation of a critical utopian space in the late 1970s, thus factoring the more-than-human-world into its exploration of social reconstruction. In this sense these narratives can be considered works that express an eco-cosmopolitan vision.

Although *Ecotopia* is not a terraforming text, it does deal with geoengineering themes that are linked to the governmental and economic restructuring of society. Its secessionist politics represents a formal link to the relationship between Earth and other terraformed planets. Separation from America allows the Ecotopian society to develop according to its own socio-political trajectory, a dynamic that is magnified by the separation of space between Earth and terraformed worlds. Some of the main elements of the Ecotopian political vision (as in *The Dispossessed*) include an emphasis on decentralisation and stable state economics that impact upon multiple levels of Ecotopian life, including production, education, local and regional politics, healthcare and town planning. A battery of lifestyle changes are presented, all of which index a shift of values and conceptions of identity. Ecotopian lifestyle resembles the hippy movement of the 1960s, while the neo-pagan practice of worshipping of trees, which draws directly from the influence of Lovelock's Gaia hypothesis, illustrates the consolidation of a series of "green" philosophies into an identifiable discourse.

The uneasy balance between the use of technology and a distrust of it, while grounded in fears of mechanisation and depersonalisation, counters the notion of the Ecotopians as atechnological primitivists. They tend to view technology as a support structure to facilitate a "return to the wilderness". The narrator, Weston, notes that the Ecotopian's 'technological austerity' is belied by their extensive use of telecommunications, trains and sophisticated and innovative methods of generating power. This use of technology facilitates the arrangement of a collective life in a decentralised government.[146] The notion of stable state economics, which underlies theories of the sustainability movement, is taken as a blueprint that structures policy making at every level. Reaching

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[145] Werner Christie Mathisen, 'The Underestimation of Politics in Green Utopias: The Description of Politics in Huxley's *Island*, Le Guin's *The Dispossessed*, and Callenbach's *Ecotopia*', *Utopian Studies*, 12.1 (2001), 56-78 (p. 69).

[146] Ernest Callenbach, *Ecotopia: A Novel About Ecology, People and Politics in 1999* (London: Pluto Press, 1978), pp. 38, 68.

the goal of a stable state involves decentralisation processes that, it is believed, will put humanity in a less destructive and exploitative relationship to nature by assisting in maintaining nature's ecological integrity. It is a homeostatic principle that has a corresponding feedback effect on social worlds. Stable states are also central to the notion of terraforming, the ideal of which is to establish a contained self-sustaining system. While Mathisen argues that *Ecotopia* and *The Dispossessed* consistently underestimate the role of politics in green utopias, these works represent an important development of the terraforming narrative in which critical reflection and ambiguity, as exemplified by *The Dispossessed*, and the confluence of egalitarian politics and ecology, are instantiated.

The narratives explored in this chapter track a fundamental transformation to the way in which relationships to the environment and politics are envisioned in sf. Two related types of narrative co-exist and mutually support each other: proto-Gaian narratives and those narratives that continue to develop their enquiry around principles influenced by energy economics. Both types of narrative challenge in various ways the assumptions of the 1950s terraforming boom and extend the character of their ecopolitical enquiry. Oppositional politics rises to the fore as the terraforming motif is used to experiment with alternative lifestyles and forms of government. Such engagement is both abstract, as in McKenna and Le Guin's proto-Gaian stories, and concrete, as in Heinlein and (again) Le Guin's consideration of governmental systems and lifestyles. It is during this period that proto-Gaian and terraforming narratives begin to converge. Sf begins to develop a distinctly "green" discourse, a greening of the terraforming narrative that is exemplified by the Californian ecologism represented by Le Guin and Callenbach, and which would be extended by other writers, notably by Robinson throughout the 1980s-1990s.

5. Edging Toward an Eco-Cosmopolitan Vision in 1980s-1990s Terraforming Narratives

In *Sense of Place and Sense of Planet*, Ursula K. Heise argues for 'the urgency of developing an ideal of "eco-cosmopolitanism," or environmental world citizenship', claiming that it is 'imperative to reorient current U.S. environmentalist discourse, ecocriticism included, toward a more nuanced understanding of how both local cultural and ecological systems are imbricated in global ones'. She considers local, national and global forms of identity that were manifest in the environmental movement since the 1960s and in ecocriticism in the 1990s, tracing the shifting scholarly debate regarding conceptions of the local and global. Heise begins with the concept of globalisation, which rose to prominence in the late 1990s as 'the central term around which theories of current politics, society, and culture in the humanities and social sciences are organized'. Although the parameters of these debates and the poststructuralist critique of essentialist nation-based identities that arose as a result began in the early 1980s and mid-1990s, Heise claims that globalisation is beginning to supersede others in theories of postmodernism and postcolonialism. Theories of hybridity, creolization, *mestizaje*, migration, boderlands, diaspora, nomadism, exile and deterritorialisation provided countermodels to essentialist, nation-based concepts of identity, while in the later 1990s concepts such as "transnationalism" and "critical internationalism", and the resurgence of the concept "cosmopolitanism" in discussions of globalisation began to take priority. She also notes that counter-critiques to globalisation have emphasised 'the value of local and national identities as forms of resistance to some dimensions of globalization', resulting in a theoretical impasse.[1] Against this scholarly background, Heise argues that modern environmentalism has been concerned with issues of the local and global since the movements of the 1960s and 1970s.

Narratives of terraforming have explored concerns that Heise argues are central to an eco-cosmopolitan awareness. Terraforming stories have considered the politics of a globalised world since Wells' *The Shape of Things to Come*.[2] Heise's discussion of deterritorialisation offers a useful theoretical concept for organising the themes explored in earlier chapters of this thesis. As

[1] Ursula K. Heise, *Sense of Place and Sense of Planet: The Environmental Imagination of the Global* (Oxford: Oxford University Press, 2008), pp. 10, 59, 4, 5, 5-6, 6.
[2] H.G. Wells, *The Shape of Things to Come* (London: Corgi, 1967).

terraforming is a process of adaptation and habitation, it too can lead to processes of deterritorialisation. Heise explains that

> The increasing connectedness of societies around the globe entails the emergence of new forms of culture that are no longer anchored in place, in a process that many theorists have referred to as "deterritorialization." Undoubtedly, deterritorialization, especially when it is imposed from outside, is sometimes accompanied by experiences of loss, deprivation, or disenfranchisement […] yet deterritorialzation also implies possibilities for new cultural encounters and a broadening of horizons that welcomed, sometimes without fully acknowledging the entanglements of such cultural unfolding with globalization processes that they otherwise reject.[3]

Sf has portrayed responses to the estranging dynamic underlying deterritorialisation in terms of a reactionary refusal of the radically other or a celebration of the alien that leads to a re-valuation of some aspect of the social, political, cultural or cognitive landscape. Encounters with cosmological nature's otherness, with alien cultures and alternative socio-political arrangements on planets undergoing terraforming, explore processes of deterritorialisation and re-territorialisation in their experiments with the possibilities for developing new attachments to alien landscapes.

Terraforming narratives foreground a range of heterogeneous spaces, connecting them in ways that parallel the dynamic Heise identifies as the use of "collage" or "montage" techniques in literature.[4] Heise's analysis focuses on several works of environmental sf, including Gaian stories such as Ursula K. Le Guin's "Vaster than Empires and More Slow" (1971)[5] and David Brin's *Earth* (1990).[6] She argues that these works 'attempt to develop aesthetic forms that do justice both to the sense that places are inexorably connected to the planet as a whole and to the perception that this wholeness encompasses vast heterogeneities by imagining the global environment as a kind of collage in which all the parts are connected but also lead lives of their own'.[7] The portrayal of spaces associated with the colonising and terraforming project, the pastoral chronotopes of the farm, garden and wilderness, along with other natural spaces such as forests and seas, develop a montage effect akin to this collage technique. Individual chronotopes are often overlaid with multiple landscapes that correspond to alternative perspectives toward nature. Narratives of terraforming build worlds

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[3] Heise, p. 10.
[4] Heise, p. 64.
[5] Ursula K. Le Guin, 'Vaster than Empires and More Slow', in *The Wind's Twelve Quarters* (London: Granada, 1982), II, pp. 25-59.
[6] David Brin, *Earth* (London: Futura, 1990).
[7] Heise, p. 64.

containing various global and local chronotopes, contrasting and connecting them in ways that construct new worlds for negotiating ecopolitical and ecophilosophical issues.

The publication of James Lovelock and Michael Allaby's *The Greening of Mars* (1984) signals the explicit convergence of terraforming and Gaian themes in sf. *The Greening of Mars* shares many stylistic features with Callenbach's *Ecotopia* but focuses on the scientific principles substrating terraforming and on propagandising for interplanetary colonisation.[8] Like Callenbach, both Lovelock and Lynn Margulis, his collaborator on the Gaia hypothesis, wrote for *CoEvolution Quarterly* in the 1970s, a publication launched from the proceeds of the *Whole Earth Catalogue* (*WEC*).[9] It was through publications such as this and his popularising scientific works, beginning with *Gaia* (1979), that the Gaia hypothesis was first introduced to the public.[10] Combining ecotopian speculation with a tradition of hard sf, Lovelock uses the terraforming narrative as a vehicle for popularising his theories about Gaia. *The Greening of Mars* argues that terraforming is not only politically desirable but feasible with the technology of the 1980s, albeit only as a private undertaking. Combining technological methods for terraforming Mars with a model derived from the assumptions of the Gaia hypothesis, the narrator tells of how '[t]he idea of "greening" Mars, rather than "industrializing" it was inherently attractive. It seemed gentler, more 'natural', and it was more natural too, in that the transformation was to be achieved by the activities of living organisms, left to their own devices'. Developing the links between terraforming and Gaia offers romantic subject matter for the exposition of the relationship between science and geopolitics. As the narrator explains, this requires that he 'discuss the nature of life itself, and the ways in which it manifests itself'.[11]

It was at a scientific meeting inspired by *The Greening of Mars* that Robert H. Haynes coined "ecopoiesis" – from the Greek root *oikos* and *poiesis*, meaning creation, production and fabrication,

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[8] Ernest Callenbach, *Ecotopia: A Novel About Ecology, People and Politics in 1999* (London: Pluto Press, 1978).
[9] James Lovelock, *CoEvolution Quarterly* (1979) <http://www.wholeearth.com/issue-electronic-edition.php?iss=2021> [accessed 23 April 2012], 97 and Lynn Margulis, *CoEvolution Quarterly* (1979) <http://www.wholeearth.com/issue-electronic-edition.php?iss=2021> [accessed 23 April 2012], 98.
[10] James Lovelock, *Gaia: A New Look at Life on Earth* (Oxford: Oxford University Press, 1987).
[11] James Lovelock and Michael Allaby, *The Greening of Mars* (New York: St Martin's, 1984), pp. 8, 112-3, 49. Hereafter referred to as *Greening*.

literally "the making of a home" – for this process of planetary adaptation.[12] This term has circulated widely in terraforming stories of the 1990s, appearing in Frederik Pohl's *Mining the Oort* (1992)[13], Kim Stanley Robinson's *Mars*[14] trilogy and NASA scientist Geoffrey A. Landis' short story "Ecopoesis" (1994).[15] *The Greening of Mars* purports to be a subjective account of the history of Mars colonisation, written during the narrator's return to Mars. It is interspersed with lengthy historical and scientific discussion of a range of subjects related to habitation of Mars, which serves to connect political and scientific ideas about migration. The decision to proceed with an ecopoietic model of planetary adaptation is political, as it would allow the colonists to develop economic independence from Earth. As the narrator explains, '[t]here might be industrialists, but they would be martian industrialists – the colonists themselves'.[16] This emphasis on economic and political autonomy is linked to evolution and species survival; the narrator describes Martian independence as an answer to the cultural ossification caused by private companies and colonial governments. Independence promotes flexibility toward changing conditions, a trait essential to the physical evolution of species in periods of environmental change.

The narrator points to an analogy between emigration from Europe and interplanetary migration, noting that in both cases colonists 'cease to be part of the continuing history of their original country or planet'. Nevertheless, the narrator is careful to assert that such analogies are incompatible with the realities of colonising Mars and fails to adequately explain its history. The climax of the narrative involves the narrator's reflection on the diverging histories of Terran and Martian humanity. The purpose of the narrator's visit to Earth is to deliver a scientific report for verification by Terran scientists. This report describes the speciation of the Martian colonists and asserts that 'we Martians now comprise a distinct species within the genus *Homo*'. This divergence from the Terran genetic code literalises the divergence of human history that Mars colonisation

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[12] Robert H. Haynes, "Ethics and Planetary Engineering: 1: Ecce Ecopoiesis: Playing God on Mars", in *Moral Expertise: Studies in Practical and Professional Ethics*, ed. by Don MacNiven (London: Routledge, 1990), pp. 161-183.
[13] Frederik Pohl, *Mining the Oort* (London: HarperCollins, 1993).
[14] Kim Stanley Robinson, *Red Mars* (London: Voyager, 1992; repr. 1996), hereafter referred to as *Red*, *Green Mars* (London: Voyager, 1993; repr. 1996), hereafter referred to as *Green* and *Blue Mars* (London: Voyager, 1996), hereafter referred to as *Blue*.
[15] Geoffrey A. Landis, 'Ecopoesis', in *Worldmakers: SF Adventures in Terraforming*, ed. by Gardner Dozois (New York: St. Martin's Griffin, 2001), pp. 311-341.
[16] *Greening*, p. 114.

entails. A distancing from Earth's history, both culturally and physically, is part of a process of re-territorialisation in which the colonists, under the impact of the 'radically different' Martian environment, struggles to make of Mars a home. Taking evolution as the determining factor for human physical and cultural development, as 'biology, nothing more', this divergence from Earth's history is both a disturbing and challenging phenomenon that carries with it the potential for 'real improvements' that should be welcomed.[17]

Divergence opens up the threat of conflict between human groups. This is complicated by the differences between the elite Martian colonists, those who have inhabited Mars for generations, and newer arrivals who have not adapted to the environment. The narrator raises fears that a new form of racialism may emerge, one that would magnify the dynamic of conflict between cultural and ethnic groups on Earth. Mars' elite 'developed its own customs and, more important, its own aesthetic concepts. Its members felt they had, to a large extent, "built" Mars'. The development of new aesthetic categories that have repercussions for the lifestyles adopted on Mars is a sign that the colonists are developing new relationships to the landscape. The colonists' decision to opt for an ecopoietic model of planetary adaptation in contrast to an industrial mode is reflected by the specific sense in which Mars is seen as having been 'built': 'Mars could have been rebuilt, physically and chemically, as a replica of Earth, rather than being encouraged to develop in its own ways'.[18] *The Greening of Mars* attempts to demystify many of the romantic assumptions embedded in the notion of terraforming as Earth replication, using representations of the physical adaptation of Mars as a way in which to tackle questions of migration and deterritorialisation.

Two works dominate the terraforming megatext of the 1980s-1990s. Pamela Sargent's *Venus*[19] and Robinson's *Mars* trilogies ultimately offer two different responses to the problem of creating a sense of place that allow the colonists of each work to develop new relations to each other and to their environments. In Sargent's trilogy the narrative turns away from Venus and Earth by shifting focus from the development of suitable lived experiences within a dynamic and autonomous

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[17] *Greening*, pp. 114, 16, 142, 154, 160, 163.
[18] *Greening*, pp. 154, 163, 154, 109.
[19] Pamela Sargent, *Venus of Dreams* (London: Bantam, 1989), hereafter referred to as *Dreams*, *Venus of Shadows* (New York: Doubleday, 1988), hereafter referred to as *Shadows* and *Child of Venus* (New York: EOS, 2001), hereafter referred to as *Child*.

planetary environment. In Robinson's, Mars' landscape is instrumental to the colonists' struggle toward a new Martian identity and new relations to Earth.

Sargent and Robinson are influenced by the feminist utopias of the 1970s-1980s; in Sargent's case her *Women of Wonder* series contributed to this discourse.[20] Unlike Sargent (based in New York at the time), Robinson lives in California and is a direct inheritor of the ecological discourse constructed by such works as the *WEC*, Callenbach's *Ecotopia* and Le Guin's oeuvre. Despite the connections that the *WEC* and sf have forged between America's space program and environmentalism, Robinson has noted the perceived incompatibility between these two discourses and explains that he edited the anthology *Future Primitive*[21] as a reaction against this split.[22] For Robinson, sf's environmental engagement possesses utopian dimensions: he explains that the *Mars* books are 'an attempt to take back the [utopian] territory – to show that the future is malleable and up to us'.[23] The rest of this chapter examines the themes that shape Robinson and Sargent's terraforming narratives to consider how they have presented sophisticated engagements with ecopolitical issues that explore the possibility of developing an eco-cosmopolitan awareness. First, however, a discussion of Sargent's 2000 short story "Dream of Venus" illustrates the explicit focus on environmental philosophy and the ramified dialogism of the terraforming narratives of this period.[24]

"Dream of Venus" was published after Robinson's *Mars* trilogy, the last book of which appeared before the completion of Sargent's *Venus* trilogy, despite the fact that the first two instalments of *Venus* predated Robinson's *Red Mars*. Although the critical and popular success of Robinson's work has overshadowed Sargent's, both trilogies engage in a sophisticated ecopolitical critique of society. "Dream of Venus", perhaps in response to Robinson's focus on environmental philosophy, but certainly in response to the burgeoning interest in this area since the 1990s, begins to reflect explicitly on what was implicit in her earlier work: on notions of intrinsic value, environmental

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[20] Pamela Sargent, ed., *Women of Wonder: SF Stories by Women about Women* (London: Penguin, 1978).
[21] Kim Stanley Robinson, ed., *Future Primitive: The New Ecotopias* (New York: Tor, 1997).
[22] Stan Nicholls, 'Kim Stanley Robinson: Says Mars is Making Eyes at Him', in *Wordsmiths of Wonder: Fifty Interviews with Writers of the Fantastic* (London: Orbit, 1993), pp. 218-226 (p. 226).
[23] Paul Buhle, 'Kim Stanley Robinson: Science Fiction Socialist', *Monthly Review: An Independent Socialist Magazine* 54.3/4 (2002), 87-90 (p. 88).
[24] Pamela Sargent, 'Dream of Venus', in *Worldmakers: SF Adventures in Terraforming*, ed. by Gardner Dozois (New York: St. Martin's Griffin, 2001), pp. 394-416.

aesthetics and respect for nature's otherness. The geologist Hassan Petrovich Maksutov is charged with assisting Miriam Lucea-Noyes in creating a mind tour of Venus, a virtual reality entertainment which Donald M. Hassler suggests 'is an echo back to the pulp genre of SF itself'.[25] After three months Venus' administrator, Pavel Gvishiani (who appears in the first two novels of *Venus*), acknowledges the mind tour as a masterpiece but, because of political restraints, request that they censor it: Miriam refuses; Hassan agrees. The Mukhtars on Earth continue to influence the direction of the terraforming project, thus forcing Pavel to dismiss Miriam and let Hassan edit the mind tour to remove its offending sections. Miriam and Hassan part and, years later, after Hassan has furthered his career, Pavel hints that he has preserved and distributed the mind tour amongst the linkers (the social elite), reminding Hassan of the dream he once shared with Miriam.

The device of the mind tour allows Sargent to consider questions of humankind's aesthetic response to nature. Entitled *The Dream of Venus*, the mind tour depicts the natural history of Venus' landscape. Miriam's creative vision and her struggle with the administration's censorship suggest links between artistic creation, terraforming as the creation of new worlds and the instantiation of a civilisation's "dreams". It soon becomes apparent to Hassan that Miriam is a visionary artist whose creation offers an alternative to the orthodox future dreamed by the Mukhtars:

> Somehow she had taken what could have been no more than an impressive visual panorama and had found the beauty in the strange, alien terrain of Venus as it might have been six hundred million years ago. It was as if she had fallen in love with that world, almost as if she regretted its loss.[26]

The sense of beauty that Hassan attributes to Miriam's depiction of Venus rests on its strangeness as an alien nature. Miriam's love for the planet and her efforts to communicate this feeling implicitly criticise the terraforming project, giving her artistic endeavour a political dimension that prompts the administration's suppression of the mind tour. This aesthetic response is at first directed toward a Venus displaced into the past, during a period in which, as some specialists argue, the planet's climate closely resembled Earth's. This oscillation between tendencies to familiarise the planet's alien otherness by appeal to proposed similarities with Earth, and the recognition of the otherness of Venus,

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[25] Donald M. Hassler, 'Ambivalences in the Venus of Pamela Sargent', *Extrapolation* 38.2 (1997), 150-156 (155).
[26] 'Dream of Venus', p. 405.

gives *The Dream of Venus* its creative dynamic, allowing Miriam to shape Venus' history into 'a moving evocation of a planet's life, a depiction of a truly alien beauty'.[27]

This visionary love of otherness is politically destabilising for its implicit criticism of the Mukhtars' terraforming of Venus. Their initial desire for a propagandistic work to encourage faith in the project on both Earth and Venus admits a contesting voice that speaks on behalf of nature's otherness. Shamed both by Pavel's hint that he has distributed the mind tour in opposition to the Council of Mukhtars and his own betrayal of Miriam's love, Hassan experiences an epiphany regarding the fraught nature of political dialogue:

> the authentic dream, after all, was still alive. Dreams had clashed, he knew, and only one would prevail. But how would it win out? It would be the victory of one idea, as expressed in the final outcome of the Project, overlaid upon opposed realities that could not be wished away. To his surprise, these thoughts filled him with a calm, deep pleasure he had rarely felt in his life, and *The Dream of Venus* was alive again inside him for one brief moment of joy before he let it go.[28]

Hassan's lesser vision is Bakhtinian; he sees his contribution to the project as a small part of a still unresolved work, admitting the possibility that the dream he has turned his back on could still be realised. Latent voices underlie dominant ideologies, suggesting the possibility of their actualisation. Politics is seen as conflict, a clash between incompatible dreams that, because 'overlaid upon opposed realities', are always defined by their opposition. This view is utopian, emphasising the unreality of the future and the work involved in its construction, which is first given shape by a vision of one future against others. Hassan, buoyed by joy and hope, turns away from what he feels is 'the authentic dream', thus highlighting the difficulty of raising support for marginalised positions. The current political reality, however, is still in flux and unresolved, pointing toward a future of hope that the *Venus* trilogy explores.

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[27] 'Dream of Venus', p. 407.
[28] 'Dream of Venus', p. 416.

5.1 Building Critical Spaces: Pamela Sargent's *Venus* and Kim Stanley Robinson's *Mars* Trilogies

Comparing Sargent's *Venus* and Robinson's *Mars* trilogies highlight several inversions of space and time: Venus and Mars offer two distinctly different settings against which society is portrayed, which is complemented by the alternative forms of temporal displacement that each trilogy imagines. *Venus* is set in Earth's far future. The first planetary adaptations of Venus are located in a legendary past that acts as background for the trilogy's portrayal of a vast engineering project conceived, for reasons of political control, to occupy the imaginative horizons of Earth's global society. Earth's Islamic government grew from a society that achieved political dominance after the Resource Wars devastated the planet. Its administration is divided into regional Nomarchies presided over by "Mukhtars" (from Arabic *iktara* meaning 'to select, choose'), elites elected by a council that occupies itself with political intrigue and fears of revolt by a disaffected populace.[29] The Mukhtars use the terraforming project as a way to deflect desire toward a grand social endeavour, 'a new dream, one that would inspire Earth's people' or, as it is suggested, one that would defuse dissension that, unchecked, might threaten the Mukhtars' political dominance.[30] Terraforming operates as a way to legitimise and maintain the Mukhtars' rule by providing society an outlet for directing their frustrations and energies, emotions rooted in the global society's rigid social stratification and collective desires.

Venus' extremely unforgiving physical characteristics present significant practical difficulties for the terraforming project, despite various technologies that allow the Nomarchies to manage Earth's climate. The terraforming project on Venus was instituted six centuries ago shortly after the cessation of the Resource Wars by the legendary Mukhtar Karim al-Anwar, who by all accounts 'saw people who needed a new dream, a goal that might lift them to greater endeavors that would rival the accomplishments of the Associated Habitats and their people, who had abandoned Earth'.[31]

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[29] 'Mukhtar', in *Online OED*, 3rd edn <http://www.oed.com.ezproxy.liv.ac.uk/view/Entry/123395> [accessed 28 August 2012].
[30] *Child* (New York: HarperCollins, 2001), p. x.
[31] *Shadows* (New York: Doubleday, 1988), p. 11.

Terraforming Venus is made possible only by the Muhktars' reliance on the aid of the comparatively advanced "Habbers", humans who permanently reside in habitats in space. Reliance on a group that had historically rejected the Nomarchies, and who subsequently function as the object of their propaganda, compromises the technological supremacy that legitimises the Mukhtars' rule. Because the terraforming project is intended to operate as a monument to the Mukhtars' supremacy, the Habbers' aid necessitates (from the Mukhtars' point of view) a continued campaign of prejudice and disavowal. The Habbers, for their part, are the 'descendants of those Earthfolk who had abandoned a planet that they saw as a worn-out husk, who fled from the aftermath of the Resource Wars into space instead of staying to rebuild their damaged Earth'.[32] Sargent thus calls these figures 'cyberutopians rather than cyberpunks'.[33] They reject terraforming and planetary habitation on moral grounds and because of a complex and more diffuse association of political and imaginative constraint with the bounded nature of planets in contrast to the limitless (horizonless) reaches and purity associated with the chronotopicity of space.

Robinson's *Mars* trilogy locates Mars terraformation in the near future, in the politico-economic context of an Earth that closely resembles contemporary social relations. Mars' comparative hospitability makes it a more likely candidate than Venus for near future terraforming, which chronotope offers a significant narrative contrast to the complex of socio-political and economic factors constructed in *Venus*. Significantly, Sargent denies the narrative potential that terraforming Mars offers by having the Habbers claim it in the historical past of the *Venus* trilogy as a site of preservation against the human modification of its natural planetary environment. This preservation theme echoes Ann Clayborne's argument for the preservation of Mars' natural (autonomous) environment in *Mars*. Clayborne's position coheres around the chromatic symbolism of "Red" for a distinctly Martian ecosphere, in contrast to the "Greens" who wish to terraform Mars by introducing adapted strains of Earthbound life into its environment. The *Mars* trilogy incorporates overt environmental ethical reflection and brings this to bear against the industrial exploitation of Mars by multinationals that see it as a resource offering raw materials and a space for capitalist investment and

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[32] *Child*, p. x.
[33] Jill Engel, 'Letters from Upstate New York: A Correspondence with Pamela Sargent', in *Nova Express* 3.3 (1991), 5-9, 19-24 (21).

development. In the *Mars* trilogy Earth is forced to respond to the negative effects of global climate change, not from a national perspective, but from a correspondingly global one, as the effects of catastrophic ecological disaster impact upon all of the planet's population. The pastoral collectives that Bakhtin identifies are represented as nested collections of spaces, often associated with contesting positions that are developed throughout the narrative. For example the chronotope of the interplanetary mine in the *Mars* trilogy is connected to debates regarding the preservation of alien planets as wilderness areas, idylls in which the socio-political struggles of humanity have not yet made an impact. The growing politico-economic primacy of multinationals throughout the trilogy contrasts with the initial nationalist interest in terraforming: the colonists known as the First Hundred, although ethnically diverse, represent the joint – and paranoid – agendas of America and Russia. Later colonists from China, Japan, Switzerland and other countries, as well as various Arabic groups who derive their identity from religio-cultural sources (Bedouin, Sufi) emigrate to Mars, introducing further nationalistic and cultural considerations to the terraforming of Mars.

This general outline serves to delineate a range of themes that are central to these extended considerations of terraforming. The sf tradition of terraforming is evidence of centripetal forces that channel the early treatment of this motif along certain trajectories; as the tradition coheres, it incorporates and generates other themes and plot elements, combining them with other sf tropes while further developing influences that have fed into early treatments of the motif. Hence, histories of colonialism linked to the theme of space colonisation frames the terraforming motif (engineering other planets into new Earths); these new Earths are often imagined as a garden (pastoral), a mode that has been re-voiced through the influence of Gaia theory's model of planetary ecologies. As becomes apparent, the motif is heavily ramified and subject to centrifugal forces that make it capable of considerable reformulation. The presentation of worlds as global chronotopes raises the question of the nature and efficacy of a global sense of place in these texts, and is complemented by a local and regional representation of space as constituents of this global chronotope. These nested spaces complicate the universalisation operative at the level of the global.

Central to both trilogies is a focus on science and technology and their political and ethical implications. Terraforming, as the Mukhtars' dependence on the Habbers indicates, involves the

application of technologically sophisticated engineering principles, which suggest the dominance of a specific ethico-political orientation underlying conceptions of space. Technology (as applied science) is inseparable from value judgements and ethics; the technological adaptation of planets is tied to political factors that dictate their particular relations to space. This relationship changes as views toward and about science and technology change, resulting in a literature that, by the time of Sargent and Robinson's trilogies, consciously reflects on the range of explorations of the social repercussions of science already pioneered by earlier works. This is a consequence of one of the formal features of the terraforming narrative: the intratextual juxtaposition of planets, and the range of intertexual spaces developed by the terraforming tradition, is mirrored by a range of politicised spaces or metaphorical worlds (exemplified by the *Mars* trilogy). Bracketing out for the moment a detailed examination of the lines of enquiry raised above as they appear throughout the terraforming tradition, this chapter first considers specific spaces in Sargent and Robinson's trilogies in order to develop the claim that they represent two significantly different treatments of terraforming, despite sharing fundamental similarities that underlie attitudes toward planetary adaptation and their socio-political and enviro-ethical implications.

5.2 Domes on Mars and Venus: Chronotopes of Enclosure in Terraforming Narratives

As the adaptation of alien planets often requires some protection from hostile environments, domes have been a prominent feature of sf narratives of terraforming and colonisation. Gary K. Wolfe considers domes in the context of images of the confined city. When considering the city as unnatural, he raises the suggestion that

> Science fiction is hardly the genre we would look to for nature worship; and indeed there are numerous works in the genre that apparently condone such wholesale subjugations of nature as "terraforming," or the engineering of alien planets for the comfort of man. But even the expansionist motif of the genre can be seen as having its roots in an awareness of the finite resources of any limited environment, and the arbitrary growth of any

> institution at the expense of the natural world – as opposed to the purposeful expansion *into* the natural world – is viewed with scepticism.[34]

Robinson's 1990s *Mars* trilogy and the popular success of Hollywood sf film *Avatar* (2009)[35] may go some way to addressing this perceived absence of 'nature worship' in sf, but as this thesis has so far shown, terraforming stories have not confined their ecocritical engagement to an ecological awareness of the finiteness of Earth's resources, as exemplified by the energy economics of Heinlein's *The Moon is a Harsh Mistress* (1966) [36], but has explored the connections between wider socio-political and environmental philosophical themes. Nevertheless, Wolfe's suggestion that recognition of the finitude of Earth's resources motivates expansionism in sf perhaps offers a broader ground for environmental reflection on the connections between the ecosystem of artificial environments and natural, planetary ecosystems. The use of domes to explore the social dimension of terraforming draws on early representations of the city as dystopian, such as in Wells' "When The Sleeper Wakes" (1899)[37] and Fritz Lang's *Metropolis* (1929).[38] Yevgeny Zamyatin's *We* (1929) uses a dome-like contrivance – a glass city – as a setting for the portrayal of the public scrutiny and regimentation of all spheres of the individual's life by a repressive socialist government.[39] Such images appear in Anderson's "The Big Rain"[40] and *The Snows of Ganymede*,[41] among other texts. In this context the chronotope of the city often functions as a literalised metaphor for the ideological values of its nationalist government and a site for the clash between opposing visions of future social arrangements.

In *Venus of Shadows*, the historian Malik suggests that domes 'are a kind of experiment, since the terraforming of Venus could have gone on without them', and on other occasions he refers to them as a type of social experiment.[42] Although often imagined as an essential element of the terraforming

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[34] Gary K. Wolfe, *The Known and the Unknown: The Icons of Science Fiction* (Kent: Kent State University Press, 1979), p. 90.
[35] *Avatar*, dir. by James Cameron (Twentieth Century Fox, 2009).
[36] Robert A. Heinlein, *The Moon is a Harsh Mistress* (London: Gollancz, 2001).
[37] H.G. Wells, 'When the Sleeper Wakes', *Project Gutenberg* (2008) <http://www.gutenberg.org/files/775/775-h/775-h.htm> [accessed 13 April 2012].
[38] *Metropolis*, dir. by Fritz Lang (Eureka Video, 1997).
[39] Yevgeny Zamyatin, *We*, trans. by Clarence Brown (London: Penguin, 1993).
[40] Poul Anderson, 'The Big Rain', in *Worldmakers: SF Adventures in Terraforming*, ed. by Gardner Dozois (New York: St. Martin's Griffin, 2001), pp. 1-49.
[41] Poul Anderson, *The Snows of Ganymede* (New York: Ace, 1958).
[42] *Shadows*, pp. 107, 261.

project, their importance lies in certain resemblances between planets that are conceived as uncontained biospheres and the contained biosphere of the dome.[43] Domes, as miniature worlds, shield the colonies in *Venus* from a planet that sets strict physical limits to terraforming and habitation. These limits metaphorically and literally correspond to political limits established by the Mukhtars:

> The people of the Project imagined a world free of Earth's constrictions, a world where, instead of displacing other forms of life, people would be creating life from lifelessness. But the domes would shut the settlers away from the dangerous world outside; the first Cytherians would be prisoners.[44]

These political limits are imagined as a form of displacement of life, while the terraforming project as a whole becomes a symbol for the renunciation of a political status quo confined to Earth. Domes, however, are ambivalently imagined as both spaces for developing a specifically Cytherian (Venusian) culture and community, and as prison cities designed to curtail cultural and political deviation from Earth's governmental system. A similar ambivalence is present in *Mars*: at the end of *Red Mars* a Martian revolution for independence from Earth is suppressed by the strategic destruction of domes controlled by the revolutionaries, resulting in many casualties. The fragility of the domes and their status as containers that set physical, political and socio-cultural limits on the colonists illustrate the correspondence between physical and metaphorical space while figuring an anxiety at the heart of civilisation's technological capacity to shape new worlds through an application of science directed by political agendas.

These domes are, at one level, a way to analyse the alien environment from a physically detached and separated "objective" position. Yet they also shut that alien environment out, excluding it from the colonists' physically experienced sense of place (which is a good thing, considering Venus' fierce inhospitality). At once protective, it narrows their imaginative horizons and turns the social experiment inward, toward the exploration of social crises. In *Venus of Shadows*, the domes become metaphorical crucibles where a repressive ecotheist cult rises to social dominance and

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[43] Martyn, J. Fogg, *Terraforming: Engineering Planetary Environments* (Warrendale, PA: Society of Automotive Engineers, 1995), pp. 37-86.
[44] *Dreams*, p. 403.

suppresses the population. These crises arise as a consequence of Earth's attempt to explore the limits of the human:

> The domes seemed nothing more than a vast laboratory in which to test various subjects, to discover if people would willingly become prisoners of the dream of terraforming, to find out if human beings could transform other worlds without losing their ties to the old or shedding their humanity, as it appeared the Habbers might.[45]

The problem of developing a new culture on Venus is magnified when the otherness of the environment is excluded. This problem manifests as a failure of re-territorialisation, of developing a culture and identity that can allow the colonists to connect with their current local and global context while also providing a space for recognising their status within a system of interplanetary relationships. Instead, the experiment is directed toward Earth's continued control over the settlements, which suggests a refusal to respond in new ways to the deterritorialisation that colonisation entails.

Against the social pressures that develop on Venus, the appearance of life on its surface operates as an emblem for the limits of political control and for a re-territorialisation of Venus. In the final novel, *Child of Venus*, several of the colonists notice something new and unexpected growing from the genetically engineered moss colonising Venus' surface outside the domes:

> it's life, and it's something we didn't plan for. We didn't plant it there ourselves, and none of our computer models, including the ones that allowed for possible contamination of our equipment, predicted that anything like it would grow from that moss.[46]

These computer models open up spaces that signal a new global context in which the scientifically informed awareness of the physical nature of Venus is emphasised. This is connected to the metaphorical implications of Iris' specialist subject, climatology, which offers a challenge to social stasis. For Iris, her early study of the terraforming project nurtures 'a sense of how much a tiny, seemingly insignificant event could alter a great deal; at the same time, it made her conscious of how much still lay outside humanity's control'.[47] This insight draws from the mathematics of chaos theory, a theme central to other ecologically focused terraforming stories such as Frank Herbert's 1965

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[45] *Shadows*, p. 185.
[46] *Child*, p. 305.
[47] *Dreams*, p. 89.

Dune[48] and Frederick Turner's 1988 epic poem, *Genesis*.[49] Fractal self-similarity at multiple scales is a feature of chaos theory and is linked to terraforming via computer modelling, which uses chaos mathematics to simulate models of environments for testing. The emblem of the unexpected growth of plant life on Venus introduces a new landscape, one that underscores how the predictive capacities of modelling fail to account fully for nature's otherness.

This challenge to the colonists' expectations, to their view of nature, is accompanied by a literal challenge to social repression embodied by the Habbers, a genetically engineered, divergent and "alien" human group who reject Earth's politics, government, and history, along with the planetary chauvinism of terraforming and colonising worlds. The terraforming project on Venus is an interface between two cultures that 'evolve unpredictably', mirroring the example of the unanticipated growth of plant life amongst the engineered moss outside the dome. The relationship between Earth and the Habbers is figured via a biological metaphor: '[e]ach culture was a cell, with Venus as the membrane through which molecules from each cell could pass. Without such an exchange, the cells would die'. Some of the Habbers recognise the necessity of interchange between themselves and Earth, fearing that they 'would lose that contact with a young, striving culture and become more insular [while] Cytherians, dreaming of their future world while trapped behind their domes, might turn on one another again; the cauldron could boil over once more'.[50] The Habbers' unwillingness to completely break away from Earth and Venus suggests a lack accompanying their rejection of planetary nature and the type of communities that might develop in these spaces.

Wolfe's discussion of artificial worlds as one of sf's important devices can be usefully compared to Sargent's use of the dome. In *Venus*, connections are made between the "Island" space stations in Venus' atmosphere, the later development of domes on Venus' surface, the space station Anwara, designed and built solely by Earth's technicians, and the Habbers' artificial worlds. The dome's surface can be read in terms of Wolfe's icon of the barrier, which shields the colonists from the unknown of the Venusian environment. Wolfe's claim that 'in many stories the barriers are simply temporary blocks to humanity's inevitable conquest of the cosmos' is certainly relevant here, as the

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[48] Frank Herbert, *Dune* (Kent: New English Library, 1968; repr. 1983).
[49] Frederick Turner, *Genesis: An Epic Poem* (Dallas: Saybrook, 1988).
[50] *Shadows*, pp. 37, 324, 514.

Islands and domes are intermediary spaces leading toward unrestricted habitation of the planet's surface.[51] The Islands, designed to settle on Venus' surface as new domed settlements at certain stages of the project, embody this idea of a series of barriers. There are also important differences between these devices, however: Mahala in *Child of Venus*, 'felt far more vulnerable here [on Anwara] than behind the transparent dome of a settlement or an Island', a feeling she attributes to a complex of factors including, controversially, 'more faith in the Habber technology that had created the ceramic-metallic alloy of the dome material' of the Islands and settlements.[52] The Habbers' mobile artificial worlds, in contrast to the rooted domes, overcome other significant barriers, having historically carried its inhabitants away from a devastated Earth and into space. There is an ethical component to their refusal to inhabit planets, expressed by the Habbers' belief that '[t]o make use of some planetary resources was acceptable; to alter a world completely was unnecessary and undesirable'. They are a society on the cusp of crossing a barrier that would definitively separate them from their planetbound roots, and yet they invest in terraforming Venus: '[t]he Project provided the Habbers with their only direct contact between themselves and the people of Earth; it was their last link with the rest of humanity'.[53]

Part three of *Red Mars* ("The Crucible") and six of *Venus of Shadows* ("The Cauldron") use metaphors of a vessel to signal the transformative aspect of the device of the dome on its contained community, foregrounding themes of social conflict, experimentation and integration. The problems that arise when working toward this potential synthesis forms the most significant barrier in Sargent and Robinson's terraforming narratives, and it is the potential for this social synthesis that encourages the Habbers' continued investment in Earth's grand engineering endeavour. The dome provides a space to explore the goal of forming new cultures from a synthesis of multiple groups with different and often opposed agendas, and this is extended to the planet as a whole. In *Venus of Shadows*, one of the children born on Venus tells of his father's description of Earth's sky as 'sometimes like this huge kettle over the Earth', to which his friend Teo replies '[t]hat makes it sound like a dome'.[54] The

[51] Wolfe, pp. 28-29, 34.
[52] *Child*, p. 211.
[53] *Shadows*, p. 37.
[54] *Shadows*, p. 306.

relation between planets and domes is echoed more frequently in *Blue Mars*, where the relatively gentler Martian climate allows the colonists to walk upon the planet's surface. Unlike the domes in *Venus*, which completely cut the colonists off from a physical relationship to their environment, Mars in the *Mars* trilogy, with its clouds 'defining the dark dome of sky above them', differs to the degree in which it incorporates nature and a plurality of landscapes within its global conception of space.[55]

Robinson uses the physical relationship between the planet and the colonists to engage in a sophisticated enviro-ethical critique. Nevertheless, even when specific environmental ethical discourse plays little part in texts prior to this period, environmental enquiry has been a longstanding feature of many terraforming narratives. The emphasis Robinson places on the landscape as an environment that provides some of the colonists with a deep personal connection to Mars help illuminate one dimension of the Habbers' investment in terraforming. Drawing on pastoral chronotopes of the garden, the Habbers' space habitat is described as 'a world of wide corridors, simple rooms, and a garden of forests, lakeshores, hills and plains at its center that seemed meant to be a monument to Earth'.[56] Their artificial reproduction of a contained biosphere can then be read as an attempt to retain a connection to "nature" and to Earth's planetary spaces, since such biospheres need not replicate Earth's ecology. The Habbers' reluctance to sever themselves entirely from planetbound nature can be seen as a response to a deterritorialisation that threatens to disconnect the Habbers from an interplanetary sense of community.

The distinctiveness of the terraforming motif is to some degree founded on its propensity to create spaces in which the confluence of the three domains of politics, science and environmental enquiry is explored in the context of worldbuilding itself. Terrafoming is a metaphor for the practice of building sf worlds as much as it is a textual space for experiments in engineering societies. Nirgal, as one of the Mars born who visits Earth, says in a speech in *Blue Mars* that

> we have to help each other. We have to regulate ourselves, we have to take care of the land. And it's here, in this part of the project, that Mars can help Earth. First, we are an experiment in taking care of the land. Everyone learns from that, and some lessons can be applied here.[57]

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[55] *Blue*, p. 193.
[56] *Child*, p. 39.
[57] *Blue*, p. 197.

By experimenting with new relations on Mars and by making use of insights that are derived from environmentally inflected experiences of new social and physical relations to others and to the land, the *Mars* and *Venus* trilogies use terraforming to explore barriers to habitation; the making of homes in a universe that humanity is alienated from. The habitats in the *Venus* trilogy, chronotopes that symbolise escape from Earth's restraints, are metonymies for a culture that has alienated itself from environments that offer spaces to experiment with and create new ways of 'taking care of the land' and of each other. Terraforming is distinctive, then, for its synthesising tendency; it is a motif that gives play to an abundance of social and environmental parameters for transformation.

5.3 Pastoral Elements in Pamela Sargent's *Venus* Trilogy

The *Venus* trilogy uses a mixture of Bakhtin's pure types of idyll and employs the chronotope of the farm and garden to characterise the terraforming of Venus. Images of both have been used in prior texts to embed value into their representations of spatial adaptation. Speaking first of the chronotope of the garden, *Venus of Dreams* uses the practice of science as one element of the craft-work idyll. Sargent combines Carl Sagan's 1973 proposal[58] for seeding life on Venus with algae to a pastoral garden image: '[l]ife was in the dark clouds, where the strands of algae still fed on the poisons. There, humanity's microscopic garden had taken root in the stormy atmosphere'.[59] This ecopoietic image promises a burgeoning onto other spatial levels of the garden chronotope and is paralleled by a cultural mirror of the garden that draws on metaphorical applications of the scientific notion of 'the built-in amplification of biological replication'.[60] This "amplification" can be metaphorically applied to the domes, which mirror Earth's social relations and function as experimental spaces for the development of new communities. The domes, by metaphorically turning the colonists' gaze inward, amplify Earth's moral landscapes and social values. The Habbers' gardens, and the gardens of the domes and the Islands, differ in a number of ways, but the chronotope of the garden within the

[58] Carl Sagan, 'Planetary Engineering on Mars', *Icarus*, 20 (1973), 513-514.
[59] *Dreams*, p. 366.
[60] 'Planetary Engineering on Mars', p. 513.

artificial world points to a fundamental anxiety rooted in an alienation from the environment and an ensuing amplification of social conflict.

In *Child of Venus*, the narrative's focus on terraforming is supplanted by the discovery of an alien signal from deep space. Earth and the Associated Habitats agree to construct the "Seeker", a space habitat designed to carry a joint crew of Cytherians, Earthfolk and Habbers to the signal to establish first contact. Because of the distances involved in this journey, the crew will ultimately be isolated from their familiar time by over a millennium, leading the Cytherians and Earthfolk to accept life extending treatments from the Habbers in order to survive the mission. Their return to Earth's solar system therefore represents a vast period of temporal deterritorialisation. This myth of sf, of first contact between alien civilisations, is deflated when the signal is discovered in a lifeless solar system and, falling silent, affirms the banal: that 'humankind knew of this alien intelligence without being able to reach out to it'.[61]

This variant of the space exploration theme embeds another experimental space within the terraforming narrative with which to explore the overcoming of boundaries between the Cytherians, Earthfolk and Habbers. The failure of contact is a deeply ironic plot development that underscores the importance of making homes, in contrast to the exploration of deep space. The structural advantage of this plot development for representations of terraforming lies in its compression of the project's timescale, thus allowing the explorers to return to a fully transformed Venus and to experience it from their now alien perspective. The apprehension that the explorers feel regarding the now unknown conditions of the human inhabited solar system leads the protagonist Mahala to think that 'they had even more of an obligation to build a true human community aboard the Seeker'. This realignment toward constructing a 'true community' takes place in a pastoral space: '[t]he core of the Seeker was made into one of the gardened environments so beloved of the Habitat-dwellers, a very gently curved landscape of rivers and forests and open grassy land'. Although this artificial world mirrors that of the domes and of Venus and Earth itself, it differs in the degree of its separation from humankind's history and continuing influence. The six hundred light year distance between the solar system and the alien signal imbues the chronotope of the Seeker with a temporal and spatial isolation that contrasts

[61] *Child*, p. 418.

with the domes above, which are connected to others in a network of communities. This space offers a pastoral separation from the complexities of globalised politics on Earth and Venus. However, the Habbers and colonists depend on a connection to planetary space in order to develop their sense of being at home: 'such places embued them with a feeling that they had not lost their humanity and their natural past entirely, while for the Earth-people aboard the Seeker, the landscape would function as a reminder of home. Mahala, who had lived her life in the environments of Venus's domed settlements, thought of the core as a monumental and ecologically complex version of a garden or a park'.[62] The Seeker is a landscape subject to polyphonic interpretation and a space that consciously symbolises the sedimented voices of culture and their interpretations of nature.

The chronotope of the Seeker exemplifies another use of the Habitat to reflect on what Bakhtin identifies as the first distinctive trait of the pastoral: the portrayal of a community and their connection to their environment. In contrast to the cultivated landscapes of the contained biosphere of the Seeker, the wild nature of the terraformed Venus that they return to highlights the sense that the pastoral spaces of the domes and habitats are somehow insufficient for supporting the colonists' growing attachment to their environment and community. "Home", the final section of the trilogy, connects the pastoral to the theme of making a home, but continues to embed the idyll within the sf framework to offer an alienated perspective on the familiar nature of the solar system. Mahala is aware that '[s]he and the others with the Seeker were outside of their history, and it might now be impossible for them to rejoin it'.[63] The sense of a coherent community identity is thus in part a function of a group's participation in history, a notion that Lovelock touches on in the concluding chapters of *The Greening of Mars*. Memory becomes central to building this sense of community; terraforming in this context serves to obliterate this sense of history. Echoing Lovelock's discussion of speciation, the returning explorers encounter humans so fundamentally divorced from what they consider human as to constitute a different species. The history of these posthumans is sealed behind an impenetrable temporal barrier and any possibility of communication leads only to ambiguity. Once

[62] *Child*, pp. 425, 397, 398.
[63] *Child*, p. 431.

again, interchange between two alien cultures is denied, although the posthumans are content to allow the explorers to settle on the terraformed Venus.

The portrayal of communities in the *Venus* trilogy is tied to Bakhtin's family idyll through the texts' focus on new generations. Mahala links terraforming to this pastoral theme when reflecting that '[t]he instincts that had given [Mahala her] daughter, that had given that genetic tie to the past, had also given birth to this world'. The theme of new generations that concludes each novel connects the family idyll to terraforming through a shared temporal orientation rooted in anticipation of the future. The long term terraforming of Venus is a project that, at its ideal, is directed toward the future and humankind's descendants, a gift that 'so many of [the explorers'] ancestors had labored to create'. Mahala's child Angharad, named after her ancestor in *Venus of Dreams*, gestates ectogenically during the return home, and belongs to this new generation whose separation from Earth's history makes them fundamentally different to the other explorers. Her experience of a now deserted yet habitable Venus, spotted by the remains of the domes and the single memorial pillar commemorating her ancestor Iris, is not preceded by fear or apprehension, as in the case of her parents, but 'with wonder and curiosity'.[64] History begins again; it is as if the utopian promise could not be fulfilled without a journey that would join the Cytherians, Earthfolk and Habbers in a space divorced from the corrupting influence of the wider interplanetary community. Physical terraforming parallels social terraforming, which is made possible through two other grand social endeavours, deep space travel in artificial worlds and the discovery of alien life.

While the narrative chooses to diverge from portrayals of terraforming and the act of building new communities on Venus, *Child of Venus* uses a deflationary strategy toward common sf tropes to help underscore the wonder with which the new generation approaches Venus and the construction of a new planetbound community. Recapitulating another prevalent trope of sf, Benzi reflects on the consolatory urge to parenthood as an expression of larger biological workings: '[l]ife always finds a way […]. That was certainly one of the assumptions behind the terraforming of Venus, wasn't it? Give life an opening, a chance, and …'.[65] Although the trilogy ultimately turns away from the process

[64] *Child*, pp. 445, 445, 430.
[65] *Child*, p. 428.

of worldbuilding as a community activity, it ends with the explorers ready to take up the project with the knowledge that other alternatives lead back to the community and their environment.

Venus of Dreams begins in Lincoln, the farming village where Iris' mother Angharad plays an important role as representative of the village's values and traditions. As one of many Plains villages, this community provides food for Earth's population. The Plainspeople take pride in this role, with Angharad explaining that 'we're just about the most important people in the world, aren't we? We feed most of it, and it's our tongue people of different lands use to speak to each other'.[66] The centrality of the farms to the global civilisation is linked to the widespread use of the Plainspeoples' language and contextualises the shape of this society's history. There exists a discontinuity between the image of a space contemporaneous to the reader and the events of the trilogy, a historical period where resources were fought for between nations and where the language Angharad refers to, "Anglaic", developed wide usage before the New Islamic States eventually emerged and secured worldwide dominance. Anglaic has left its traces, along with its political implications, upon the text's cultural topography, from which a constructed historical continuity to a time contemporary to the reader can be inferred. This is important for terraforming narratives and for the agricultural pastoral as it impacts upon the motive and social function for engaging in the complex process of terraforming. The farm, seen as a space for the production of resources, is both metaphorically and literally represented within a frame that emphasises the transformation of culture over time.

The Plainswomen connect agricultural space to generational time by conjoining their farming culture to an unbroken matriarchal line. The importance of seasonal cycles and the labour that this entails, along with cycles of generational time, subordinates a linear time represented by a matriarchy in which daughters assume their heritage when their family farm is passed to them. This ties the family to the landscape in a continuing cycle that is threatened by Iris' wanderlust, which she directs toward Venus. Hassler argues that while the Habbers embody a utopian future, notions of lineage and heritage are 'complemented by a sense of mission back to the fragile Earth environment. What the settlers learn from terraforming Venus can be used to avert further ecologic damage on Earth'.[67] Iris'

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[66] *Dreams*, p. 26.
[67] Hassler, p. 154.

wanderlust disrupts this attachment to the local, recapitulating the pastoral's traditional motif of the idyll disrupted by technological intrusion, but it also introduces a new conception of a global, interplanetary space that relates uneasily to the Plainspeople's sense of inherited place. As a child Iris cannot conceive of departing from the farm and the Plains. She demonstrates a conservative response when she considers her Grandmother Julia's talk of Venus and imagines a static future where '[t]he boys would wander the Plains and the girls would stay in Lincoln and farm, as her family had always done'. Angharad, like the other Plains families, is acutely conscious of the continuity of their ancestry, which is 'preserved not only in Angharad's memory but also in the memory banks of the cyberminds that served Lincoln'.[68] Sf's use of the pastoral, even when the country is represented, is interpenetrated with items associated with the city: 'cyberminds' are the artificial intelligences that operate as the Nomarchies' information management technology, while the farm's role in supplying the global population with food has already been considered.

Angharad's failure to prevent Iris from leaving Lincoln to pursue her scientific studies demonstrates this vital link between the space of the farm and the generational cycle. The link between generations and the local landscape comes into conflict with Iris' awareness of a space outside the local. The idyll of the agricultural pastoral is confronted with the growth of a new conception of space that implies freedom, large-scale achievement and grandeur, all of which are accompanied, in Angharad's view, by 'the misery and regret that were sure to come to [Iris] if she did not do her part for the farm and her line'. Iris confronts her mother with an alternative vision that accounts for her disruption of this cycle, arguing that '[a] grandson of yours might take a branch of our family line to another world'.[69] The divergence of her family line and the pride that Iris' achievements bring to her Earthbound family impacts upon her descendants: Harriett Teresas informs her cousin Mahala (Iris' great-great-grandaughter) of the greater worth that knowledge unrelated to agriculture is accorded within their earthbound family.[70] The process of reconciling the divided family branches occurs in a section called "The Garden", thus establishing a series of links between the two central pastoral chronotopes of the garden and farm, and the generational, family idyll. Joined to the

[68] *Dreams*, p. 4.
[69] *Dreams*, pp. 154, 155.
[70] *Child*, p. 297.

successes of spatial adaptation that the terraforming project has wrought, changes of behaviour for those on Earth have also reverberated from the decisions and actions of those involved in the project. This cultural change arises in the interstitial space created by the tension between time as cyclical and stable and time as linear and subject to historical change, thus showing how the pastoral reconciles these apparently contradictory temporal views:

> Teresa also encouraged my lessons because she saw that a time might come when I'd have to know more than how to run a farm. 'Things can change,' she always said. 'They've been the same for a long time now, maybe for too long.' And as it turned out, she was right.[71]

This response to the evidence of inevitable change to Earth's global society does not end by retreating into the idyll of the idealised, sublimated pastoral, but leads to a flexibility to adapt to new social conditions initiated from a space beyond the local. The stasis fundamental to the survival of the global population after the Resource Wars is now a restraining social enclosure. By following Iris' lead as the first pioneer of change in the family, the succeeding generations respond to the demands brought about by shifting societal needs at the global level, both internally and in connection with the repercussions of the terraforming project.

Iris links terraforming to farming and the garden when reflecting that '[m]aking grain grow on the Plains was little compared to seeing a world bloom under one's hands'.[72] Again, the desire for a magnification of achievement is sustained through an implicit depreciation of the local on Earth. The verb 'making' emphasises the work involved in farming on Earth whereas the verb 'seeing' emphasises an almost passive perceptual act that downplays the labour involved in terraforming Venus, thus idealising the project. The nature of the activity also shifts from agriculture, a resource focused form of cultivation, to gardening, a form of cultivation associated in functional terms with leisure. This metaphor captures the shift of value from the sf use of the agricultural pastoral to the garden pastoral. Earth is envisaged as a space requiring constant resource management. The scarcity of resources provides one of the most powerful motives for terraforming other planets; visions of the garden pastoral on Venus elide the stark economic challenges involved in terraformation.

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[71] *Child*, p. 297.
[72] *Shadows*, p. 13.

When Iris has matured and is living on the Islands she thinks of the connection between farming and terraforming explicitly:

> Terraforming, in its own way, was an extension of farming, a way of forcing a world to yield to the needs of human beings. Venus, like Earth, would surrender to their efforts for a time, and then strike back at them; each season would bring its own battles.[73]

Terraforming for Iris is not imagined as farming in a metaphorical sense, but as part of a history of agriculture. This arises as a logical consequence of civilisation's technological ability to manipulate its environment and the accompanying view that human relationships to the land involve active domination. Venus, like Earth with its unpredictable climatic changes, is not simply passive but is imagined as responding in cycles of aggression to this attempt at domination. The chronotope of Venus and Earth are, when seen in their totality, personified. A scientific understanding of climatology and a theory of ecology that emphasises the relationships between complex systems is incorporated into this vision of terraforming:

> She sighed. She had a model to study, one that showed the cycle of photochemical and thermochemical reactions that changed Venus's sulfuric gases into cloud particles. The cycle was complex, and a recent increase in volcanic activity on the Venusian surface meant that more sulfur, emitted by volcanic eruptions, would be entering the atmosphere.[74]

This model encodes ecological principles of interconnectedness that mirrors the economic integration of Lincoln in a network of villages, all of which are functionally directed toward the political structure of the Nomarchies: '[t]here had not been as much of a surplus that year, but the weather in other parts of the world had been favorable; the Nomarchies would be able to feed all of Earth's citizens'.[75] This view of the Plains differs from Angharad's in that Lincoln's dependency upon the larger patterns of climate is underscored alongside the Nomarchies' dependency upon both the Plains villages and Earth's planetary ecology.

These relationships define another spatial reordering of the divided landscape in terms of a layering of orders of magnitude and function. The Nomarchies (such as the Native American Nomarchy) are organised as a network of politico-cultural spaces encompassing the physical spaces

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[73] *Shadows*, p. 257.
[74] *Dreams*, p. 234.
[75] *Dreams*, p. 48.

represented in the text (the local, regional, climatic and global). The interdependency of local space, of the different farms and villages, and their relationship to the regional level, is given a sf twist:

> A few rainclouds might be routed their way if the rain were not needed more elsewhere and if the task could be done without altering climatic patterns too greatly. The Nomarchies tended to be cautious about such matters.[76]

Sargent's use of geoengineering develops the relationships between the complex, chaos informed understanding of climate and ecology, in both its scientific and metaphorical senses, via an emphasis on the economic and political links between spaces. Evolution plays its part in this dialogue. As mentioned above, terraforming is conceptualised as an advanced form of agriculture. The term 'planetary evolution' appears in *Venus of Dreams* a total of four times and refers to planetary scale climatic, geological and ecological cycles and the interconnections between them.[77] Terraforming is a form of long term labour in which a dynamic conception of time is essential to the transformation of these landscapes. The *Venus* trilogy exemplifies sf's use of the garden and farm chronotope to bring into dialogising relationships new scientific discourses and traditional uses of the pastoral.

5.4 The Garden in Kim Stanley Robinson's *Mars* Trilogy

Robinson's Mars trilogy deploys the image of the garden to analogous dialogic effect. In *Blue Mars* images of the garden appear as an indicator of the drastic transformations that terraforming brings to Mars. Sax Russell is taken on a tour of Tyrrhena Massif near Sabishii, where the shaping of the Martian landscape prior to terraforming is described as, '[n]ot chaos, technically speaking, but wild, speaking its unimaginable age in polyglot profusion'. This polyglossia is characterised by the geologic and meteorological forces that have shaped the planet for billions of years. Joined to these voices are those of a new shaping force. After his guides point out the colonising plant life Russell understands that 'it was all fellfield, the whole Tyrrhena Massif'. This area is an 'intensively cultivated' space; Russell evokes pastoral imagery when he describes it as a garden. Russell's guides

[76] *Dreams*, p. 40.
[77] *Dreams*, p. 59, p. 195, p. 235.

explain that various cultural gardening aesthetics are deployed, ranging from the Japanese Zen of Muso Soseki and others, Fu Hsi's Feng Shui, Persian gardening gurus such as Omar Khayyam and American ecologists such as Also Leopold, Wes Jackson and the biologist Oskar Schnelling. These voices serve as a springboard for new visions of the landscape that have co-evolved with specific features of Mars' topology and climate, an ecopoietic technique that embeds humanity into the landscape through the co-adaptation of their gardening strategies with the land. Russell notes that this results in a landscape built from a polyphony of voices, 'an aesthetic journey, filled with allusions and subtle variants of tradition that were invisible to him'.[78]

For Russell's guides, ecopoiesis is 'terraforming redefined, subtilized, localized. Transmuted into something like Hiroko's areoformation'. Moving from the global to the local, ecopoiesis re-visioned as gardening attempts to connect a terrestrial landscape to the primeval Martian planet, resulting in modifications to both. Like the areophany, this process is one of '[c]oevolution, a kind of epigenetic development' that subtly redefines the boundaries of the Martian land as an experiment in building homes that respect nature's otherness. While Russell initially views ecopoiesis as an unmediated process in which the initial conditions are established by human agency ('let loose the seeds, then watch it all develop on its own. Self-organizing ecologies'), Russell's guides see 'Mars [as] all a garden. Earth too for that matter. This is what humans have become. So we have to think about gardening, about that level of responsibility to the land. A human-Mars interface that does justice to both'.[79] Echoing Sargent's *Venus* trilogy, this view of terraforming as gardening is an interface that mediates between human communities and non-human nature.

Gardening is explored in another episode focalised through the Mars born Nirgal. At Shining Mesa, along the banks of a stream fed by meltwater from the Marineris canyon floors, 'forest galleries were springing up' 'whose balsa canopies were allowing a great number of plant and animal species to flourish underneath them'. According to Nirgal's acquaintances 'it was the most diverse biotic community on Mars'. Such a landscape signals the extent of the transformations Mars has undergone after colonisation. Nirgal's tour of Shining Mesa takes place alongside an internal struggle over two

[78] *Blue*, pp. 89, 89, 91.
[79] *Blue*, pp, 91, 91, 93, 93.

conflicting modes of inhabiting the land; between the nomadic lifestyle he is familiar with and the settled life of a home: '[h]e wanted to live in the open air. To learn a patch of land, its soil and plants and animals and weather and skies, and everything else'. Candor Chasma is too sublime a location, too much a wilderness, for individuals to establish roots and inhabit the land. Nirgal decides to resume his search for the absent Hiroko, thus allowing the narrative to explore the physical changes to the Martian landscape on the now blue Mars. Nirgal's view of the Elysium Massif strait is like nothing he has ever seen before: 'water, the sea, a whole future world'. It is during this search that he comes to realise that the familiar primeval Mars is gone. His childhood companions encourage him to stop looking for Hiroko, and he decides instead to 'look at the land', prompting him to return to the lands surrounding the city Sabishii, Tyrrhena Massif, to try his hand at gardening. Thus, he moves from a nomadic lifestyle to a settled lifestyle; '[h]e would be an ecopoet', but '[f]irst he had to learn the land'. Nirgal becomes a steward of a small basin, where 'working out one's locality's connections to the larger region was a big part of the ongoing process of ecopoesis'. As he cultivates his allocated basin, a microcosm of the plant and animal life that continues to be established at Tyrrhena Massif, a 'Tyrrhena commitee on the introduction of new species' visits Nirgal in order to establish a position toward the local ecology: 'there was a growing sentiment to regard this mix as "natural" to Tyrrhena, to be altered only by consensus'. After this visit, Nirgal says to the marmots who have taken up residence by his home 'now we're indigenous': on Mars, being indigenous is a matter of political consensus.[80]

Another perspective on the transformations to Mars is supplied by Clayborne, whom Russell accompanies on an expedition and observes her reading the landscape like a text. Russell sees her as an oracle, a visionary whose love of rock – of abiologic life – he compares to Hiroko's visionary areophany. He attempts to uncover the etymology of the words stone and rock, but quickly abandons himself to a Mars landscaped as a tabula rasa, a seemingly boundless space invested with a creative potentiality directed toward the future. Such a view contrasts with his brief exploration of the etymology of the word garden. Derived from the Old Norse *gard* for enclosure, it '[s]eemed to share origins with guard, or keeping', thus resonating with the image of the dome as an enclosure. The

[80] *Blue*, pp. 379, 380, 380, 382-383, 383, 390, 394, 396, 398, 399, 400, 405, 405.

rocky Martian land is a space opposed to the cultivation of gardens seen in Tyrrhena Massif and the banks of the Arena Glacier: '[w]ithout active gardening, this was what one got'. The encroaching plant life is a source of anger and depression for Clayborne, who interprets it as the destruction of Mars. Michel encourages her to walk amongst the changed Martian landscape and argues that terraforming has made humankind a part of the land and its ecology, essentially embedding them into a new home. For Clayborne, Michel suggests, '[y]our task becomes seeing the Mars that always endures'.[81]

Encouraged by this suggestion, Clayborne embarks on a walkabout to re-discover her relationship to the now altered Mars. Her encounter with the new landscape brings her face to face with an ecology imported from Earth, the short food chains of the Antarctic comprising marine, avian and mammalian life. Along with the image of skuas scavenging a dead seal, Clayborne observes a polar bear, which gives chase to her after feeding from the same carcass. This pivotal encounter introduces a new vantage to her consciousness: '[s]he only had to close her eyes and she saw again that heraldic image of the bear flowing over the rock; but open them and there the dashboard gleamed, bright and artificial and familiar. Ah so strange!'.[82] For Clayborne, the image of the polar bear emblematises change; it is a haunting vision that initiates a transformation that eventually allows her to step back from her nihilism and prepares her for a modified relationship to the new Mars.

5.5 "Stepping Back" in Kim Stanley Robinson's *Mars* Trilogy

The environmental philosopher Holmes Rolston, III identifies two broad categories of worldview around which debate over the aesthetic appreciation of nature revolves: 'one that aesthetic experience must be participatory, relating an actual beholder to a landscape; the other that nature is objective to such beholders, actually known in the physical and biological sciences'. Considering the question of whether aesthetic appreciation of landscapes needs to be science-based, Rolston compares those various and diverse examples of what he calls "prescientific" approaches to nature which, on the one

[81] *Blue*, pp. 98-99, 99, 91-92, 100, 256, 257.
[82] *Blue*, pp. 262-264, 268.

hand, characteristically misunderstand nature (from the point of view of scientific objectivity), while on the other have developed specific ways of relating to that nature based on human co-adaptation with their environment. Rolston reflects on the assumption that 'no one appreciates the canyon, for what it really is, unless helped by geologists' and argues that '[s]cience cultivates the habit of looking closely, as well as of looking for long periods of time. One is more likely to experience the landscape at multiple scales of both time and space'. Nevertheless, he is well aware of the problems of contingency associated with this claim, noting that 'science or no science, everyone can gain some of that sensitivity'.[83]

Thomas Heyd suggests that the aesthetic appreciation of nature need not rely on science and that science may actually be harmful to such appreciation because it directs attention to the 'theoretical level and the general case', rather than to 'the personal level and the particular case that we actually need to engage. Heyd argues that the 'aesthetic appreciation of nature should be guided by a great variety of stories from a diversity of walks of life and cultures because this enriches our capacity to appreciate nature aesthetically'.[84] Interplanetary imperialism, a tradition substrating such classics as Ray Bradbury's *The Martian Chronicles* (1950)[85] and Heinlein's *The Moon is a Harsh Mistress*,[86] are stories that have traditionally interpreted cosmological nature as a field for American conquest and annexation. Sf has also simultaneously challenged this imperialism, a trend that feeds into Sargent and Robinson's exploration of human-nature relations in their terraforming trilogies.

Robinson's Mars trilogy portrays a not unfamiliar Earth subject to overpopulation, pollution, global warming, rising sea levels, war, famine and severe economic and political inequalities between the rich and poor, a list that matches Glen Love's list of contemporary environmental problems.[87] These ecological changes affect social, political and economic repercussions. In *Red Mars*, a group of one hundred scientists known as the First Hundred begin terraforming Mars in 2027. The text's form

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[83] Holmes Rolston III, 'Does Aesthetic Appreciation of Landscapes need to be Science-Based?', *British Journal of Aesthetics*, 35 (4) (1995), 374-386 (pp. 377, 375, 374, 376, 377).
[84] Thomas Heyd, 'Aesthetic Appreciation and the Many Stories About Nature', *British Journal of Aesthetics*, 41 (2) (2001), 125-137 (pp. 126, 137).
[85] Ray Bradbury, *The Martian Chronicles* (New York: Doubleday, 1958).
[86] Robert A. Heinlein, *The Moon is a Harsh Mistress* (London: Gollancz, 2001).
[87] Glen A. Love, *Practical Ecocriticism: Literature, Biology, and the Environment* (Charlottesville: University Press of Virginia, 2003), pp. 14-15.

foregrounds the importance of, and problems associated with, opening spaces for dialogue in two ways: first, by utilising different perspectives to focalise each section and, secondly, by portraying the social activity of the colonists from these alternating perspectives. This involves portrayal of the confrontations and differences of ideology between opposed groups or individual. The Machiavellian Frank Chalmers recognises the importance of exchange between opposed positions when orchestrating his rival's assassination in *Red Mars*' opening sequence. He thinks of his chosen assassin as a 'fool […] talk means everything. We are nothing but information exchange, talk is all we have!'.[88] Chalmers' plan for political dominance involves sowing discord between cultural groups. By manipulating the historical antagonisms between Arab and American nationalism Chalmers sabotages any attempt toward dialogue. Raising awareness and support for political positions and lifestyles is a major narrative component of the trilogy and is conducted through discussion, campaigning and interviews, further reflecting the importance of information exchange. As multiple individuals and groups attempt to define the Martian landscape according to their own values, the exchange and conflict between their contesting positions establish a literary ecology that opens a space for debate over the meaning of Mars.

The *Mars* trilogy portrays a developing Martian community and its struggle for political independence from Earth. One view of Mars is purely instrumental in the sense that it is seen only as a means to relieve the pressures threatening Earth's population. In response to uprisings on Mars the official line from Earth's governments is that '"Mars is not a nation but a world resource"'. This perspective is directly connected to the mining that had begun earlier in the text in Antarctica, a space that, as a natural reserve, has been protected from such activities by the 1961 Antarctic Treaty. Clayborne places the blame for the breach of this treaty squarely on their efforts to terraform Mars: she explains that '[t]hey kept mining and oil out of Antarctica for almost a hundred years […] [b]ut when terraforming began here it all collapsed'.[89]

This view of nature as a resource highlights technology's influence in redefining humanity's treatment of external space. The chronotope of the first colonising outpost in *Red Mars* implies a

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[88] *Red*, p. 31.
[89] *Red*, pp. 602, 298.

series of potential narrative trajectories that draws upon the pastoral opposition between images of the "natural" landscape of the country and the technological city. As Bakhtin explains, the chronotope is the artistic representation of space and time as interrelated in a text; time qualifies spatial meanings and vice versa. This representation, because linguistic, allows it to accrue a series of human-centric meanings from structures internal to the text and through sf's megatext, a discourse constructed by works in the sf tradition. Russell's assessment of terraforming is cast in doubt in the light of Nadia Cherneshevsky's trip with Clayborne to the North Polar Region. On her return, she sees their habitat in a new light: '[i]t had the disordered, functional, ugly look of Vanino or Usman or any of the Stalinist heavy industry cities in the Urals, or the oil camps of Yakut. They rolled through a good five kilometers of this devastation'.[90] The description of the outpost taps into the narrative potential of the dystopia, the alternative to the possibility of a utopian interplanetary colony. This theme contributes to the ongoing debate regarding the development of new societies on other worlds. It constructs an image of a repressive society signified by the chronotope of the city as wasteland, delineating a socio-political structure that rejects a heteroglossic dialogue that can incorporate all the voices of the multiple groups who work toward constructing a new Martian identity.

Greater control of the environment is thus accompanied by a greater willingness to adapt the landscape for purely anthropocentric ends; consideration of nature's otherness does not feature as a constraint to terraforming. Cherneshevsky also responds to the environment instrumentally, although this response is a personal as opposed to an economic one. When Clayborne invites her to a trip to Mars' Polar Regions, she sees the wilderness of the Martian landscape and experiences a cognitive shift that allows her to re-evaluate this space. She thinks that '[a]ll this beauty was so strange, so *alien*', and the narrator continues: 'Nadia had never seen it properly before, or never really felt it, she realized that now; she had been enjoying her life as if it were a Siberia made right, living in a huge analogy, understanding everything in terms of her past'.[91] Her recognition of the alien aspect of Mars' landscape helps her to identify her own tendency to project meaning onto nature's otherness. Cherneshevsky's identification of Mars with Siberia instantiates a landscape that is completely

[90] *Red*, p. 191.
[91] *Red*, p. 171.

constituted by her imposition of meaning onto it. Her initial view of Mars as a new Siberia is instrumental because it allows her to cope with the deterritorialisation that accompanies the unfamiliarity of, and the demands of living within, an alien landscape.

Here we see the pastoral refigured: by contrasting the alien with the familiar, its strangeness is raised to the level of awareness, which draws attention to how Mars is unlike familiar natural landscapes. It signifies the new; civilisation on Earth is shifted to a nostalgic past. Cherneshevsky responds to the intuition that Mars is not solely a field for the imposition of her engineering discipline, thus overlaying the chronotope of the Martian wilderness with non-instrumental value. This episode draws on the mystique of Mars, constructed, as Russell notes, from '[a]ll those dumb sci-fi novels with their monsters and maidens and dying civilizations. And all the scientists who studied the data, or got us here', but challenges conventional ideas of beauty, pushing us as readers to reflect on a personal, aesthetic response to a nature not already conceived of as determined by instrumental cultural expectations.[92] Through Cherneshevsky's experiences of the "real" Martian landscape with Clayborne, an ecologically oriented perspective is woven into the dialogue of the text and stands out as one of its major ideological voices.

Cherneshevsky's approach is indicative of general trends toward landscaping Mars. Hailwood focuses particular attention to what he calls 'a kind of intellectual fragility involved with the difficulty of maintaining natural otherness in view: the ease with which it is overlooked in the cultural process of feeling at home and secure in a landscape'.[93] Earth's view of Mars as a resource is an example of a form of landscaping that prefigures and justifies physical terraforming. Clayborne reflects that '[o]nly on Mars did they walk about in a horrendous mishmash of the dreams of the past, causing who knew what disastrous misapprehensions of the real terrain'.[94] Such 'disastrous misapprehensions' disrespect nature's otherness and exemplify the failure to recognise the constructivism inherent in landscaping. Clayborne and Cherneshevsky are both aware that such cultural projections are ways in which continuity with the past is maintained. An awareness of intellectual landscaping processes allows

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[92] *Red*, p. 212.
[93] Simon Andrew Hailwood, *How to Be a Green Liberal: Nature, Value and Liberal Philosophy* (Chesham: Acumen, 2004), p. 29.
[94] *Green*, p. 155.

Cherneshevsky to acknowledge that physical space is not solely constituted by anthropomorphic perspectives.

Carol Franko argues that intersubjectivity is central to two of Robinson's short stories: "Exploring Fossil Canyon" and "Green Mars", collected in the *Mars* trilogy's companion volume *The Martians* (1999).[95] They

> explore the subjective processes that shape such debates [about nature's value] and suggest that the most important moments of growth are those that involve a crisis in one's perception of otherness, and that such crises open the way for the discovery of a social utopian impulse, one that responds to otherness, human and non-human.[96]

These insights can be applied directly to the *Mars* trilogy. "Instrumental" is a term from environmental philosophy that refers to the way in which we value nature, and forms one of the dimensions to Hailwood's formulation of the concept of nature's otherness. He argues that 'the value conferred by nature's otherness is best thought of as non-instrumental (independent nature is a "negative end" [a constraint] in virtue of its otherness), extrinsic and objective'. Its value is located "extrinsically", by virtue of the fact that it is other to humanity. Nature's otherness also has objective value, and here Hailwood adopts Thomas Nagel's conception of objectivity, which he describes as 'a method of understanding from a detached perspective, formed by stepping back from an initial view to arrive at a new conception taking in the original and its relation to the world'. Cherneshevsky's cognitive shift is an example of this process of 'stepping back' and reconsidering her relationship to the environment. There are other implications involved with this conception of objectivity: Hailwood quotes Nagel's explanation that '"[t]he wider the range of subjective types to which a form of understanding is accessible – the less it depends on specific subjective capacities – the more objective it is"' but notes that, to avoid nihilism, '[n]ormative realism […] requires the retention of some relatively subjective element'.[97] Objectivity is therefore dependent upon the convergence of multiple subjectivities, but this process exists in tension with individual subjective perspectives which regulate a potential regress toward nihilism.

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[95] Kim Stanley Robinson, *The Martians* (London: Voyager, 1999).
[96] Carol Franko, 'Working the "In-Between": Kim Stanley Robinson's Utopian Fiction', *Science Fiction Studies* 21 (1994), 191-211 (199).
[97] Hailwood, pp. 13, 52, 52.

Each section of the *Mars* trilogy is focalised from the perspective of a different character while the whole depicts the various attitudes and ongoing debates from individuals and groups toward the land. The debate between the Reds and Greens is fundamental to the trilogy and is represented by the geologist Clayborne and Russell, a physicist turned biotechnologist. In *Red Mars* they confront each other on this issue and establish their initial positions toward terraforming. Clayborne argues that 'you're going to wreck the historical record, destroy the polar caps, and the outflow channels, and the canyon bottoms – destroy a beautiful pure landscape, and for *nothing at all*'.[98] While Clayborne's emphasis on the physical fragility of natural features apparently supports an intrinsic view of nature's otherness, her discussion of the geological 'historical record' and an aesthetic of beauty suggest that this is otherwise. Russell, on the other hand, argues that

> Changing it won't destroy it. Reading its past might get harder, but the beauty of it won't go away. If there are lakes, or forests, or glaciers, how does that diminish Mars's beauty? I don't think it does. I think it only enhances it. It adds life, the most beautiful system of all […] Mars will always remain Mars, different from Earth, colder and wilder.[99]

Russell, too, places value on aesthetic aspects of the landscape, but for him only biological processes have extrinsic aesthetic value. He recognises the presence of otherness as a component of nature on Mars and he distinguishes nature's otherness from an alien nature's otherness. Clayborne is dissatisfied with Russell's more popular position but is unable to effectively articulate a response, demonstrating the difficulty involved in speaking for the rights of a-biological nature. She does, however, attempt such a response:

> I think you value consciousness too high, and rock too little. We are not lords of the universe. We're one small part of it. We may be its consciousness, but being the consciousness of the universe does not mean turning it all into a mirror image of us. It means rather fitting into it as it is, and worshipping it with our attention. […] You've never even seen Mars.[100]

Clayborne advocates an attention to nature's otherness that is almost religious, criticising the anthropocentric landscaping that follows from the view of humanity as 'lords of the universe'. She sees terraforming as imperial in its approach to nature when she completes Russell's claim that '[d]eciding to go to Mars is like the first phrase of a sentence, and the whole sentence says –' '*Veni*,

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[98] *Red*, p. 212.
[99] *Red*, p. 213.
[100] *Red*, pp. 213-214.

vidi, *vinci*'.[101] This "sentence", the familiar narrative of interplanetary colonisation that seems to demand resolution in familiar ways, could be considered the political landscape that informs terraforming. This position is distinct from her earlier emphasis on aesthetic beauty and is intrinsic in the sense that it does not depend on consciousness to evaluate its aesthetic potential. However, it is still extrinsic in that an appropriate response to the universe is one of paying attention and of 'fitting into it as it is', which depends on recognising it as other from the perspective of humanity. Clayborne's view in this pivotal episode of the Red-Green debate involves extrinsically valuing landscapes in the manner of Hailwood's notion of nature's otherness. Robinson's *Mars* trilogy attempts to negotiate new relationships to a nature already intellectually landscaped with meaning.

This relation of extrinsic worth is confused, however, because Russell refers to Clayborne's position as advocating intrinsic worth, as when he thinks that 'she believed in some kind of intrinsic worth for the mineral reality of Mars'.[102] Russell fails to understand Clayborne's arguments; *Green Mars* and *Blue Mars* are partly concerned with his decision to step back from and re-evaluate his initial position, partly to better understand Clayborne's own perspective and partly to attempt to convince her that the terraforming project also has its own kind of value. On a walking trip with Clayborne in *Blue Mars* he realises that '[o]ne had to let things speak for themselves. This was perhaps true of all phenomena. Nothing could be spoken for. One could only walk over the land, and let it speak for itself'.[103] If, however, it is not possible to speak for the landscape, how do you convince those who disrespect nature's otherness to maintain a green (or rather red) perspective unless its value can be related in some way to humanity? Accepting nature's otherness as an extrinsic value is one way in which characters begin to recognise existences external to humanity. It is only by persuasion that Clayborne manages to convince Cherneshevsky to experience another aspect of Martian nature. Clayborne and, eventually, Russell's focus on viewing the landscape opens up other textual spaces in which appropriate responses to the environment are explored.

As the trilogy progresses, the Red/Green positions splinter into a variety of mediations between these two extremes, and Russell comes to question his initial position. Setting the narrative

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[101] *Red*, pp. 56-57.
[102] *Green*, p. 186.
[103] *Blue*, p. 98.

on the red planet allows the ideological connotations of green as a label for environmental consciousness to be inverted, with it coming to represent the interests of an unreflecting and destructive process. That these values have led Earth to its current environmental and political crisis allows us to question further our notions of an acceptable interplanetary environmental consciousness. It also leads us to question the symbolic value of terraforming and explore the implication that it leads to a mirroring of the socio-political dynamics on Earth. Space is thus politicised as groups struggle to define the meaning of Mars and their relationship to it.

Clayborne and Russell exemplify the way in which language is used to speak for the Martian landscape from perspectives that view it as a site of traditional symbolic value, and from contesting positions that contribute to define textual spaces for the confrontation and interaction of different discourses. Russell views Mars as lifeless and therefore ripe for the seeding of life, a traditional sf theme. Clayborne sees it in terms resonating with the American Pastoral, with the Martian landscape occupying the role of pristine wilderness. These values are represented synchronically, as spaces that are placed in juxtaposition to each other: Clayborne and Russell embody contesting views toward the Martian landscape while Chalmers considers it as a space in which to manoeuvre for political dominance. However, through the diachronic structure of a text (narration and character dialogue), these and other positions come into contact with one another to allow an implied audience to consider and question the value systems represented. Different characters may express contesting positions toward a particular landscape that can be read against the implied authorial voice. As Russell's questioning of his initial position shows, a character may be exposed to different ideological worlds and attempt to reconcile the contrast between the discourses that these landscapes are made to represent. Confrontations with nature's otherness deterritorialises and thus allows characters to step back, allowing them to develop alternative ways of valuing their environment.

5.6 Visions Reflected Back to Earth

While visiting the Alps Nirgal experiences the realisation that 'Earth was so vast that in its variety it had regions that even out-Marsed Mars itself – that among all the ways that it was greater, *it was greater even at being Martian*'.[104] This impression is generated by the tension between the similarities and differences of climate between the Alps and a terraformed Mars, one in which Nirgal, as one of the first children born on Mars, feels at home in. Antarctica, as we learn in the opening of *Red Mars*, is also '*a landscape that was almost as cold and harsh as Mars itself*', which explains why it functions as the selection and training site for the First Hundred prior to their journey to Mars.[105] What this relation highlights is the presence of nature's otherness in all landscapes. Even on Earth, where many spaces are significantly modified by physical and psychological cultural adaptations, an element of this otherness remains, reminding the reader that human ends and values do not exist in isolation from the natural world. Nirgal is Martian and so Earth for him represents an alien planet; this perspective offers the reader an opportunity to engage in Nagel's process of stepping back and reassessing their subjective viewpoint toward the status of nature's otherness on the familiar landscapes of Earth.

The *Mars* trilogy suggests that reliance on technological fixes as an answer to societal conflict is inadequate. Championed by the Russian Arkady Bogdanov and the American John Boone, a break with history becomes one of the driving goals of the more politically minded on Mars. They believe that the social patterns on Earth are responsible for many of the ills that humanity faces and that nothing but a complete overhaul will do: a discarding of those that are unhelpful and destructive and a retaining of those that speak for cultural pluralism and a new Martian identity that can offer the colonists a sense of a global identity distinct from that of Earth. Boone, after many discussions with Bogdanov, advocates 'a new Martian way, a new Martian philosophy, economics, religion!'.[106] This call for a new outlook is one of the central ideas of sf narratives of terraforming, and it takes its place in an ongoing debate with other texts that explore issues of economic and socio-political

[104] *Blue*, p. 201.
[105] *Red*, p. 41.
[106] *Red*, p. 410.

independence on Earth. This economic independence is connected specifically to a Martian perspective in which local forms of community, along with the appropriate forms of cultural and economic interchange between communities, are emphasised in contrast to Earth's socio-political schisms, themselves caused by individualistic and nationalistic perspectives toward resources and land use. Terraforming literalises metaphors for the creation of discursive spaces with which to explore new forms of local and global connectedness and identity that stand as alternatives to destructive social formations on Earth. The intersections between texts and between generic categories such as sf, utopia and the pastoral are heteroglossic and engage with the sf megatext and with contemporary discourses of environmental philosophy and geopolitics.

That the initial colonising outpost is built near resources dropped from Earth, including a full range of technologies built by Boeing, Rolls Royce and other companies, indicates that the outpost itself and the terraforming effort that it leads to is driven by commercial interests from the most powerful of Earth's transnationals, a political fact that some of the First Hundred, unlike Bogdanov, would prefer to ignore: 'it all comes back, and we have a return of ownership, and prices, and wages. The little scientific station is being turned into a mine, with the usual mining attitude toward the land over the treasure'.[107] This draws on the sf megatextual trope of technological sophistication, but associates these technologies with familiar companies, implying one of the uncanny oscillations of the subjunctivity of sf, which Samuel R. Delany claims is 'blanketly defined by: have not happened' – an unspoken "yet" may linger at the end of that sentence.[108] Here the chronotope of the scientific station, associated with exploration and the scientific utopia, is shifted to that of the mine, an industrial, capitalist image. Driving these economic interests is the application of advanced technology as a means of securing the resources with which to relieve scarcity on Earth, thus allowing Earth's governments to cope better with the growing ecological crisis there. Paradoxically, the historical application of increasingly advanced technology has enabled Earth's population to boom, resulting in a depletion of natural resources and contributing to the growing crisis. The discovery on Mars of a new treatment that can significantly prolong human lifespan further emphasises this dynamic. Some

[107] *Red*, p. 403.
[108] Samuel R. Delany, *The Jewel Hinged Jaw: Notes on the Language of Science Fiction* (New York: Dragon Press, 1977), p. 44.

predict that this will increase the transnationals' drive for economic security for two reasons: because it will exacerbate the already problematic division between the rich and poor, and because it will increase overpopulation on Earth: 'if this damned treatment only goes to the rich, then the poor will revolt and it'll all explode – but if the treatment goes to everyone, then populations will soar and it'll all explode'.[109] In this context Mars is seen only as a space for the resolution of Earth's eco-political problems. The view of the scientific station and of Mars as a mine represents the transnationals' attempt to impose an identity based solely on utilitarianism onto the Martian landscape and its community. Because the transnationals only recognise Mars as a source for the extraction of resources and because they consider the scientist's role to be completely focused on this aim, their priorities for the physical adaptation of the landscape reflect an attempt to turn the planet into a mine. Similarly, the scientific community on Mars is also considered in utilitarian terms, not as individuals whose lived experience on the planet might justify alternative interpretations of the landscape.

The urge to make a break from the trajectory of reified ideology is mirrored by the narrative's discontinuity in time. Set in 2026, this near future narrative compresses the traditional gap between the time the text was published (1992) and the far future setting of much sf dealing with the colonisation of the solar system. Such far future narratives imply significant changes to socio-political structures and technology, as the discussion of Sargent's *Venus* trilogy above illustrates.

The *Mars* trilogy, however, begins by retaining many of the socio-political structures that are now familiar and calls them into question as the narrative progresses. It also adds further weight to the notion that the series of crises faced on Earth oscillates between Delany's sf subjunctivity 'have not happened' and 'have not happened yet', but may soon.[110] The solution demonstrated by the text's emphasis on social relationships in a new experimental space asserts that it is not by focusing on adapting the landscape but by landscaping the self, by metaphorically terraforming the individual and social aspects of a community, that the best hope for effective change is to be realised. This is wrapped up with the Martian landscape itself: a phrase that appears throughout the trilogy, '[s]o we terraform the planet; but the planet areoforms us', demonstrates that the global landscape has a

[109] *Red*, p. 415.
[110] Delany, p. 44.

corresponding effect upon the identity of its inhabitants and suggests that there is an influence exerted upon this sense of planet from an alien nature's radical otherness.[111]

Sf taps into a range of generic forms and discourses and reconfigures them through its own language in order to provide textual spaces for a consideration of human relationships to the landscape. In the foregoing discussion this is achieved by adapting the pastoral and utopian form in conjunction with portraying debate between positions to consider questions of land use and responsibility toward the land. These alternate perspectives arise from differences in physical space, from the contrast between the planetary spaces of Earth and Mars and the meaning invested in them. Local, global and interplanetary space is constituted by ecologies of landscapes embodying multiple ideological positions. In this way the concept of the chronotope, as a unit for the analysis of texts, is joined to Bakhtin's theory of dialogism, which is especially important as it is the principle by which Broderick's megatext operates. Dialogism and the chronotope interact to define the structure of a text; parts interrelate to take on additional layers of meaning, and changes to one dimension impact upon others. In the glossary of *The Dialogic Imagination* dialogism is described as 'the characteristic epistemological mode of a world dominated by heteroglossia':

> Everything means, is understood, as a part of a greater whole – there is a constant interaction between meanings, all of which have the potential of conditioning others. Which will affect the other, how it will do so and in what degree is what is actually settled at the moment of utterance.[112]

The Red/Green debate and the view of technology as the solution to ecological problems on Earth are specific examples of voices that work to condition each other. Linked to the internal ecology of a text is an external one in which individual works referring to others in the same genre exist in a dialogue that contribute additional layers to the meaning of the themes and images therein.

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[111] *Red*, p. 301.
[112] M.M. Bakhtin, *The Dialogic Imagination: Four Essays*, ed. by Michael Holquist, trans. by Caryl Emerson and Michael Holquist (Austin: University of Texas Press, 2002), p. 426.

5.7 Mapping an Unimaginable Immensity: Visions of the Future

This chapter now returns to the planetary chronotopes of Earth and Mars and the specificities involved in the developing interplanetary relationship between the two planets. As the trilogy progresses these themes are argued over and considered from an increasing number of different perspectives and contexts. Nirgal explains the importance of colonising the planet in a speech he makes while visiting Earth, which opens up a space for an alternative meaning to be associated with the Martian landscape:

> 'Mars is a mirror,' he said in the microphone, 'in which Terra sees its own essence. The move to Mars was a purifying voyage, stripping away all but the most important things. What arrived in the end was Terran through and through. And what has happened since then has been an expression of Terran thought and Terran genes. And so, more than any material aid in scarce metals or new genetic strains, we can most help the home planet by serving as a way for you to see yourselves. As a way to map out an unimaginable immensity'.[113]

Nirgal points out the structural relationship between the chronotopes Earth and Mars, a relationship that has received much attention in sf narratives of colonisation. In doing so he underscores a postcolonial dimension to terraforming other planets, aspects of which have already been discussed in terms of national and global identity and familiar and unfamiliar spaces. In *Orientalism*, Edward Said notes that 'there is no doubt that imaginative geography and history help the mind to intensify its own sense of itself by dramatizing the distance and difference between what is close to it and what is far away'.[114] The vacuum of space, itself a chronotope symbolising a purifying transformation, signifies the radical distance between the two planets and serves as one of several estranging devices. This distance, and the imaginative geography already associated with Mars, establishes it as a field for the exploration and experimentation of alternative social and individual identities that allow Earth's population to see distorted reflections of their self, modified by influences from the alien landscape, but only if it is not landscaped solely in terms of the chronotope of the interplanetary mine.

When applied to sf worlds, Said's notion of Orientalism sheds light on Clayborne's resistance to the terraforming of Mars, which is geared towards recreating the self, symbolised by Earth's landscape, on another planet. Clayborne and Cherneshevsky's response to the wilderness of the

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[113] *Blue*, p. 178.
[114] Edward Said, *Orientalism* (London: Penguin, 2003), p. 55.

Martian landscape is an affective response to nature's otherness, a non-human identity that remains outside of the familiar bounded spaces of the colonising outposts. Terraforming reduces these spaces to a partial identity through the growth of an ecological system imported from Earth: an ecological colonialism. This identity is partial because such imports must be adapted to the alien environment and because unadapted imports are subject to the evolutionary influence of these alien spaces. The social aspect of settling other planets and the ecologically focused terraforming project are not simply two material necessities to ensure survival on Mars, but are attempts to reduce Mars' otherness to an identity. This notion is encapsulated by the phrase "terraforming" itself: the colonists attempt to change the Martian landscape, which is other from the point of view of Earth's population, into another Earth. Reference to mapping temporality ('[a]s a way to map out an unimaginable immensity'), can be read as a reference to the importance of landscape as "hero" or "character" in sf and to the notion of a sense of wonder, a character's and (potentially) a reader's response to the notion of a conceptual breakthrough, a shift in the conceptual paradigms framing views of the world.[115] Mars' function as a way to map the future is one such conceptual shift that connects Earth and Mars. The trilogy literally spatialises an imagined future in the form of a series of novels as an attempt to address human-centred concerns that cannot be predicted from our present vantage. In the process it acknowledges concerns that the Martian landscape exists independently of the interests of Earth's population. Nirgal's speech, however, elides this aspect of Mars.

Said discusses the example of 'Bouvard's vision of Europe regenerated by Asia', which 'represents what Flaubert felt to be the nineteenth-century predilection for the rebuilding of the world according to an imaginative vision, sometimes accompanied by a special scientific technique'. He notes that '[k]nowledge of the Orient, because generated out of strength, in a sense creates the Orient, the Oriental, and his world'.[116] In this sense the reconstructed other is an identity, the projected qualities of the creators, because it excludes the other from opportunities to define themselves. Nature's otherness has no obvious voice and so is at greater risk of being spoken for. Denial of otherness provides foundations for the repetition of the historical influences that Bogdanov advocates

[115] *Blue*, p. 178.
[116] Said, pp. 114, 40.

against in breaking away from history. This apparent mirror is mediated by the effects of the Martian environment on the colonists, who do respond to the otherness of Mars and adapt their culture to account for new forms of local and global belonging. Through the synthesis of self and other Nirgal offers Earth an opportunity to regenerate themselves in a manner that resonates with Said's examination of Bouvard's (sometimes scientific) utopian vision.

The *Mars* trilogy constructs textual spaces populated by competing ideological positions. The language of sf, namely its use of megatextual images including chronotopes, spatialises a dialogue between these positions mutually to illuminate and question them. The spaces of Mars, Earth, the colonising outposts and mining facilities take part in a heteroglossic dialogue in which different voices are placed in relation to each other to create a polyphonic whole that offers an examination of societies in relation to their environment. The *Mars* trilogy illustrates the way in which the meaning of these chronotopes is contested. The Martian landscape is spoken for from the position of transnationals, Greens engaging with the terraforming process, and Reds agitating for the preservation of Mars as wilderness. These debates embody the process of world-building on the social level, in which a new Martian identity, distinct from Earth, arises from the interstices of debate and from the Martian landscape's influence on them. This world building engages with eco-cosmopolitan concerns and is linked to utopia and dystopia, two alternative paths through which the development of the new society could lead.

5.8 Science and Nature

Science offers sf a series of discourses that terraforming stories adopt and adapt to inform literary constructions of alien landscapes. The initial motivation to transform alien planets into new Earths puts into play contesting interpretations of ideal relationships to the environment. Scientific discourse dominates these "discussions", accruing metaphorical implications (often socio-political) and offering alternative perspectives on the environment, variously undercutting or contributing to other modes of understanding. Robinson connects science to socialism, distinguishing it from nineteenth century

scientism by explaining that 'the "scientific" returns as a way of talking about providing some kind of ecological basis to economy [...] Another way it returns is to regard science itself as a utopian project and as a form of human interaction'.[117] Through the course of such narratives, as colonists struggle to re-territorialise their new environments, the feedback between science and non-scientific knowledge generates alternative conceptions of the nature and import of alien spaces, forcing us to rethink the concept of nature and of human relationships within these environments.

Because of his early efforts as head of the terraforming project in pioneering a heavy industrial terraforming model, Russell is closely aligned with the values linked to applied science as an expression of colonial ideological value.[118] He initially behaves like a caricature of the scientist figure who prefers to separate politics and science. Speaking of instances in which, like the cell-culture metaphor in Sargent's trilogy, nature is brought to account for social relations, Russell argues 'I don't think it helps to make analogies between the physical and social worlds'. Russell's fundamental disagreement with Clayborne over the future of Mars centres around Russell's failure, in her view, to "see" the landscape: his early perception is mediated by a range of scientific apparatus and audio-visual technologies, and he defines Mars' value in terms of its value to the terraforming project.[119] Clayborne's view, on the other hand, is informed by her scientific awareness of "deep" geological time and by her experience of this landscape. This opposition reflects Rolston's participatory versus objective view of the environment, with Clayborne's preferred method of relating to Mars involving long periods of physical exploration, participation with and perception of Mars. Yet her experience is combined with a scientific view that shapes her awareness of global processes. Just as science can, as Rolston argues, lead to a better appreciation of the environment, something more may be needed, perhaps something '[t]hat may go beyond science, but [which] must go through science to go beyond'.[120]

The problem of developing a sense of place that includes an aesthetic appreciation of the environment is a perceptual issue, and science remains a powerful tool for developing these

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[117] Buhle, p. 89.
[118] *Green*, p. 257.
[119] *Red,* pp. 646, 639.
[120] Rolston III, p. 375.

perspectives. This is joined to a political problem, one of persuading others to view the landscape in like manner. In *Red Mars*, Clayborne reflects that her inability to understand Russell and vice versa is due to '[v]alue systems based on entirely different assumptions. Completely different kinds of science'.[121] As Russell struggles to understand and reconcile his longstanding disagreement with Clayborne in *Green Mars*, he suggests that their difference centres on 'the fact-value problem. Science concerns itself with facts, and with theories that turn facts into examples. Values are another kind of system, a human construct'.[122] Despite the central problems Clayborne quickly raises in response, that science is also a human construct and that it too has values embedded within its scientific method, Russell insists that terraforming as applied science involves a choice of how to utilise the insights gained from science, and so is a value problem, whereas science and the scientific method itself are concerned only with facts.

By *Blue Mars* Russell modifies this view to articulate a vision of science as utopian and objective, 'a social construct, but […] also and most importantly its own space, conforming to reality only; that was its beauty'. He describes how science is built on a method that privileges dialogue and adaptation, arguing that '[i]n truth the work of science was a communal thing, extending back even beyond the birth of modern science, back all the way into prehistory, as Michel had insisted; a constant struggle to understand'.[123] Russell remains convinced that the communal practice of scientific enquiry in this general sense is the source of as much of the value of science as the facts and theories that it leads to. He experiences an epiphany during a moment in which he "steps back" to reflect on the practice of a "Martian" science that indexes the growth of a new global sense of belonging to the alien planet:

> something inside him would glow till it hurt, some parasympathetic reaction spilling out of his limbic system – now this was science, by God, this was Martian science, in the hands of the scientists themselves, working together for some collective goal that made sense, that was for the common good; pushing at the edge of what they knew, theory and experiment bouncing back and forth like a blur of Ping-Pong balls, week after week finding out more, going after more, extending the great invisible parthenon right out into

[121] *Red,* p. 649.
[122] *Green,* p. 185.
[123] *Blue,* pp. 677, 676.

> the uncharted territory of the human mind, into life itself. It made him so happy that he almost didn't care if they ever figured things out; the search was all.[124]

This Baconian image of the utopian impulse in science re-locates the focus of the scientific utopia away from the construction of societal blueprints to one emphasising a dialogical process whereby scientific engagement with the natural world ramifies through social worlds. This view of the practice of science as a communal activity accords more importance than is usually given to the means by which knowledge of the natural world is procured. The *Mars* trilogy scrutinises the structure of the scientific enclave and its communal goal which, taken as a model, raises the question of its connection to the wider political sphere. In *Red Mars,* Bogdanov tells Boone that 'a scientific research station is actually a little model of prehistoric utopia, carved out of the transnational money economy by clever primates who want to live well', and that their unwillingness to tackle the problem of 'work[ing] to create such conditions for everyone' compromises its status as a genuine utopia.[125]

Russell's outlook toward science changes in response to social upheaval. As the head of the terraforming project and in his role as one of the mythic "generals" of the Martian revolution for Independence from Earth, Russell is positioned at the forefront of a political struggle for defining Mars, forcing him to grapple with the problem of the fact-value interface, of working to establish a foundation for the practice of science, and of developing a genuinely communal decision making process. Suffering from aphasia after capture and torture in *Green Mars*, Russell slowly recovers his linguistic ability alongside a new awareness of social interchange. He begins to consider the importance of other modes of understanding in *Blue Mars*:

> Symbolic value: it was a concept Sax was trying very hard to understand. [...] symbol, "something that stands for something else," from the Latin symbolum, adopted from a Greek word meaning "throw together". Exactly. It was alien to his understanding, this throwing together, a thing emotional and even unreal, and yet vitally important.[126]

Russell's reflection on meaning takes him into the figurative realm, and his considerations lead him to combine his understanding of science with this notion of symbolic meaning, not to blur the boundaries of each, but to complement his experience with another perspective. He makes connections between the "throwing together" of the symbol, the mind, ecology and climatology, and

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[124] *Blue,* p. 702.
[125] *Red,* pp. 402, 403.
[126] *Blue,* p. 47.

uses metaphors drawn from the science underlying terraforming to suggest models that characterise the mind itself: 'an ecology – a fell-field – or else a jungle, populated by all manner of strange beasts', or 'chemical energies surging hither and yon, like weather in an atmosphere'.[127]

> That was better – weather – storm fronts of thought, high pressure zones, low-pressure cells, hurricanes – the jet streams of biological desires, always making their swift powerful rounds ... life in the wind. Well. Throwing together. In fact the mind was poorly understood.[128]

This metaphor for the human mind utilises the chaos influenced science of meteorology in a manner that echoes Sargent's spatialisation of Venus' hostile environment and the domes, all of which operate as metaphors for the mind turned inward. Ecology and climatology are figuratively aligned to the indeterminacy involved in analyses of the otherness of the human mind. Ecology takes on a figurative status as the science of "throwing together" as it depends on a range of scientific and cultural disciplines to portray and grapple with the entirety of an ecological network that includes humanity and their adaptations to multiple environments.

Sargent and Robinson's trilogies imagine several levels of engagement with other worlds that form a complex of interacting or contesting discourses of varying degrees of dominance. These works establish a plurality of discourse, a model of overlapping interests that intersect and diverge, but are ultimately brought together in the physical space of the terraformed world. Sf has offered an especially powerful language for expressing ecocritical concerns, but this has risen slowly to the foreground in its own distinctive ways in terraforming stories. The influences feeding into or implied as narrative possibilities explore counter-models to inadequate relations between the human and non-human.

Rolston ends his paper by reflecting on various pre-scientific views of the environment, arguing that '[s]cience should demythologise these views but must itself find a new myth that encourages appropriate aesthetic responses to nature'. He is not claiming that traditional cultural responses to nature are detrimental or irrelevant, but that scientific understanding necessarily needs to demythologise them in order to be science. Just as Clayborne argues in *Red Mars*, Rolston claims that

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[127] *Blue,* p. 55.
[128] *Blue,* p. 55.

‘humans are always the landscape architects, and even science is another cultural way of framing landscape’.[129] Terraforming, as a literature of landscaping, partakes of the throwing together theorised by Russell, combining various scientific, political and cultural parameters into the space of its thought experiment. It uses the dialogic structure of scientific enquiry identified by Russell to construct images of science and society that offer variants to imperial approaches to nature. The science of the *Venus* trilogy also opens up reflection on the use of projects of applied science to enforce repressive socio-cultural and political agendas. Both trilogies explore science’s limits and investigate ways in which “prescientific” and scientific modes of understanding fuse. Terraforming narratives concern themselves with the struggle of transformation, and it uses the sciences, especially ecology, to construct new myths for conceptualising and relating to nature and society.

[129] Rolston III, pp. 384, 376.

Conclusion

Narratives in the terraforming tradition contribute to a polyphony of worldviews toward society, its ideal relationship to its environment and its relationship to nature. This tradition dovetails the exploration of intra-human relationships with the examination of human relationships to cosmological nature. Landscaping processes act as interfaces for this preoccupation with society and with the relationship between the human and non-human. The pastoral, utopian discourse, ecology and environmentalism, along with elements of the wider sf megatext, have fed into the structure of terraforming narratives and have helped shape their thematic engagements. The megatext that the terraforming tradition constructs is Bakhtinian in its propensity to interrelate multiple texts and voices within the textual space of the terraformed world. The process of worldbuilding that the terraforming narrative enacts provides a forum for philosophical, socio-cultural and political inquiry that is ecological in character. Drawing from the insights of James Lovelock's Gaia hypothesis since the 1980s, terraforming has become a primary motif for environmental and ecological enquiry in sf discourse. At the level of discourse, these stories re-use narrative elements and tropes developed by earlier texts, sometimes recycling but often struggling to transform these elements into new engagements with contemporary social and ecological anxieties.

This thesis has shown how the development of the idea of terraforming first arose within sf discourse before influencing scientific speculation about the future and environmental philosophical thought during a period of anxiety regarding climate change. This influence generated a feedback loop between sf, science and environmental philosophy, which helped shape the development of a narrative that could provide fertile ground for engagement with contemporary environmental concerns. Chapter two demonstrates how the first terraforming and proto-Gaian narratives can be read against fundamental environmental philosophical themes such as landscaping and establishes the relationship between nature's otherness and the representation of alien environments and organisms in sf. Chapter three analyses the influence of the American Pastoral in the terraforming narratives of the 1950s boom and draws connections between landscaping processes, Bakhtin's chronotope and the sf megatext.

Chapter four explores the influence of James Lovelock's Gaia hypothesis and the burgeoning environmental movement on the development of representations of terraforming in the period 1960-1970, while chapter five considers how terraforming was consolidated and grew more sophisticated in its representation in the period 1980-1990. This thesis concludes by considering trends in the development of the terraforming narrative post-1990s before offering further avenues for research in the "Coda".

Terraforming narratives are preoccupied with the problem of creating a new human history that can escape, resolve or transcend the failures of the past. Perhaps inspired by the success of Robinson's *Mars* trilogy, but certainly by the increasing global attention that climate change received, many terraforming stories were published during the period of the 1990s-2000. One such text, Brian Aldiss and Roger Penrose's *White Mars* (1999),[1] responds to the ideas raised in Robinson's *Mars* trilogy.[2] Drawing on the utopianism of *Ecotopia* (1975)[3] and *The Greening of Mars* (1984),[4] *White Mars* advocates a non-interventionist model of engagement with the solar system that is grounded upon the intrinsic value of non-human nature. Like Lovelock's *Greening*, *White Mars* represents another instance of collaboration between sf writers and scientists (Penrose), thus underlining the importance of science as an essential element informing the sf imagination of landscape. Although an important text because of its explicit engagement with other texts in the terraforming tradition and for its philosophical and scientific debate over issues of environmental ethics, it has had comparatively little impact on other terraforming narratives.

Jack Williamson returned to terraforming with five short stories and novelettes comprising the novel *Terraforming Earth* (2001),[5] which continues the trend toward reflection on the future planetary changes that Earth might undergo. Williamson deploys a device that allows the narrator to explore changes to Earth in several distinct periods of time, each separated from the other at the

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[1] Brian Aldiss and Roger Penrose, *White Mars: Or, the Mind Set Free, a 21st Century Utopia* (London: Little, Brown, 1999).
[2] Kim Stanley Robinson, *Red Mars* (London: Voyager, 1992; repr. 1996), *Green Mars* (London: Voyager, 1993; repr. 1996) and *Blue Mars* (London: Voyager, 1996).
[3] Ernest Callenbach, *Ecotopia: A Novel About Ecology, People and Politics in 1999* (London: Pluto Press, 1978).
[4] Michael Allaby and James Lovelock, *The Greening of Mars* (New York: St. Martin's Press, 1984).
[5] Jack Williamson, *Terraforming Earth* (New York: Tom Doherty Associates, 2003).

geological scale. The device in question is cloning: a Lunar base and a system allowing the automated creation of clones has been established in order to provide a means of escape and preservation in case of catastrophe on Earth. In an echo of his earlier short story "Collision Orbit" (1942),[6] an impactor threatens Earth before this base can be completely prepared and a suitable staff organised. An ad hoc group is hastily assembled to ensure that genetic material and appropriate information can be supplied to the future clones, who slowly repopulate the Earth and who stand as witnesses to a future history on an Earth inhabited by strange creatures and colonising aliens. The overall thrust of these linked stories emphasises the plasticity of Earth's topography while illustrating the continuity and differences that underlie human societies. It explores the conflicts that alien and human groups continually struggle with over the course of their histories. To a lesser degree than Earth's topography, these civilisations are malleable and demonstrate a wide range of variation.

A group of short stories and novelettes published at this time illustrates the tendency for terraforming narratives of this period to turn toward a consideration of Earth and history. Robert Reed's "A History of Terraforming" (2010)[7] exemplifies this connection, also present in his story "A Place with Shade" (1995).[8] In "A Place With Shade" the narrator reflects on terraforming as an extension of the desire to transform the environment, a motive that is represented by the historical development of ever more complex technologies. One passage connects humankind's history of altering or remaking physical space to create dwellings on Earth to the comparatively sophisticated process of industrial and biological terraforming:

> Terraforming is an ancient profession.
> Making your world more habitable began on the Earth itself, with the first dancing fire that warmed its builder's cave; and everything since – every green world and asteroid and comet – is an enlargement on that first cozy cave. A hotter fusion fire brings heat and light, and benign organisms roam inside standardized biomes. For two hundred and ten centuries humans have expanded the Realm, mastering the tricks to bring life to a nearly dead universe. The frontier is an expanding sphere more than twenty light-years in radius – a great peaceful firestorm of life – and to date only one other living world has been discovered. Pitcairn. Alien and violent, and gorgeous. And the basic inspiration for the recent New Traditionalist movement. Pitcairn showed us how bland and domesticated

[6] Jack Williamson, 'Collision Orbit', in *Seventy-Five: The Diamond Anniversary of a Science Fiction Pioneer*, ed. by Stephen Haffner and Richard A. HauptMann (Michigan: Haffner Press Oak, 2004), pp. 216-277.
[7] Robert Reed, 'A History of Terraforming', *Asimov's Science Fiction Magazine* 34.7 (2010), 74-106, hereafter referred to as 'History'.
[8] Robert Reed, 'A Place with Shade', in *Worldmakers: SF Adventures in Terraforming*, ed. by Gardner Dozois (New York: St. Martin's Griffin, 2001), pp. 193-220, hereafter referred to as 'Shade'.

> our homes had become, riddled with clichés, every world essentially like every other world. Sad, sad, sad.[9]

In this light terraforming is seen as an extension of humankind's attempt to make of Earth a suitable human habitation. The theme of bringing life to a dead universe precedes the superficiality of life that has been progressively shorn of physical obstacles and challenges to overcome. These challenges are directly connected to a sublime aesthetic principle informed by experience with an alien nature's otherness.

"A History" takes these issues to an interplanetary context, and like Williamson's *Terraforming Earth* it makes use of vast sweeps of time to introduce and explore the relationship between changes to society and the continuity of human nature. "A History" dramatises a slow struggle toward a worldview in which humanity can feel at home in their environment. This story features life extending technologies that allow the narrator to focus on the impact of a pivotal individual's influence over the course of the human relationship to the galaxy. The elite driven shaping of history and the relationship between leaders and their followers is central to "A History". The future and the past in both of Reed's stories are essential to the way in which individuals approach nature and society. The past and the future reciprocally shape each other when dialogised with alternative perspectives toward the past. Knowledge of the past, while not a sufficient condition for an environmental and egalitarian view of others, is a necessary condition for developing an appropriately scaled view of human relationships to the universe.

In "Shade", Locum is confronted by a pupil (Ula) who sabotages the designed world that he is contracted to create on her father's (Provo Lei's) planet. Lei disapproves of Locum's profession, considering it 'pretentious and wasteful, this business of building cruel places'. Lei reveals that Ula's prior experiments had resulted in the ecological collapse of the planet's original Beringan ecology, which at the time of Locum's visit resembles 'an inspired apartment complex, lovely in every superficial way'.[10] The organisms that Ula introduces into this sanitised and calibrated world are a reminder of the otherness of nature and the value judgements that result in the exclusion of specific organisms from this world. In an extension of this environmental ethic to human concerns, Lei tells

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[9] 'Shade', p. 199.
[10] 'Shade', pp. 193, 195.

Locum of Ula's history of neglect and abuse before he adopted her. "Shade" suggests that human injustice and the exclusion of elements of nature stems from a willingness to disavow certain aspects of history. The question of an environmental ethic directed toward microbiological life is indebted to the influence of the 1960s environmental movement and to sf's longstanding engagement with the idea of nature, in both its cosmological and biological senses.

Locum subscribes to the New Traditionalist (NT) movement, which seeks 'to regain the honesty of the original Earth. Hard winters. Droughts. Violent predation. Vibrant chaos'. Another NT principle is that '[t]he fit survive. We build worlds with too much diversity, knowing that some of our creations are temporary. And unworthy'. One NT motto is the classic statement 'Red of tooth and claw', which alludes to the Hobbesian view of evolution as violent competition. What makes the original Earth special in this context is the 'three billion years of natural selection, amoral and frequently shortsighted … and wondrous in its beauty, power, and scope … and how we in the Realm had perfected a stupefying version of that wonder, a million worlds guaranteed to be safe and comfortable for the trillions of souls clinging to them'. Locum dislikes the trend of terraforming worlds for ease of living as much as Lei dislikes Locum's NT ethic. Ula, however, is disappointed with Locum's beliefs and goes further, claiming that 'Nature is so much more cruel and honest than you'd ever be'.[11]

Ula tells Locum of an incident in which she re-enacted the ecological collapse through freezing of the original deep sea vent communities on Lei's world, in which she froze herself along with one such community that she had re-established. Locum can only explain this behaviour as a way for her to 'know how if felt' for a species to undergo ecological collapse. She asks Locum '[h]ow do you think it would feel? Your world is thrown free of your sun, growing cold and freezing over … nothing you can do about it… and how would you feel…?', but Locum is unsympathetic because only bacteria perished, '[n]othing sentient'.[12] Her recollection of this affective response toward non-sentient life shows a respect for all life that is unusual in earlier terraforming narratives, which tend to concern themselves only with the preservation of sentient alien life. She relates a childhood story in

[11] 'Shade', pp. 197, 200, 205, 205, 206.
[12] 'Shade', pp. 209, 207, 208.

which her father takes her to a new mine where evidence of the original ecology is preserved as 'striations . . . how layers of bacteria had grown, by the trillion . . . outnumbering the human race', causing her to cry '[b]ecause they had died'.[13] This evocative response is laden with guilt regarding the assumption of humankind's superiority over "lesser" organisms and represents a significant extension of moral awareness to organisms usually excluded from such ethical concern.

The notion of landscaping as both an intellectual and physical process is explicitly related to the concept of the scientific model and simulation:

> Terraformers build their worlds at least twice.
> The first time it is a model, a series of assumptions and hard numbers inside the best computers; and the second time it is wood and flesh, false sunlight and honest sound.
> And that second incarnation is never the same as the model. It's an eternal lesson learned by every terraformer, and by every other person working with complexity.
> Models fail.
> Reality conspires.[14]

The gap between the ideal and the manifest substrates the status of terraformed worlds as models. Within this creative space multiple ideals converge and struggle with one another. As expectation cedes to experience, the complexity of nature leads to a failure of human attempts to shape and control it. The physical space that is terraformed is related to the human mind, which is an internal world: '[m]inds are secretive. And subtle. And molding them is never so easy and clear as the molding of mere worlds, I think'. Locum remembers an incident at the academy on the day of his graduation: an aged teacher asks him '[w]here do these worlds we build actually live'? Her answer, disregarded by Locum at the time, is that they reside '[i]n our minds […] That's the only place they can live for us, because where else can we live?'.[15] These passages reflect a divorce between internal and external worlds; terraforming in this context is a physical process that attempts to make manifest a clash of ideals that seek intellectual and physical resolution.

"A History" features six episodes from the life of the last of the first "atums", a name borrowed from Egyptian mythology referring to the 'god whose task it was to finish the unfinished worlds'.[16] This story features examples of pantropy alongside terraforming, illustrating the close

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[13] 'Shade', p. 208.
[14] 'Shade', p. 204.
[15] 'Shade', pp. 204, 207, 207.
[16] 'History', p. 81.

connection between two motifs that, for reasons of space, this thesis has not delved into. Human bodily modifications in this story include life extending technologies, the miniaturisation of bodies, the substitution of crystalline structures for organic minds and a communal databank for the storage of memories. As a child Simon remembers how the Martian community's hope for a safe Mars drives terraforming, a motive that is grounded in an internalisation of Keekok Lee's Asymmetry Thesis and which ultimately leads to a view of terraforming as a battle against nature. Two collapses of the Martian ecology confirms the early atums' distrust of life in favour of technological solutions that seemingly offer surer control of the environment. Simon, in his later role as chief atum, follows another philosophy that embraces life as offering the most sustainable structure for terraforming. He couples this to an acceptance of local ecological failures as an expression of this life. After a period of galactic warfare, Simon confronts Naomi, a colleague formerly engaged in a genocidal struggle to ensure that events conform to her vision of suitable finished worlds. This episode leads to Simon's execution of Naomi for war crimes, thus affirming his rejection of the mastery of nature and of societies that his conventionally brilliant and successful colleague extols.

Acceptance of the uncertainty that life represents is prefigured by Simon's childhood entanglement with a debate over terraforming Mars. Like Clayborne in Robinson's *Mars* trilogy, Lily works to preserve the original ecology of Mars. Unlike *Mars*, microbial life is proven to exist on the planet; some of the community's members are involved in a preservationist project to collect samples for the "Zoo", a repository of Martian micro-organisms. Simon views this preservation as 'sad', arguing that 'Life should be busy'.[17] At the zenith of his career as chief atum he enacts a plot to protect extra-galactic planets from terraformation by a group of atums who had abandoned the galactic society early in Simon's career, thus ensuring the preservation of indigenous life in those environments.

Simon's stance toward extra-galactic terraforming is built on the idea that people should look toward the quality of their lives within their present environments: '[w]e will embark as soon as we can trust our nature and our institutions not to use this migration as an excuse for easy growth and return voyages of conquest [...]. When we have become adults, finally mature and responsible on all

[17] 'History', p. 88.

occasions [...]'. Fundamentally this story declaims power, celebrates life and asks that humankind matures without losing a sense of wonder toward the universe; in an echo of Laurence Manning's "The Living Galaxy", Simon asserts that 'we will not leave this little realm of ours until we are children again. Wide-eyed, enthralled children who know what they have in their hands and hold it with all the care they possess'[18]. Simon stands as a witness to the struggle that accompanies humankind's colonisation of the galaxy. In his climactic speech, Simon attempts to leave a legacy of wonder and restraint for the civilisations of the future.

Joe Haldeman's "For White Hill" (1995) and Linda Nagata's "Goddesses" (2000) engage with history and the focus on Earth that dominates stories of this period. "For White Hill" takes place on a far future Earth that has been devastated during a conflict known as the "Extermination". The Fwndyri are an alien race responsible for creating nanophages, intelligent nanomachines programmed to deconstruct human DNA and which were later reprogrammed to sterilise life on Earth. In response to this conflict a Council of Worlds headquartered on Earth was formed and several people, like the narrator and White Hill of the title, 'were "bred" for immunity to the nanophages'.[19] The story centres on a competition between selected artists from around the galaxy, the purpose of which is to commemorate the conflict and devastation of Earth:

> Before they reterraformed the Earth, though, they wanted to isolate an area, a "park of memory," as a reminder of the Sterilization and these centuries of waste, and brought artists from every world to interpret, inside the park, what they had seen here.[20]

Among other monuments of Earth's history, the artists tour the Grand Canyon and Chicago, the Pyramids of Giza and Rome for inspiration. During the tour they receive word that the competition has been profoundly changed: '[s]omehow the Fwndyri have found a way to make its [the sun's] luminosity increase'[21]. They have found a way to accelerate the aging process of the sun, thus resuming hostilities with Earth.

Memory is central to this story. The narrator begins by stating that 'I am writing this memoir in the language of England, an ancient land of Earth, whose tales and songs White Hill valued'. White

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[18] 'History', p. 106.
[19] Joe Haldeman, 'For White Hill', in *Worldmakers: SF Adventures in Terraforming*, ed. by Gardner Dozois (New York: St. Martin's Griffin, 2001), pp. 245-276 (p. 246).
[20] Haldeman, pp. 250-251.
[21] Haldeman, pp. 257-259, 260.

Hill tells the narrator that she did not tour the domes for inspiration for her piece because '[a]ll the story's here, anywhere. It isn't really about history or culture'. Petrosian possesses a palindromic mood that allows statements such as 'Dreams feed art and art feeds dreams' to be conveyed by three words–although translating these statements into English makes their meaning uncertain.[22] This awareness of language, of the memories of monuments and of the land itself, is woven into a philosophy that the narrator's relationship with White Hill exposes him to:

> The reality is that it is all one to them. What makes Seldenians so alien is that their need for balance in life dissolves hierarchy: this piece of art is valuable, and so is this orgasm, and so is this crumb of bread. The bread crumb connects to the artwork through the artist's metabolism, which connects to orgasm. Then through a fluid and automatic mixture of logic, metaphor, and rhetoric, the bread crumb links to soil, sunlight, nuclear fusion, the beginning and end of the universe. Any intelligent person can map out chains like that, but to White Hill it was automatic, drilled into her with her first nouns and verbs: Everything is important. Nothing matters. Change the world but stay relaxed.[23]

This is an ecological vision that tackles the problem of meaning. Art, sex and food–all three are equally valuable to life. The narrator continues his reflection on the English language throughout the text, noting earlier that 'England's versatile language, like mine and hers, is strangely hobbled by having the one word, love, stand for such a multiplicity of feelings' and that '[p]erhaps that lack reveals a truth, that no one love is like any other'.[24] Experience is larger than the ability of language to record. Memory itself suffers from the problem of satisfactory representation. The narrator's memoir, and the theme of art itself, offers a potential avenue that the reader is implicitly asked to judge: does his record do justice to the memory of White Hill and his emotional investment over the course of the events of the story?

The problem of making records through art is captured by the aesthetic division between the artists after they receive news of the resumption of conflict with the Fwndyri:

> We had divided into two groups, and jokingly but seriously referred to one another as "originalists" and "realists." We originalists were continuing our projects on the basis of the charter's rules: a memorial to the tragedy and its aftermath, a stark sterile reminder in the midst of life. The realists took into account new developments, including the fact that

[22] Haldeman, pp. 245, 247, 247.
[23] Haldeman, p. 266.
[24] Haldeman, p. 265.

> there would probably never be any "midst of life" and, possibly, no audience, after thirty years.[25]

White Hill claims both sides; the narrator is an originalist. As an empathic therapist and practitioner of "jaturnary", White Hill is able to share the consciousness of the mentally ill and connect them to others.[26] She decides to submerge her ego to join the thousand inhabitants on Earth together in a potentially thousand year cryogenic sleep aboard a spaceship that will allow them to escape the devastation of Earth. The memoir recorded by the narrator is a monument raised to her name. It is to be translated into as close a universal language as Earth's xenobiologists can contrive, cast in a material that will outlast the centuries and appended to a document recording the sum of Terran knowledge,

> a standard book that starts out with basic mathematical principles, in dots and squares and triangles, and moves from that into physics, chemistry, biology. Can you go from biology to the human heart? I have to hope so. If this is read by alien eyes, long after the last human breath is stilled, I hope it's not utter gibberish.[27]

This uncertainty emphasises the transience of language and memory and casts a critical eye over the monuments that are experienced during the tour. Earth in its present state is one such monument, prompting White Hill to exclaim that '[t]his is too big and terrible a thing. I feel like an interloper. They've lived through centuries of this, and now they want us to explain it to them?'.[28]

From an environmental philosophical perspective, this story is a tour de force of landscaping. The way in which humankind copes with both global and private disaster is through an art that wrestles with the status of landscape and memory. Description of the natural landscape, which function as monuments to humankind, illustrate this succinctly: '[t]he first stop [on the tour] that was interesting was the Grand Canyon, a natural wonder whose desolate beauty was unaffected by the Sterilization'. "For White Hill" landscapes space in terms of its relationship to a human past. That the Grand Canyon is unaffected by the Sterilization points toward the autonomous existence of a space that exceeds the human capacity to landscape, and yet the context in which the artists experience this space introduces an aesthetic of loss and desolation by which Earth's monuments are interpreted. The

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[25] Haldeman, p. 267.
[26] Haldeman, p. 252.
[27] Haldeman, p. 275.
[28] Haldeman, p. 254.

natural beauty of the Grand Canyon and its independence from the affairs of sentient beings demonstrates an aspect of the Asymmetry Thesis. Descriptions of Chicago mention its '[a]reas of stunning imaginative brilliance next to jury-rigged junk. And everywhere bones, the skeletons of ten million people, lying where they fell'[29]. The story's use of the dying Earth narrative alongside the terraforming motif generates nostalgia for a natural and cultural past that has been severed through conflict from the present of the story.

Linda Nagata's "Goddesses" exemplifies the increased interest in geoengineering themes in the terraforming narratives of this period. "Goddesses" is told from the perspectives of three people involved in the remediation projects of the two corporations Global Shear in Four Villages, India, and Green Stomp in America, allowing the narrative to map themes across geopolitical boundaries. The narrative questions and attempts to break down assumptions, a principle that Cody of Green Stomp connects to environmental rejuvenation in a manner that echoes Ursula K. Le Guin's use of the wall motif in *The Dispossessed*: '[k]icking apart toxic "non-biodegradable" molecules was a physical thrill. In her mind, it was the same as kicking down the mental walls that fenced people in'. One of the walls that the narrative attempts to address 'said [that] technology must eventually lead to apocalypse, whether through war, engineered disease, overpopulation or pollution'. "Goddesses" is holist in its consideration of the role that corporations should play in addressing issues of health, conflict and responsibility, while it also weighs the impact of traditional socio-cultural views directing public concern. Global Shear and Green Stomp are involved in bioremediation, which attempts to tackle the problem of environmental degradation through the socio-economic re-structuring of society alongside the physical management of the environment via ecopoietic means. Cody is motivated by a personal history of chemical poisoning that seems to leave her barren, a legacy left by corporations with irresponsible policies for the disposal of chemicals. Michael of Global Shear thinks that 'Four Villages was a microcosm of the world and it faced formidable problems – poverty, overpopulation, illiteracy, environmental degradation, and perhaps worst of all, the poison of old ideas – but none of

[29] Haldeman, p. 257.

these challenges was insurmountable'.[30] "Goddesses" clearly marks its structural similarity to the modelling aspect of the terraformed world and relates physical poisons to 'the poison of old ideas'.

Debate in "Goddesses" is spatialised; its structure maps ideas across several domains and contexts. Audio-visual technologies work to foster collaborations between individuals in various continents, thus widening the field of experience available to those with access to these networks. Fundamentalism is critiqued for its inhibition of appropriate adaptations to new social environments, changes that can be traced back to alterations in a society's physical environment. Gharia in India and Cody in America are juxtaposed as examples of two types of fundamentalism: '[b]oth of them had let antique expectations twist the balance of their lives'. Cody's inability to adapt her expectation for a future with daughters motivates her divorce from Michael, while the decreasing population of females in Four Villages prompts Gharia to blackmail Michael with the intention of possessing through marriage the final viewpoint character who is represented in the narrative, the abused widow Rajban. Michael's superior Karen questions his aid to Rajban, arguing that harbouring a widow breaches traditional etiquette and sows distrust amongst the population. Michael, however, realises that it is with the marginalised women of Four Villages that he should be building trust. In response to Karen's reminder that '[y]ou are there to grow an economy, not to rescue damsels in distress', Michael argues that '[d]amsels are part of the economy, Karen. Everyone matters and you know it. The more inclusive the system is, the more we all benefit'.[31] This economic perspective is ecological and bridges physical and social parameters to address the limits of corporate social responsibility.

"Goddesses" is fundamentally a story about ideas, but also about the power of the idea, which is likened to a form of magic. Rajban's personal history is testimony to the mistreatment of women in society, but her narrative trajectory also illustrates how the seed of an idea can take root and grow. Michael's own experience mirrors Rajban's change of consciousness; their interaction begins a process of mutual education and adaptation to new social contexts. Rajban's exposure to the ideas of an all-female group who support each other in business ventures funded by the Southern Banking Alliance culminates first in capitulation to the demands of her husband's family, then in rebellion

[30] Linda Nagata, 'Goddesses', in *Goddesses & Other Stories* (Kula: Mythic Island Press, 2011), pp. 233-336 (pp. 244-245, 245, 335).
[31] 'Goddesses', pp. 323, 335.

against the abuse and the expectations that are demanded of her. An ecological image emblematises the growth of Rajban's rebellion and establishes a new position for her with regard to her moral environment: '[h]er fists clenched as the seed sprouted in a burst of growth, rooting deep down in her gut and flowering in her brain, thriving on the magic soil of new ideas'. As a gardener able to conjure '[l]ife from lifelessness', an ability that Rajban thinks of as 'magic ha[ving] flowed into the soil', she connects this emblem for the power of ideas to take root, grow and change social environments to the physical process of tending a garden. This magic is given sf credibility when it is discovered that her only possession, a pouch of dirt, is 'a natural bioremediation culture, a community of microorganisms fine-tuned for the pollutants particular to the soil around Four Villages', a discovery that offers Rajban economic independence.[32] Terraforming symbolises this interdependence between the idea and its power to change the world.

This emphasis on the past, salient during this period, not only reflects on a history of climate change, planetary adaptation and the building of societies and civilisations, but also meta-textually on the history of terraforming in sf, a notion that Reed's "A History" makes especially clear in its reuse of motifs and ideas from other terraforming stories. These stories reflect elegiacally on colonisation, but dwell on the theme in a more troubled way: the legacy left by other terraforming stories is one that questions and struggles ambivalently with the idea of planetary and societal adaptation. These stories are much less sure of the outcome of terraforming and much more aware of the relationship between the treatment of nature and society. As "Goddesses" exemplifies, a history of environmental degradation from an era of industrial contamination is now firmly integrated into the terraforming megatext. However far sf narratives of terraforming might range, these stories show in microcosm that the tradition comes full circle to reflect back on contemporary Earthbound concerns.

[32] 'Goddesses', pp. 321, 262, 262, 333.

Coda

Terraforming has continued to infiltrate scientific understanding of environmental change on Earth since 2000. The real world example of geoengineering embodied by Ascension Island in the Atlantic, in which Charles Darwin and Joseph Hooker began a project in 1850 to transform the arid volcanic island into its present day forested environment has been acknowledged as an important example of directed environmental change and a premonition of terraforming.[33] In 2012, the three part BBC documentary *How to Grow a Planet* drew on terraforming and Gaian themes to frame its discussion of the evolution of Earth's planetary environment.[34] This thesis has raised the relationship between science and sf on many occasions, but the example of terraforming offers the potential for a more detailed analysis of the feedback between these two areas of discourse, and of the language used to communicate science to the wider public.

Along with the anthology *Worldmakers: SF Adventures in Terraforming* (2001), Gardner Dozois has edited a companion volume dealing with pantropy: *Supermen: Tales of the Posthuman Future* (2002).[35] This thesis has acknowledged the relationship between terraforming and pantropy and has to some extent considered its importance in the context of the former, but a closer examination of the significance of bodily adaptation and planetary colonisation would suitably address an area necessarily given less emphasis in this thesis. Likewise, the links between terraforming and related sf themes that explore ecological ideas would also prove profitable; such themes include ecotastrophe, natural disasters and dying world narratives. The discourse of apocalypse would appear to unite all these themes.

Terraforming has also increasingly infiltrated film and television, featuring as the renegade astronauts' goal in the two part "Space Race" episode of *Archer* (2012)[36] and as a rumoured corporate

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[33] Howard Falcon-Lang, 'Charles Darwin's Ecological Experiment on Ascension Island', *BBC News* (2010) <http://www.bbc.co.uk/news/science-environment-11137903> [accessed 10 July 2012].
[34] *How to Grow a Planet*, dir. by Nick Shoolingin-Jordan (BBC, 2012).
[35] Gardner Dozois, ed., *Worldmakers: SF Adventures in Terraforming* (New York: St. Martin's Griffin, 2001) and *Supermen: Tales of the Posthuman Future* (New York: St. Martin's Griffin, 2002).
[36] "Space Race" parts 1 and 2, *Archer*, created by Adam Reed (FX / Floyd County / Radical Axis, 2012).

agenda in Riddley Scott's *Prometheus* (2012).[37] Although this thesis has discussed William Cameron Menzies' *Things to Come* (1936)[38] and James Cameron's *Avatar* (2009),[39] further research into the terraforming motif in film and television is called for. Examples of relevant texts include David Lynch's *Dune* (1984),[40] the *Star Trek: The Next Generation* episodes "Home Soil" (1988) and "Family" (1990),[41] the *Star Trek II* movie *The Wrath of Khan* (1982),[42] Joss Whedon's *Firefly* (2002) series and the *Firefly* film *Serenity* (2005),[43] and anime such as *Origin: Spirits of the Past* (*Gin-iro no kami no Agito* 2006).[44] This attention to terraforming in other media can be extended to that of computer gaming: Lovelock assisted with the design of the simulation game *SimEarth: The Living Planet* (1990).[45] Together with such real time strategy games as *Dune II: The Building of a Dynasty* (1992)[46] and *Sid Meier's Alpha Centauri* (1999),[47] and such 3D shooters as *Red Faction* (2001),[48] there is ample potential for an investigation of terraforming in multiple media.

This thesis has necessarily examined only the dominant trends in the development of the terraforming motif in sf. In addition to the many novels, short stories and poetry that this thesis has not been able to examine, further study of the feedback between science and sf and a more detailed consideration of the motif's appearance in other textual formats, including film, television, art and games, will undoubtedly uncover subtler or more localised trends that may yield new insight into the development of the terraforming narrative and its place as a master motif for contemporary environmental thought.

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[37] *Prometheus*, dir. Ridley Scott (Scott Free / Brandywine, 2012).
[38] *Things to Come*, dir. by William Cameron Menzies (London Films, 1936).
[39] *Avatar*, dir. by James Cameron (Twentieth Century Fox, 2009).
[40] *Dune*, dir. by David Lynch (De Laurentiis, 1984).
[41] "Family" (1990) and "Home Soil" (1988), *Star Trek: The Next Generation*, created by Gene Roddenberry (Paramount).
[42] *Star Trek II: The Wrath of Khan*, dir. by Nicholas Meyer (Paramount, 1982).
[43] *Firefly*, created by Joss Whedon (Mutant Enemy / 20th Century Fox, 2002-2003) and *Serenity*, dir. by Joss Whedon (Universal / Barry Mendel, 2005).
[44] *Origin: Spirits of the Past* (*Gin-iro no kami no Agito*), dir. by Keiichi Sugiyama (Gin-iro no Kami no Agito Production Committee / Gonzo / Media Factory, 2006).
[45] *SimEarth: The Living Planet*, designed by Will Wright (Maxis, 1990).
[46] *Dune II: The Building of a Dynasty*, designed by Joseph Bostic, Aaron E. Powell and Brett Sperry (Westwood Studios, 1992).
[47] *Sid Meier's Alpha Centauri*, designed by Brian Reynolds, Michael Ely, Bing Gordon and Sid Meier (Firaxis Games, 1999).
[48] *Red Faction*, designed by Volition, Inc (Volition, Inc, 2001).

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