



UNIVERSITY
OF WOLLONGONG
AUSTRALIA

University of Wollongong
Research Online

University of Wollongong Thesis Collection
1954-2016

University of Wollongong Thesis Collections

2003

Exploration without boundaries: virtual voyages into virtual landscapes

Hilary Frances Rhodes
University of Wollongong

UNIVERSITY OF WOLLONGONG

COPYRIGHT WARNING

You may print or download ONE copy of this document for the purpose of your own research or study. The University does not authorise you to copy, communicate or otherwise make available electronically to any other person any copyright material contained on this site. You are reminded of the following:

This work is copyright. Apart from any use permitted under the Copyright Act 1968, no part of this work may be reproduced by any process, nor may any other exclusive right be exercised, without the permission of the author.

Copyright owners are entitled to take legal action against persons who infringe their copyright. A reproduction of material that is protected by copyright may be a copyright infringement. A court may impose penalties and award damages in relation to offences and infringements relating to copyright material. Higher penalties may apply, and higher damages may be awarded, for offences and infringements involving the conversion of material into digital or electronic form.

Recommended Citation

Rhodes, Hilary Frances, Exploration without boundaries: virtual voyages into virtual landscapes, D.C.A. thesis, Faculty of Creative Arts, University of Wollongong, 2003. <http://ro.uow.edu.au/theses/350>

Research Online is the open access institutional repository for the University of Wollongong. For further information contact the UOW Library: research-pubs@uow.edu.au

NOTE

This online version of the thesis may have different page formatting and pagination from the paper copy held in the University of Wollongong Library.

UNIVERSITY OF WOLLONGONG

COPYRIGHT WARNING

You may print or download ONE copy of this document for the purpose of your own research or study. The University does not authorise you to copy, communicate or otherwise make available electronically to any other person any copyright material contained on this site. You are reminded of the following:

Copyright owners are entitled to take legal action against persons who infringe their copyright. A reproduction of material that is protected by copyright may be a copyright infringement. A court may impose penalties and award damages in relation to offences and infringements relating to copyright material. Higher penalties may apply, and higher damages may be awarded, for offences and infringements involving the conversion of material into digital or electronic form.

Note: The print copy of this thesis came in a box set with the following items.

1. Invitation, passport & postcards
2. The Explorers Guide
3. Documentary video of exhibition & presentation on CD ROM
4. An interactive multimedia adventure version 1.0
5. Audio CD
6. Appendix D: Index of Researched .pdf files on CD ROM

These are available with the print copy of the thesis in the Library.

Exploration Without Boundaries: Virtual Voyages into Virtual Landscapes

A thesis submitted in partial fulfilment of the degree

Doctor of Creative Arts

from

The University of Wollongong

by

Hilary Frances Rhodes

Grad. Dip. Design, University of Technology, Sydney (1994)

Master of Design (Digital Media), University of Western Sydney (1997)

Grad. Dip. Vocational Education and Training, University of Technology, Sydney (1999)

The Faculty of Creative Arts

2003

Certification

I, Hilary Frances Rhodes, declare that this thesis, submitted in partial fulfilment of the requirements for the award of Doctor of Creative Arts, in the Faculty of Creative Arts, University of Wollongong, is wholly my own work unless otherwise referenced or acknowledged. The document has not been submitted for qualifications at any other academic institution.

Hilary Frances Rhodes,

25 February 2003

Acknowledgments.

Thanks to the many who contributed their valuable time and effort in facilitating my virtual journeys.

To my partner, Graeme Stentiford for supporting me over the years in this endeavour as well as helping with many of the more laborious tasks of putting together the gallery installation and for his endless patience and cups of tea.

To my supervisor, Associate Professor Dr. Diana Wood-Conroy who was always there to support me in both my real and virtual explorations with invaluable advice and meticulous observations.

To Associate Professor Dr. Stephen Ingham.

To Dr. Kurt Brereton for his excellent advice over the years.

To the staff of the Faculty of Creative Arts for their organisational and technical support.

To John Marthick, Faculty of Geosciences for assistance with the Digital Elevation Map originating from the NSW Land Information Department in Bathurst.

To Steve Kilgannon, Computer Systems Officer at NADC (Nepean Arts and Design Centre) at Western Sydney Institute of TAFE, Kingswood, for patiently assisting me with the large format printing and photocopying.

To my colleagues at NADC for support and allowing me time off to complete this project, as well as permission to use the facilities for the production of the exhibition.

To my design diploma students at NADC for putting up with my all-consuming obsession, beta-testing my project and providing me with valuable feedback and interested support.

Finally, to Benoit Mandelbrot, Kenton Musgrave, Eric Wenger and Kai Krause, for developing the tools that enabled me to explore boundless fractal plains and lose myself in virtual landscapes.

Exploration Without Boundaries: Virtual Voyages into Virtual Landscapes

Abstract

Exploration Without Boundaries is a visual digital media exploration reflecting industrial, technological and environmental change over time. It comprises an interactive CD ROM, a book, and a gallery installation. *Exploration Without Boundaries* is distinctive in that it describes natural and imagined worlds in the virtual domain with materials described entirely by means of algorithms and fractals, rather than from photographic textures.

This document is an exegesis that assists the viewer in understanding the complexities of *Exploration Without Boundaries* and to place it in an historical and social context. It addresses aspects of particular theories and issues pertinent to the work, for instance aesthetics, fine art, mathematics and cultural studies.

I consider aspects of utopian and dystopian environments in the historical context of virtual reality, its technology and literature. Importantly I consider the relationship of the real and virtual worlds, and provide an overview of Land Art, an influential art movement of the 1970s, by comparing the creation of spatial constructs in the real world with generating land forms in the virtual world, and place *Exploration Without Boundaries* in the context of art work in the landscape. In particular, I present two case studies of noted Land Art artists, Robert Smithson (1938-1973 US) and Richard Long (b. 1945 UK).

Navigation, mapping and orientation are all important concepts in *Exploration Without Boundaries*, therefore I provide information concerning topographic and diagrammatic mapping as they relate to computer games and environments. Also I compare the environments of *Exploration Without Boundaries* with those of two other interactive CD ROMs: *Eve* (1996) by Peter Gabriel, (b. 1950 UK) and *Puppet Motel* (1995) by Laurie Anderson (b. 1947 US).

Neither the process nor the production of *Exploration Without Boundaries* can be separated from its technological origins, therefore I discuss work done by Benoit Mandelbrot (b. 1924 Warsaw, now resident in USA), Kenton Musgrave (b. 1955, USA) and Eric Wenger, (b. 1960 France, now resident in USA) in developing the tools for synthesising mathematically described textures.

In an autobiographical context, I examine some of the historical and theoretical aesthetics underlying *Exploration Without Boundaries*, and describe the landscape as seen from an ironic post-modern view of the colonial perspective. Finally, I provide a description of the content of both the gallery installation and the interactive CD ROM and the structure and symbolism of *Exploration Without Boundaries*.

Contents

Introduction. Introduction to the digital media project, <i>Exploration Without Boundaries</i>	1
The Chapters.	3
Chapter 1: Material: Infinite fractal coastlines	4
1.1. Fractals, Nature and Algorithmic Art	4
1.2. A Brief Historical Outline of the Development of Fractal Geometry	7
1.3. Benoit Mandelbrot	8
1.3.1. Mandelbrot's Early Research	9
1.3.2. Mandelbrot, Modernism and Formalism	9
1.4. Musgrave and Conceptual Considerations in the Creation of Virtual Worlds	10
1.5. Eric Wenger and the Synthesiser Paradigm	12
1.6. Fractals, Virtual Reality and Psychedelia in a Cultural Context	14
1.6.1. Fractal Imaging and Computer Aided Psychedelic Experiences: a Self Similarity	18
1.6.2. Psychedelic Trips Made in <i>Bryce</i>	19
1.7. Mathematics Expressed in Visual Art	20
1.7.1. Patterns in Mathematics in Science and Art	21
1.8. Fractal Infinity in the Virtual Environment	23
1.9. Playing God in the Creation of Realistic Virtual Landscapes	26
1.10. Conclusion: <i>Exploration Without Boundaries</i> , More than the Sum of its Fractals	27
Chapter 2: Virtual Space: <i>Exploration Without Boundaries</i> in context	
2.1. Definitions	29
2.1.1. Virtual: Adjective	29
2.1.2. Real: Adjective	29
2.1.3. Virtual Reality	30
2.2. Aspects of Virtual Reality in Literature and Film	30
2.3. Technological Utopia and Dystopia	30
2.4. The Military Origins of Computer Technology and Virtual Reality	33
2.5. Types of Virtual Reality and their Relation to <i>Exploration Without Boundaries</i>	34
2.6. The Artist and the Process of Making a Virtual 3-D Digital Landscape	35
2.7. The Process of Creating Virtual Worlds	36
2.8. Modernism, the Grid and Virtual Reality	37
2.9. In Conclusion	39

Chapter 3: Landscape: Virtual and Real	41
3.1. Brief Historical and Cultural Underpinnings of Land Art	41
3.2. The Documentation of Land Art	44
3.3. Case Studies of Contrasting Works by Two Land Art Artists, Robert Smithson (1938–1973 USA) and Richard Long (b. 1945 UK)	47
3.3.1. <i>Spiral Jetty</i> (1970) by Robert Smithson	48
3.3.2. Richard Long (b. 1945), <i>Pick Up Sticks</i> (1980): A Study in the Art of Travel	49
3.4. The Digital and the Physical – Creating Virtual Land Art	50
3.5. Viewing Virtual Places and Land Art	52
3.6. Eric Wenger (b. 1960), Land Art and <i>Bryce</i>	52
3.7. <i>Bryce</i> as the ideal software for the creation of <i>Exploration Without Boundaries</i>	57
3.8. Poem: <i>Pick Up Sticks</i>	57
3.9. Conclusion	60
Chapter 4: Navigation in the Virtual World	61
4.1. The Virtual Map as Simulacrum	61
4.2. Mapping in Virtual Domains and Spatial Paradigms	63
4.2.1. Conceptual Spatial Mapping	63
4.2.2. Topographic and Location Mapping	64
4.3. The Habitation of Virtual Cities and Virtual Worlds	65
4.4. The Map as a Virtual and Symbolic Landscape	66
4.5. The Development of Interactive Spatial Environments in Digital Games	67
4.6. Navigation Structure and Multimedia Authoring Packages	68
4.7. The Structure of the <i>Exploration Without Boundaries</i> Interactive CD ROM	70
4.8. Games and the Imagined Environment	72
4.9. Mapping Narratives in Virtual Environments	73
4.10. Metaphors of Travel and Locality in Interactive Productions	74
4.11. A Comparison Between the Environments in <i>Exploration Without Boundaries</i> , <i>Eve</i> and <i>Puppet Motel</i>	77
4.12. Simulated Space and Place	78
4.13. Conclusion	79
Chapter 5: Exploration: Toward the Unknown Region	80
5.1. The Sublime Landscape	80
5.2. Colonial romanticisation of travel	82
5.3. Influence of Colonial Illustration	84
5.4. Romantic Travellers in the Landscape	85

5.5. Panoramic Landscape in Film as Virtual Reality	87
5.6. On the Road: Movie and Motel	89
5.7. Film and Virtual Reality, a Comparison	90
5.8. A Traveller's Autobiography	90
5.8.1. Living in South Africa During the 1950s and 1960s	91
5.8.2. Overland Trips	94
5.9. Catharsis of Travel	95
5.10. Conclusion	98
Chapter 6: Realisation: <i>Exploration Without Boundaries</i>	99
6.1. The Gallery Installation	99
6.2. The Main Components of <i>Exploration Without Boundaries</i>	100
6.2.1. The Structure of <i>Exploration Without Boundaries</i> Interactive CD ROM	101
6.3. Icons of Exploration and Orientation	103
6.3.1. The Maze	104
6.3.2. Compass	105
6.3.3. The Power Pylons	106
6.3.4. Passports and Maps	107
6.3.5. Spirals, Datum Mark and Double Cross arrow	108
6.3.6. The Vista Cubes	108
6.4. The Virtual Regions	109
6.4.1 The Virtual Gallery	109
6.4.2 The Regions	110
6.5. The Audio in the Installation and Interactive CD ROM	122
6.6. In Conclusion, Replicating Travel in the Virtual World	123
Appendix A: Craft and Skill Base	126
A.1. Family Background – Fascination With Patterns	126
A.2. Model Making and Technical Drawing	126
A.3. Influences of 1960s and 1970s Illustration	127
A.4. Participation in the Wollongong <i>Biennale</i>	128
A.5. Assorted Examples of Previous Work	129
A.6. Earlier work in <i>Bryce</i>	131
A.7. An Abridged Curriculum Vitae	133
A.7.1. Qualifications	133
A.7.2. Selected Appointments and Relevant Employment	133
A.7.3. Group Exhibitions	133

Appendix B: Technical Procedures in the Creation of <i>Exploration Without Boundaries</i>	134
B.1. Introduction	134
B.2. Hardware	134
B.3. Applications	135
B.4. Models	139
B.5. Regional Considerations	140
B.6. <i>QTVR QuickTime</i> Movies	143
B.6.1 <i>QTVR</i> Cubic Movies	144
B.6.2. Assembling the <i>QTVR</i> Cubic Movies for Interactivity	144
B.7. Audio	145
B.8. Producing the Final Interactive in MacroMedia <i>Director</i>	145
B.9. Technical Problems Encountered	145
Appendix C: A Short History of <i>Bryce</i>: Company, Community and Artists	146
C.1. Overview	146
C.2. The <i>Bryce</i> Developers	146
C.3. <i>Kais Power Tools</i> and Graphics Software Development	147
C.4. Kai Krause on AOL and his Influence in the Digital Imaging Community	147
C.5. Further Development of the <i>KPT Photoshop</i> Plug-ins	148
C.6. Krause: a Brief Biography	149
C.7. Early Audio and Graphic Software Experiments	149
C.8. The Charisma and Personality of Krause	150
C.9. Eric Wenger, 'Father' of <i>Bryce</i>	151
C.10. A Brief History of the Evolution and Changes within the Company	152
C.11. Purpose of <i>Bryce</i>	154
C.12. The <i>Bryce</i> Community Online	155
C.13. Genres of Work Created in <i>Bryce</i>	155
C.14. A selection of Works by Prominent <i>Bryce</i> Artists	156
Appendix D: Index of Researched .pdf files on CD ROM	157
Glossary	158
Bibliography	159
Figure Credits	169
Appendix E: Developmental Sketches and Research	
The material in this section comprises the initial sketches of the work, as well as a very small section of the visual research undertaken.	

List of Figures

Figure 1.	Synthesiser interface of the texture editor in <i>Bryce 2</i>	4
Figure 2.	The classic Mandelbrot Set	5
Figure 3.	Geometry, fractals and nature	6
Figure 4.	Leonardo Da Vinci, turbulent waters	6
Figure 5.	Space-filling Peano curve	7
Figure 6.	Menger sponge	7
Figure 7.	Sierpinski gasket on balloon canopies in <i>Bryce</i>	7
Figure 8.	Development of the Koch Curve	7
Figure 9.	Escher and Sierpinski gasket on Ravello Cathedral pulpit	8
Figure 10.	<i>Blessed State</i> , Kenton Musgrave – early fractal landscape	10
Figure 11.	Musgrave article about fractals in <i>Scientific American</i>	11
Figure 12.	Eric Wenger at MacWorld with <i>Bryce</i> landscape	12
Figure 13.	The <i>Bryce 5</i> texture synthesiser and application filters	13
Figure 14.	Lurid computer fractal imagery	14
Figure 15.	LSD ‘tab’ art	14
Figure 16.	Michael English, <i>AMEN</i>	15
Figure 17.	Roger Dean, <i>Close to the Edge</i> fantasy landscape	15
Figure 18.	Tony Edwards, Captain Goodvibes flying through arches	16
Figure 19.	Satty, psychedelic vortex collage in the <i>Archaic Revival</i>	16
Figure 20.	Fantasy castle at Burning Man	17
Figure 21.	Macintosh iTunes synaesthetic audio player	17
Figure 22.	Lightshow by the <i>Sensual Laboratory</i>	17
Figure 23.	<i>Planetary Traveller</i> video	19
Figure 24.	‘Vasarely’ image generated by <i>ArtMatic</i>	20
Figure 25.	Victor Vasarely, <i>VP-115</i>	20
Figure 26.	Mauritz Escher, <i>Relativity</i>	20
Figure 27.	H. Rhodes, 3-D <i>Bryce</i> interpretation of <i>Relativity</i>	20
Figure 28.	H. Rhodes, <i>Falling Through Time</i> , Pastance CD cover	21
Figure 29.	H. Rhodes, Bargello tapestry	21
Figure 30.	Eleanor Kent, <i>5 Knitted Fractals</i>	21
Figure 31.	Jacquard Loom and punch cards	22
Figure 32.	Enlargement of integrated circuit	22
Figure 33.	<i>Bryce</i> texture synthesiser showing three components of a texture	23
Figure 34.	H. Rhodes, <i>Plateau of Mirrors</i> , a VR expression of infinity	24

Figure 35.	K. Musgrave's <i>Mojoworld</i> , landscape with GPS	24
Figure 36.	H. Rhodes, <i>The Planetarium of Infinity</i> , entrained worlds in a trefoil knot	24
Figure 37.	M. C. Escher, <i>Möbius Strip I</i> , woodcut	25
Figure 38.	M. C. Escher, <i>Trefoil Knot</i> , drawing	25
Figure 39.	H. Rhodes, <i>Virtual Klein Bottle, 2001</i> , 3-D interpretation of 4-D endless space	25
Figure 40.	A. Brown, Kai Krause as digital guru, a colour illustration	26
Figure 41.	B. Mandelbrot, <i>God Creates Waves</i> , fontispiece of a French Bible Moralisée	26
Figure 42.	Pearce, a photograph of someone wearing a virtual reality headmount	30
Figure 43.	Warner Bros, inside <i>The Matrix</i>	31
Figure 44.	The Tyrell Corporation in <i>Bladerunner</i> ,	31
Figure 45.	<i>Metropolis</i> , part of opening sequence	32
Figure 46.	Edwin Link and his flight simulator	33
Figure 47.	The flight simulator in the Powerhouse Museum, Sydney	34
Figure 48.	Molecules, a simulated 3-D view	34
Figure 49.	<i>The Wedge</i> , Powerhouse Museum, Sydney	34
Figure 50.	The Cartesian grid in the <i>Bryce 5</i> environment	36
Figure 51.	Hajo Rose, a Bauhaus print formed by typed patterns	37
Figure 52.	<i>Column Museum</i> , showing many possible forms of columns	37
Figure 53.	Sol de Wit, <i>Floor Piece #4</i> , a painting showing the modernist grid	38
Figure 54.	A chip, or integrated circuit highly magnified, showing maze/grid patterns	38
Figure 55.	H. Rhodes, space scene of south-south-west region, <i>Exploration Without Boundaries</i>	39
Figure 56.	H. Rhodes, industrial scene from the <i>Era of Power, Exploration Without Boundaries</i>	39
Figure 57.	Duisberg-North Park, an industrial project in Germany	39
Figure 58.	Scene from <i>Riven</i>	40
Figure 59.	James Turrell, an aerial view of <i>Roden Crater</i> , Arizona	41
Figure 60.	De Maria, <i>Lightning Field</i>	42
Figure 61.	Robert Morris, <i>Observatory</i> , 1971, The Netherlands	42
Figure 62.	Michael Heizer, <i>Complex 1/City</i> , 1968	42
Figure 63.	H. Rhodes, a photograph of cave dwellings at Gôremé, Turkey	43
Figure 64.	Stonehenge, an aerial view	43
Figure 65.	W. H. Jackson, <i>Mountain of the Holy Cross</i> , 1873	43
Figure 66.	The Ziggurat, a photograph of the tapering spiral tower at Sammara, 'Iraq	43
Figure 67.	Richard Fleischner, <i>Sod Maze</i> , 1974, Rhode Island, an aerial view	44
Figure 68.	H. Voth, <i>Himmelstreppe</i> , (Sky Stairway) 1984, Morocco	44
Figure 69.	J. Pierce, <i>Triangular Redoubt</i> , 1971, Pratt Farm	44

Figure 70.	Image from an educational geology video for the BBC, in <i>Bryce</i>	44
Figure 71.	R. Smithson, drawing for <i>Asphalt Rundown</i>	45
Figure 72.	R. Smithson, <i>Asphalt Rundown</i> , 1969, Rome, Italy	45
Figure 73.	Some of Smithson's documentation of <i>Spiral Jetty</i>	45
Figure 74.	Nancy Holt, a map to locate a buried poem	45
Figure 75.	Richard Long, <i>Walking a line in Peru</i> , 1972	46
Figure 76.	R. Smithson, <i>Spiral Jetty</i> , 1970, Rozel Point, Salt Lake, Utah	46
Figure 77.	R. Smithson, location map of <i>Spiral Jetty</i>	47
Figure 78.	Nico Israel, <i>Spiral Jetty</i> underwater	47
Figure 79.	Nico Israel, <i>...abandoned Hope...</i>	48
Figure 80.	R. Smithson, <i>Spirals</i>	48
Figure 81.	H. Rhodes, fractal textures for the surface of a terrain	49
Figure 82.	Richard Long, <i>California Wood Circle</i> , 1976, a photograph of an installation	50
Figure 83.	Richard Long, <i>A Line in Scotland Cul Mór</i> , 1981	50
Figure 84.	Virtual sculpting of the land: simulating erosion in <i>Bryce</i>	50
Figure 85.	Richard Serra, <i>Tilted Arc</i> , a large public steel sculpture	51
Figure 86.	Eric Wenger, <i>Spiral</i> , virtual Land Art, 1998	52
Figure 87.	Eric Wenger, <i>Stone Circle</i> , virtual Land Art, 1998	53
Figure 88.	Eric Wenger, <i>Spiral</i> , virtual Land Art, 1998	53
Figure 89.	Eric Wenger, <i>Coloured shapes day</i> , virtual Land Art, 1998	53
Figure 90.	Eric Wenger, <i>Coloured shapes night</i> , virtual Land Art, 1998	53
Figure 91.	Aerial photograph of the desert site of Burning Man	54
Figure 92.	Eric Wenger, <i>Rocks and Ice</i> ,	54
Figure 93.	Bill Nieffeneger, Kai as <i>Photoshop</i> Icon	55
Figure 94.	NSW South Coast Digital Elevation Map converted to a greyscale height map	62
Figure 95.	H. Rhodes, <i>Kurnell from the air...</i> , a virtual view	62
Figure 96.	Marshall Islands navigation map	63
Figure 97.	<i>Neuromancer</i> , the cover of the book	63
Figure 98.	Digital Elevation Map of Royal National Park converted to a greyscale height map	64
Figure 99.	Map of habitation patterns of <i>AlphaWorld</i>	65
Figure 100.	<i>Map.Net's</i> 3-D cityscape view of the world wide web	65
Figure 101.	<i>Two city maps: Noll's Rome and Apple's eWorld</i>	66
Figure 102.	H. Rhodes, <i>Virtual Port Kembla Harbour</i> , the map as territory	67
Figure 103.	<i>Spacewar!</i> the first interactive screen-based computer game	67
Figure 104.	Part of <i>Lord of the Rings</i> locality map	68

Figure 105.	The SCA (Society of Creative Anachronism) – a feast in progress	68
Figure 106.	<i>Caverns of Zen</i> , a text adventure game	68
Figure 107.	Kripalani, <i>Legacy of Time</i> , Himalayan scene	70
Figure 108.	Diagram of structure of <i>Exploration Without Boundaries</i>	71
Figure 109.	Scene from <i>Riven (Myst II)</i> , ride to the gas island	72
Figure 110.	Map of <i>Myst Island</i> , a navigational aid for a virtual journey	73
Figure 111.	3-D map of <i>Edanna</i> in <i>Myst III Exile</i>	74
Figure 112.	Peter Gabriel, <i>Mud</i> – the elemental state, a scene from <i>Eve</i>	75
Figure 113.	Peter Gabriel, <i>The Garden</i> - an idyllic pastoral setting, a scene from <i>Eve</i>	75
Figure 114.	Peter Gabriel, <i>Profit</i> - a polluted industrial landscape, a scene from <i>Eve</i>	75
Figure 115.	Peter Gabriel, <i>Paradise . . .</i> a scene from <i>Eve</i> embodying renewal	75
Figure 116.	Laurie Anderson, <i>Puppet Motel . . .</i> the main screen, showing passage and portals	76
Figure 117.	Laurie Anderson, <i>Puppet Motel</i> 1995, motel bedroom scene	77
Figure 118.	H. Rhodes, North-east <i>Primæval Era</i> panorama, <i>Exploration Without Boundaries</i>	77
Figure 119.	John Ross, <i>A Remarkable Iceberg</i> , from <i>Voyage of Discovery</i> , 1819	80
Figure 120.	Albert Bierstadt, <i>The Rocky Mountains</i> , 1863, a sublime oil painting	80
Figure 121.	Illustrations by Ruskin and Turner, from <i>How to look at Mountains</i>	81
Figure 122.	Berann, panorama of Yellowstone National Park	81
Figure 123.	Heck, <i>Forms of Clouds</i> , a storm at sea	82
Figure 124.	Heck, <i>Primitive Forest of Brazil</i> , a rainforest scene with explorer and indigenes	82
Figure 125.	T. and W. Daniell, <i>Giants Causeway</i> , a well known rock formation in Ireland	83
Figure 126.	Charles Doughty, <i>Encampment of the Billi Aarab</i> , a desert scene	84
Figure 127.	Heck, an illustration of the rare triple rainbow	85
Figure 128.	Wilfred Thesiger, <i>A valley in Hunza, Northern Pakistan</i>	85
Figure 129.	A postcard of the Alpine resort of Schmitenhöhe	86
Figure 130.	Thomas Baldwin, <i>A Balloon Prospect From Above the Clouds</i>	87
Figure 131.	Bertrand, <i>Wadi Rumm</i> , an aerial view of rock formations	88
Figure 132.	Denis Hopper, <i>Easy Rider</i> , a scene from the classic 'road movie'	88
Figure 133.	H. Rhodes, <i>On the Road, Era of Power (south-west)</i> , <i>Exploration Without Boundaries</i>	89
Figure 134.	Edward Hopper, <i>Gas</i>	89
Figure 135.	Cinerama audience, 1954	90
Figure 136.	BOAC Lockheed Constellation aeroplane at Heathrow, 1946	90
Figure 137.	H. Rhodes, <i>Dusty, dry Johannesburg in winter</i> , 1971	91
Figure 138.	Clive van den Berg, <i>Mine Dump Project</i> for Johannesburg <i>Biennale</i> , 1995	92
Figure 139.	H. Rhodes, <i>Main road to Maseru, Lesotho</i> 1971	93

Figure 140.	<i>Ouaouzagour, in the Draa Valley, Morocco</i>	94
Figure 141.	<i>Ourzazate, the castellated kasbah</i>	94
Figure 142.	<i>Toufliat, in the High Atlas</i>	94
Figure 143.	H. Rhodes, <i>Syrian desert, 1973</i>	95
Figure 144.	T. Rhodes, <i>Hilary looking down on the Kabul Gorge, Afghanistan, 1971</i>	95
Figure 145.	H. Rhodes, <i>Hunter Valley Balloon Trip, 1984</i>	96
Figure 146.	T. Rhodes, <i>Hilary on deck, Pendennis Castle, 1971</i>	96
Figure 147.	T. Rhodes, <i>Looking out of windows, Malaysia, 1971</i>	96
Figure 148.	Augustus Egg, <i>Travelling Companions, 1862</i>	97
Figure 149.	Navigation Structure of <i>Exploration Without Boundaries</i>	102
Figure 150.	The Maze, detail, and photograph of the installation maze	103
Figure 151.	The maze-like appearance of a computer micro devices chip	103
Figure 152.	H. Rhodes, the in-ground reservoir maze in <i>Exploration Without Boundaries</i>	104
Figure 153.	The large stone labyrinth on Jungfrau Island, Sweden	104
Figure 154.	H. Rhodes, face of Victorian compass, featured in <i>Exploration Without Boundaries</i>	105
Figure 155.	H. Rhodes, rendered 3-D virtual compass	105
Figure 156.	H. Rhodes, virtual high-tension pylon	106
Figure 157.	H. Rhodes, virtual power pylon and dam, <i>Era of Power</i>	106
Figure 158.	H. Rhodes, passport in <i>Era of Exploration</i> scenes	107
Figure 159.	Part of map used in the <i>Era of Power</i> scenes	107
Figure 160.	Palæolithic rock drawings in the Lascaux caves, France	108
Figure 161.	Trigonometric station at Mount Canabolas, near Orange	108
Figure 162.	H. Rhodes, Vista Cube of the south-south-west, <i>Exploration Without Boundaries</i>	108
Figure 163.	Models of vista cubes and panoramas, made from printed cell	109
Figure 164.	Heck, cloud formation and light	110
Figure 165.	H. Rhodes, 3-D theodolite in <i>Exploration Without Boundaries</i>	110
Figure 166.	H. Rhodes, <i>Chill Out</i> billboard, northern region, <i>Exploration Without Boundaries</i>	110
Figure 167.	Ansel Adams, <i>Transmission lines in Mojave Desert, 1941</i>	111
Figure 168.	H. Rhodes, <i>Spillway Thrills</i> , dam and pylon billboard, <i>Era of Power</i>	111
Figure 169.	Rubbing of a stone map of Hua Shan, 1700	111
Figure 170.	H. Rhodes, <i>Offshore Las Palmas, 1971</i>	112
Figure 171.	H. Rhodes, east-north-east in the <i>Era of Power, Exploration Without Boundaries</i>	112
Figure 172.	H. Rhodes, <i>On the Beach</i> billboard, east-north-east, <i>Exploration Without Boundaries</i>	112
Figure 173.	H. Rhodes, <i>Desert scent with tents...</i> , Jordan, 1971	113
Figure 174.	H. Rhodes, eastern billboard, desert scene, <i>Exploration Without Boundaries</i>	113

Figure 175.	Valve from gas island scene in <i>Riven</i> , 1997	114
Figure 176.	H. Rhodes, water pump and aqueducts in the <i>Era of Power</i>	114
Figure 177.	H. Rhodes, <i>On the Road to Shiraz, Iran</i> , 1973	114
Figure 178.	Detail, locality map of Hasa Oasis, Arabia	114
Figure 179.	H. Rhodes, <i>Doughty Adventures</i> south-east billboard, <i>Exploration Without Boundaries</i>	114
Figure 180.	H. Rhodes, <i>Balloons over African Plains</i> , 2002	115
Figure 181.	Sextants for reference	115
Figure 182.	Nissen hut for construction reference	115
Figure 183.	H. Rhodes, <i>Scotties... Camps</i> south billboard, <i>Exploration Without Boundaries</i>	115
Figure 184.	Siliceous sinter pattern in Champagne Pool	116
Figure 185.	Tesla coil emitting sparks	116
Figure 186.	Stone circle	116
Figure 187.	Roger Dean, <i>A View Over Atlantis</i> , book cover illustration, 1972	116
Figure 188.	<i>Hipgnosis</i> , hillside chalk carving, front cover illustration, 1974	117
Figure 189.	H. Rhodes, <i>Magic... Tours</i> south-west billboard, <i>Exploration Without Boundaries</i>	117
Figure 190.	Badlands	117
Figure 191.	Exploration nostalgia on a wall in a parking lot	117
Figure 192.	H. Rhodes, <i>Virtual yellow beetle</i> , west-south-west, <i>Exploration Without Boundaries</i>	118
Figure 193.	H. Rhodes, <i>Looking south from the northern clifftop at Garie Beach</i> , 1988	118
Figure 194.	DEM (Digital Elevation Map) of NSW Royal National Park, greyscale height map	118
Figure 195.	H. Rhodes, <i>Visit Beautiful Era Beach</i> billboard, <i>Exploration Without Boundaries</i>	119
Figure 196.	A Victorian mine pithead, Gold Reef City theme park, Johannesburg	119
Figure 197.	Pithead and dump along the Main Reef Road, Johannesburg	119
Figure 198.	H. Rhodes, <i>Alien Abduction</i> west-north-west billboard, <i>Exploration Without Boundaries</i>	120
Figure 199.	H. Rhodes, 'A knotted circus tree', 2002. Also inset sycamore knot	120
Figure 200.	Rod Irving, <i>Crop circles</i>	121
Figure 201.	H. Rhodes, <i>Power Towers</i> north-north-west billboard, <i>Exploration Without Boundaries</i>	121
Figure 202.	The <i>MetaSynth</i> interface, U&I Software-	122
Figure 203.	H. Rhodes, a coal loader, hand drawn and airbrushed	126
Figure 204.	Michael English, hand-rendered carriage wheel	127
Figure 205.	Roger Dean, a fantasy dwelling	127
Figure 206.	H. Rhodes, one postcard print from <i>Re/brand?</i> 2000 Exhibition	128
Figure 207.	H. Rhodes, <i>Fractured Landscape</i> , 1971	129
Figure 208.	H. Rhodes, <i>Citadel</i> 1969	129
Figure 209.	H. Rhodes, <i>Gothic memories</i> , 1971	129

Figure 210.	H. Rhodes, <i>Exhibition poster for design school</i> 1980	129
Figure 211.	H. Rhodes, <i>H</i> , 1980	129
Figure 212.	H. Rhodes, <i>Per Airbrush ad Astra</i> , 1986	129
Figure 213.	H. Rhodes, <i>Berber Group</i> , 1969	130
Figure 214.	H. Rhodes, <i>Memories of Gôremé</i> , 1975	130
Figure 215.	H. Rhodes, <i>Sydney Skyline from Balls Head Reserve</i> , 1977	130
Figure 216.	H. Rhodes, <i>5 Ways Pub, Paddington, Sydney</i> , 1977	130
Figure 217.	H. Rhodes, <i>Albuquerque</i> , 1997	131
Figure 218.	H. Rhodes, fractal lightning using <i>Xenofex Photoshop</i> filter	131
Figure 219.	H. Rhodes, structures with procedural textures	131
Figure 220.	H. Rhodes, <i>Dura Europos</i> , 1999	131
Figure 221.	H. Rhodes, <i>Earth, Fire, Sky, Night</i> , 1996	131
Figure 222.	H. Rhodes, <i>Poser</i> head with Escher-like effect, 1999	131
Figure 223.	H. Rhodes, <i>The Great Eggscape</i> , 1997	132
Figure 224.	H. Rhodes, <i>Skyhooks</i> , 1997	132
Figure 225.	H. Rhodes, <i>De Stijl house</i> , 2000	132
Figure 226.	H. Rhodes, <i>Eroded Slimedump</i> , 2000	132
Figure 227.	H. Rhodes, <i>Old Church</i> , 1999	132
Figure 228.	H. Rhodes, <i>Homage to Tanguy</i> , 1999	132
Figure 229.	Interface and scene in <i>Bryce 5</i>	135
Figure 230.	Interface and scene in <i>Vue d'Esprit</i>	135
Figure 231.	Interface and scene in <i>Bryce Lightning</i>	135
Figure 232.	Interface of <i>BSmooth</i>	136
Figure 233.	Interface and scene in <i>Photoshop</i>	136
Figure 234.	Interface and lightning in <i>Xenofex</i>	137
Figure 235.	Interface and terrain in <i>MacDEM</i>	137
Figure 236.	Profiles of pylon and maze in <i>Illustrator</i>	137
Figure 237.	Interface of <i>MakeCubic</i> 360° Cubic QTVR panoramas	138
Figure 238.	Interface and node map of <i>VR Worx</i>	138
Figure 239.	Interface and virtual compass in <i>MapSaVR</i>	138
Figure 240.	Interface and scene in <i>SoundSaVR</i>	138
Figure 241.	Interface and knot in <i>KnotPlot</i>	139
Figure 242.	Theodolite reference, also construction and interface, <i>Strata Studio</i>	140
Figure 243.	Map of roads and dam in <i>Illustrator</i> , then <i>Photoshop</i>	140
Figure 244.	The Maze extruded in <i>Strata Studio</i>	141

Figure 245.	Procedural brick texture with interface of <i>Vue d'Esprit</i>	141
Figure 246.	Crop circles in <i>Illustrator</i> , then <i>Photoshop</i>	143
Figure 247.	The 3-D virtual compass in <i>Strata Studio</i>	144
Figure 248.	Maze animation and interface of <i>Flash</i>	145
Figure 259.	AOL <i>Bryce</i> forum with topic folders and messages	147
Figure 250.	MetaTools on AOL	148
Figure 251.	Kai Krause demonstrating <i>KPT Goo</i>	151
Figure 252.	Eric Wenger	151
Figure 253.	Storml, one of the images donated by disaffected <i>Bryce</i> artists	153
Figure 254.	H. Rhodes, <i>Metacreations, it's your funeral</i> , 2000	154
Figure 255.	Bill Ellesworth, <i>Fountain of Aegaeon</i>	156
Figure 256.	Cartesius, <i>At least there's paper</i> , 2000	156
Figure 257.	C. R. Crisman, <i>Rust</i> , 1997	156
Figure 258.	J. Ternald, <i>After the Bath</i>	156

Introduction to the Digital Media Project, *Exploration Without Boundaries*

Exploration Without Boundaries realises my own fragmented recollections of travel in simulated digital landscapes. Memories of reality usually consist of a mixture of changing reflections and visual fragments, which inevitably become progressively distorted and degraded over time, becoming fused with the imagined and the dream world. Thus *Exploration Without Boundaries* is a virtual world reflecting my journeys in the real world, an iconic journey recalling broken memories of past experiences viewed in the light of the contemporary context of socio-industrial climate of change and uncertainty.

In *Exploration Without Boundaries* the total absence of the human form is vital to its expression, as to introduce recognisable figures would be to make it gender or culture specific. I intended that there be a general experience of loss and isolation, and whatever recognisable artefacts pertaining to human occupation are present in the landscapes, act as metaphors, rather than having any literal significance. Placing objects or sounds in the scenes associated with generalised times and cultures implies the presence of humans and their endeavours, thus giving viewers a chance to imagine their own narratives and histories, and to imbue the artefacts with their own significance. Therefore, the gaze in *Exploration Without Boundaries* is that of the lone traveller who explores empty unbidden landscapes in strange lands, always with the explorer's urge to see over the next ridge or round the next bend in the river, attracted by features in the distance that seem all the more tantalising by their immediate unattainability.

Ever preoccupied with mysteries of natural and fabricated patterns, optical puzzles concerned with symmetry, mazes and mirrors, and fascinated by the ever-changing horizon, I was drawn to the idea of creating landscapes entirely with fractals and algorithms. Similarly the Dutch artist, Mauritz Escher (1898-1972) and the Hungarian designer, Victor Vasarely (1908-1997), artists fascinated with mathematics, created complex and puzzling works with visual algorithms and were deeply involved in representing three dimensions in the two dimensional domain. Their concern with patterns is reflected in the technological developments in computer aided graphics like the weaver who uses a Jacquard loom to realise far more complex patterns than could have been achieved hitherto. The technology facilitates; the artist creates.

Exploration Without Boundaries traverses imaginary and real landscapes in 3-D space and representational time. There are no boundary fences or customs officials in these virtual worlds, and the planar horizon in the landscape imaging programs *Bryce 5* and

Vue d'Esprit 4.5 is boundless and infinite. It is for these reasons that I chose virtual landscape images as the ideal medium to explore the unfathomable and mysterious concepts present in these fractal landscapes. The labyrinth and compass are metaphors for disorientation and orientation, losing and finding one's way.

The three-dimensional (3-D) environments of *Exploration Without Boundaries* have been produced both as video animations of travelling through landscape as well as *QuickTime Virtual Reality (QTVR)* scenes which have been incorporated in an interactive CD ROM. Some scenes have also been reproduced in print as part of a gallery installation so that the viewer may experience a documentary of the world-builder's own virtual journey into these spaces. In particular, the large format prints and full screen projections arouse in the viewer a greater sense of an immensity of scale and heightened hyperreality.

Exploration Without Boundaries was produced in my home studio using proprietary software as well as specialised applications. Working in this manner, without being dependent on external equipment allowed me the time, space and ambience to create these virtual environments. Throughout the entire production, I deliberately chose technologies for which I had synergy.

The Chapters

In each chapter I provide a detailed description of different aspects and theoretical context of *Exploration Without Boundaries*.

Chapter one: discusses fractal geometry and the pioneering work of the mathematician Benoit Mandelbrot, computer scientist Kenton Musgrave and programmer/artist/musician Eric Wenger, describing their contribution to the development of realistic digital landscape imaging during the 1980s in the USA. Fractals are the digital building blocks employed in the construction of *Exploration Without Boundaries*.

Chapter two outlines concepts of virtual reality as they impinge on *Exploration Without Boundaries*, a project that emulates reality. This chapter also describes existing digital virtual reality technologies and gives an overview of their origins as well as theoretical aspects of virtual reality digital media in the context of the prevalent discourses. There is also a section concerned with utopias and dystopias in literature, film and digital media.

Chapter three examines the process and experiences involved with sculpting landscape in both real and virtual worlds and referring to Land Art, an influential movement in the USA and the UK during the 1970s in particular.

Chapter four looks at both mapping and navigation, both of which are intrinsic to many interactive multimedia projects. In this chapter, the development of authoring packages and their relation to structure of navigational games is also described.

Chapter five interrogates the way romantic adventure has informed *Exploration Without Boundaries* whose images are consciously influenced by illustrations from the colonial period of exploration, and describe the landscape and aesthetic as seen from an ironic post-modern perspective. In concluding, I present in an autobiographical context, how my travels have informed this work.

Chapter six describes the content of both the gallery installation and the CD ROM and explains the structure and the symbolism in *Exploration Without Boundaries* and its amalgam of viewpoints.

Although I briefly discuss various theoretical aspects as they relate to the work, this document is not intended to be read from any particular theoretical viewpoint. The theoretical aspects, whether they be concerning aesthetics, virtual reality, mathematics or new media discourse, are pointed out purely in order to give the viewer a background against which *Exploration Without Boundaries* may be read.