Loading World: (re)Creating Life, Nature and Cosmos in Evolutionary Computer Games

William Gavin Mackie

Goldsmith's College, University of London

PhD Media and Communications

I, William Gavin Mackie, declare that this thesis and the work presented in it are my own and have been generated by me as the result of my own original research.

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Abstract

As a generalised field of study, artificial life has produced specific meanings and narratives about what it means to be alive: structured around the concepts of code, information, evolution, connectionism, emergence and cybernetics that connect silicon and carbon life together. Evolutionary computer games and popular programs have introduced the general player and user to advanced artificial life creations, with games based on the nurturing and breeding of silicon creatures placed within new digital natures conceived as computational regimes. Considered is the question of how it has become possible to talk of silicon entities as being alive, and to explore their relationship with carbon life as presented within evolutionary computer games. Similarities between digital and material proposed within computational regimes are also investigated. Playing computer games is developed as a productive practice that constructs meanings, stories and narratives within play. Tracing spiritual and scientific myths and narratives of construction, creation and change, reveals how common stories about life, nature and cosmos are employed in the building of bonds between silicon and carbon. Evolutionary computer games are presented as actively promoting themselves as artificial life products creating links with the life and biological sciences. Meaning produced within play is shown to naturalise and normalise specific definitions of life steeped in neo-Darwinian evolutionism and cybernetics, and how our digital creations have become perfected examples of the essence of this life. Whether this conceptualisation of life, nature and cosmos works within computational regimes is questioned and discussed. Reflecting similar arguments contesting the neo-Darwinian evolutionary perspective within biology, the assumptions employed within this framework are investigated and challenged. Utilising Bruno Latour's program of political ecology and his concepts of proposition and habit. An alternative framework is suggested to examine artificial life, utilising Bruno Latour's program of political ecology, his concepts of proposition and habit, and our relation with these entities.

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Chapter 1

Playing with Life, Nature and Cosmos:

An Introduction

‘Loading World’...

... the window announces as Creatures *begins for the first time on my PC. Immediately I am presented with this new ‘world’ – the planet/place of Albia – a digital artificial life ecosystem ready to host new silicon life forms called Norns, the creatures it is my new duty to raise and breed. The Robinson Crusoe landscape of Albia – ready-made thatched dwellings and caves, tropical beaches, blue ocean and thriving ‘natural’ ecosystem of plants and insects – is matched by the high-tech devices scattered around the planet – learning computers, transporters, incubators and such. Albia seems to be the perfect harmony of nature-technology deserving of the task at hand – to “actually create life on your PC” as the game box proclaims, the genesis of life within the technology of the computer and through the technoscience of artificial life.*

As a bit of a sceptic, I proceed with a slight touch of cynicism towards the birth of my first Norn. From the six Norn eggs available from the hatchery, three male and three female, I pick a male and place it in the incubator and wait. The incubator whirls and whizzes away, the egg comes to life (so to say), and within a minute or two, the incubator’s door swings open and my first Norn pops out in its amazing Disney-esque splendour and almost overbearing cuteness. The first task at hand is to give my new charge a name – still the cynic, he receives the simple designation ‘It’ as I complete his birth certificate (upon reflection ‘Adam’ may have been more suitable for the mythical journey at hand). Now, based in the artificial life technology that It is, he must learn everything from the bottom-up in a process of emergence. Luckily, I have been given some tools to help him along his way. In Albia I am extended by a floating hand that I control with my computer mouse. Attracted to movement, It finds my hand of great interest and follows me around. This is useful – as I type the names of objects into the keyboard that I am pointing to whilst It watches me, he attempts to repeat the words. He progresses from simple burblings to the production of whole words. My own cynicism begins to break down as It says ‘Gavin’ for the first time - along with new ‘life’ a new parent has been born – myself. After a process of learning aided by the ‘learning

computers' which display basic directions and commands, and are acted out by a humanoid stick figure with their matching word, It and I seem to be able to communicate on at least a rudimentary level, although deterred by It's seeming lack of concentration and want to explore on his own. My responsibility to It is to protect him from the dangers of Albia – poisonous plants; the depths of water where he cannot swim; the nasty disease ridden Grendels who enjoy nothing more than slapping a Norn around and spreading sick – while allowing him to explore and enjoy a fruitful Albian life.

Far from a game of parental pet keeping, one of the goals of Creatures is to breed (and engineer) new Norns, improving the Norn line. For this, It needs a female friend, so I am back to the hatchery to start the process over again with Eve (by this point, the mythic connotations of what I am playing through were not lost). Not before long, It and Eve are enjoying life together, growing through adolescence and into adulthood. With physical maturity (Norns develop throughout their whole life – both in their digital metabolism and their on-screen appearance), also comes sexual maturity, and soon I am hearing the 'blop' of Norn sex and Eve is soon pregnant. Norns lay eggs, and after gestation Eve is depositing hers and carrying on with her life. Soon the first 'natural' birth on my Albia occurs, and some time after that, through a combination of natural births and the occasional trip back to the hatchery, there is a lively population of Norns living Norn life on my screen. With a number of Norns present, however, my job becomes more difficult – not only because of the increased numbers to track and maintain, but also because the Norns lose interest in my hand figure, preferring each others' company to mine. Norns come across as wilful and independent little creatures; my challenge soon becomes adapting myself to Norn life rather than them adopting mine. With Norn life comes Norn death. If developing 'relationships' with the Norns in the game and watching Norn liveliness only softened my cynicism to the game, then attempting to prevent and then witnessing my first Norn death squashed it. Norns, in all their big-eyed overly innocent charm, are touching.

And so life on Albia goes on, Norns living and multiplying under my (somewhat) careful eye – they enjoy the pleasures and dangers that Albia presents, and I tinker with Health Kits and Science Kits and keep them healthy and happy. This is certainly one level to which Creatures can be played – taking part in the day-to-day life on Albia in an overseeing role. Through investigation, I find that Creatures can be played in many other ways that take the game to new levels. Norns can be selectively bred for desired traits. If this is unsuccessful (or time consuming) players can genetically engineer new Norns with a variety of never before seen traits (mernorns with fish tails that live and

breathe in the ocean or Norns of unusual colourings or costumes – including Star Trek Norns in Federation uniforms). Any Norn can be traded over the Internet and Creatures *boasts a multitude of sites about the game, offering Norns for 'adoption', a practice I am soon enjoying. These expanded ways of playing the game are supported through the official* Creatures *website, where players can learn more about the game, link their personal* Creatures *sites, and find out more about Norn genetics and life, including artificial life and the links between silicon and carbon- based biologies that artificial life proposes. These ties are evident in the manner(s) in which* Creatures *is played. Before the computer algorithms that make up Norns' 'genetic code' were released by the game developers, players initiated the "Norn Genome Project" (analogous to the human version from which it finds its namesake) to hack and discover what this code was. Players selectively breed and genetically engineer Norns, including transgenic engineering with Grendels and other Albian creatures, to introduce traits into the Norn line that are not 'naturally' present. "Wolfing runs", where* Creatures *is left running at high speeds to encourage multiple generations of Norns in a short time span, allow players to perform evolutionary experiments within the game. The controversy that arose within the* Creatures *community when it was revealed that a player answering to the tag Anti-Norn was purposely torturing and abusing Norns and then placing them on his website, led to a heated debate on the aliveness of Norns and Norn rights. From this, numerous 'adoption agencies' were set up, where these neglected Norns could be fostered and adopted by budding Norn developmental psychologists, who made it their goal to resocialise them in a system not dissimilar to child protection social services. If the actual life status of these silicon creatures of computer code is debatable, the close resemblance to how users play within this new digital nature and Albian culture and their parallel 'real world' analogies points to more than a fleeting modelling of life. Norns and the other creatures of Albia seem to be alive enough, and alive enough to tell us about our own carbon based life.*

The *Creatures* series of games[1] are artificial life experiments and evolutionary computer games, allowing players to 'create life' on a PC, following a genealogy of other computer games and (techno)scientific computer based research projects including the popular *SimLife* and *SimEarth*, *Technosphere*, *Biomorphs*, *Tierra*, the *Game of Life* and recently released *Spore,* by leading games designer Will Wright and producers Maxis and Electronic Arts (EA Games). Together, these programs

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[1] There are three PC games in the series, plus add-ons and a version for children, *Creatures Adventures,* as well as versions for Playstation and Game Boy Advance.

present a multitude of computer algorithms that can reproduce themselves and evolve within the electronic and silicon confines of the computer, which come together under the umbrella of the technoscientific discipline of artificial life. Since its origin in the late 1980s, artificial life has paired life itself and computer sciences in the development of new human-made life forms, typically in robotics or computer software programs (as does *Creatures*), expanding the domain of the life sciences to possibilities of life outside of carbon based chemistry, from 'life-as-we-know-it' to 'life-as-it-could-be' (Langton 1996: 40). The status of life that Norns (and the other creatures artificial life practitioners create) claim, and is claimed for them, embodies a new rhetoric and set of definitions of life that has grown from post-war cybernetics, information theory (informatics) and neo-Darwinism, to which the technoscience of artificial life is intimately tied. This is an essence of life that is found in form and not matter, which is steeped in an allegiance with code, information, self-organisation, evolution, feedback and emergence. On a broader cultural scale the new life sciences, cybernetics, informatics and artificial life form key building blocks of an emerging sensibility of the posthuman most notably mapped by Katherine Hayles (1999). This holds new fluid informational relationships between humans and the things around us, including other non-human entities and importantly, a new cosmology of computational regimes. For Tizziana Terranova, posthuman evolutionism has initiated "a huge ontological shift not only in the nature of human society, but in that of our very bodies" (1996b: 167). She continues:

> This mutation has been brought about, on the one hand, by the exposure to
> simulated images in the most traditional media, and, on the other, by the
> slow penetration into our daily life of almost invisible technological
> gadgets... The process of 'invasion' of the human body and psyche by the
> machine is destined to increase over the years (1996b: 167).

The aim of this thesis is to explore this 'penetration' of the technological and the technoscientific through the convergence of the strands of technoscience, media and culture within evolutionary computer games and the *Creatures* series in particular. Hayles finds that this penetration has already found a place in how we define ourselves:

> When we compute the human, the conclusion that the human being cannot
> be adequately understood without ranging it alongside the intelligent
> machine has already been built into the very language we use. (2005: 148)

Creatures and its peers can be considered as 'intelligent machines' and as assemblages, tied and linked to other assemblages, in what the Critical Art Ensemble, influenced by Deleuze and Guattari, would call the 'Flesh Machine' (1998) – the collection of machinic processes that are both deterritorialising and reterritorialising what it means to be alive, of life itself.

This thesis does not at all aim to decisively uphold or dismiss the claims of Norns, Grendels and other artificial life creations as being actual instances of life. This is not a judiciary panel on what is and is not allowed to constitute life. Such a project would quickly need to resort to a type of essentialism this thesis is keen to avoid and actively rejects. Instead, it intends to explore what life means in the posthuman and how it has become possible to talk of computer algorithms as constituting life. Brian Massumi, developing upon (or deviating from) Deleuze and Guattari, posits the question as:

> The question is not, Is it true? But, Does it work? What new thoughts does it make possible to think? What new emotions does it make it possible to feel? What new sensations and perceptions does it open in the body? (1992: 8)

Further, this thesis aims to illuminate the ties between silicon and carbon life and how our silicon cousins are helping to shape and define what 'life itself' is and where and how as (post)humans we 'fit in' with this new understanding (and as shall be shown, it is carbon life that is made to fit within the framework we have created for silicon life forms, and not vice versa). More than just an examination of life, the implications of new posthuman sensibilities takes us beyond mere life to a more far reaching analysis. The relationships between space and time, reality and virtuality, and the actual and the artificial are all implicated in a more fruitful understanding of life in the posthuman. For Sarah Kember the "convergence between biology and computer science provides the context for an emergent technoscientific culture within which the status of autonomy and artificiality are highlighted and problematised" (2003: 1). This understanding needs to consider the ontological implications of what is at stake in this new posthuman informational evolutionism.

Crucially, this thesis examines not a purely scientific research project, high art installation or other 'culturally elite' manifestation. Instead, it studies a popular medium and games that are and have been enjoyed by people the world over. *Creatures* and other evolutionary artificial life computer games provide a unique platform in which to explore the cultural and technoscientific shifts that are taking

place in the posthuman. As artificial life experiments do not need computers of high processing speed or memory, most artificial life programs perform equally well in the laboratory or on a home PC. The technology and science behind evolutionary computer games is often at the forefront of the artificial life field. Steve Grand, artificial life researcher and the programmer and developer of the original *Creatures* game, is unreserved about his claims for the game:

> A game it might be, but if you'll forgive the staggering lack of modesty this implies, Creatures was probably the closest thing there has been to a new form of life on this planet in four billion years. These creatures probably still represent the state of the art in synthetic life forms. (qtd. in Lyall 2002)

In a reversal of the usual directionality from military to entertainment usage of technology, the UK Ministry of Defence has taken up the technoscience behind *Creatures*, in the development of "Unmanned Air Vehicles (UAVs)... a completely autonomous virtual organism which takes responsibility for control of the flight of the aircraft" or, in other words, "intelligent, human-like artificial pilots"[2] (see also Davidson 1998). *Creatures,* when including its fully on-line version *Creatures Docking Station*, claims to be the largest Artificial Life experiment in the world, larger than *Network Tierra*, the digital Internet ecological project initiated by American Artificial Life researcher Thomas Ray. The evolutionary computer games *SimLife* and *SimEarth* have both been actively marketed in the US as educational tools for high school teachers in biology, with special educational versions of the games released for this purpose. This must not be lost in either the theory or methodology of this thesis; these games are played for fun and enjoyment by a wide and diverse player base, breaking down the boundaries between culture and science, entertainment and education. They form prototypical examples of what Julian Sefton-Green proposes when he suggests that with new communication technologies emerging, it is no longer possible to concisely delineate applications or users into clean categories of age groups or purpose (1998: 4, 15).

Creatures, SimLife, SimEarth and their peers do not identify themselves as either computer games or research projects. They are designed and played for entertainment, but are aware of and actively promote their technoscientific status. They encourage their players to learn about life in both its silicon and carbon based instantiations, actively making crossovers between the two. They position players directly in the role of an artificial life researcher (amongst other player

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[2] http://www.creatures.co.uk/newstand/mediabox/ns_media_pr_17mar98.htm

roles – many of which are played concurrently) and engage the player in the production of new posthuman definitions of life and cosmology through their play.

This thesis aligns with and expands on a growing literature and response to artificial life, technoscience and popular culture; most notably Sarah Kember's work in generating an active dialougue between feminism, media and communications and science (2000, 2005 and especially 2003). Kember finds that "ALife is an intrinsically interconnected discipline within which dialogical strategies and bioethics are being articulated, and it is constituted in and by a process of globalisation" (2003: 12). Her contribution to this diologue is to enter into the discussion, providing her own map of the field and a response initiated from a standard feminist oppositional standpoint, but growing (and remaining 'limited') by this. Kember's is an account of artificial life that "few specialists would recognise" attempting to "situate the discipline of ALife within a wider technoscientific culture which includes, crucially, genomics, evolutionary psychology, memetics and organic metaphors of agency, technology and social processes" (2003: 13). Whilst my response in this thesis similarly contributes to such a dialogue, it specifically focuses on the discoures that artificial life are forming in its relation with and within popular culture and media, and in particular within computer games. Within the bounds of bioethics, the thesis explores and ultimately questions statements about life itself, both silicon and carbon, that artificial life, incorporated with evolutionary computer games, produces in its use of essntialist definitions of life. It runs alongside and moves beyond analysis such as Kember's to ask if a popular form of actual artificial life could be possible, one that does not rely on shared reductionary essentialist definitions between silicon and carbon. In doing so it utilises Latour's framework of political ecology (2004) in the formation of such a discussion. By taking computer games as a serious form of popular culture and media, this thesis develops and further contributes to a cultural perspective of computer game studies, one that places computer games within greater cultural landscapes and dynamics.

This thesis can be placed within three key areas that form foundations to its structure and argument: reality, discussions on life, and the use of computer games as a form of scientific output. This is a thesis that incorporates discussions on new meanings of what it means to be alive, of 'life itself'. An understanding of the stories, produced since the middle of the twentieth century on the statements of life, forms the first foundation of this introduction. The key determinants of

informatics, cybernetics, gene action and evolution have produced a (de/re)territorialisation with new definitions that alter life's ontological and epistemological status. This has allowed new possibilities of posthuman definitions of life and new cosmologies. Emerging life (techno)sciences, such as artificial life, play a critical role in reterritorialising what it means to be alive within these standpoints. These new definitions of life itself have ontological and epistemological implications, that demand a close examination of 'reality' that initially highlight the realist-constructivist split that has been dramatically focused on within the science wars. This thesis takes a different approach in its relationship with reality and answers Bruno Latour's call to move tangentially and radically away from the realist-constructivist opposition in its entire myriad of forms. Instead, I take from recent materialist positioned work highlighting the intra-actions between humans and nonhumans, between the living and nonliving that are involved in the ever-continuous production of the world and reality we are embedded within. This exploration forms the second foundation of the thesis. The third positions the computer games this thesis examines as an area of science studies. It views such games as machinic assemblages, taking from Deleuze and Guatarri, that tie into other machinic assemblages that are deterritorialising and reterritorialising what it means to be alive. Seen in such a light, and with the claims that have been made about *Creatures* and other Artificial Life based games, this thesis considers games as science, actively producing new territories of life itself through play.

Life

At the forefront of artificial life and the posthuman are new definitions of life and what it means to be alive that find a connection with the recent focus on the gene as a key figure. This association is found not only in the life sciences, but also throughout contemporary Western society. American social commentator Jeremy Rifkin proclaimed a shift in history from the age of physics and chemistry to an age of biology in what he has designated as the "biotech century" (1999). He finds powerful new social currents emanating from new work in genetics and the life sciences:

> There are many convergent forces coming together to create this powerful
> new social current. At the epicenter is a technological revolution unmatched
> in all of history in its power to remake ourselves, our institutions, and our
> world. Scientists are beginning to reorganize life at the genetic level. (1999:
> 1)

It is this shift in the management of "Life in a post-human mode [that] has taken centre stage in the political economy of advanced capitalism" (Braidotti 2006: 37). Andrew Ross also instigates the life sciences at the centre of the social agenda. As with Rifkin, Ross finds a shift in focus to issues of nature and the life sciences:

> For, in many ways, it is the legacy of ideas about evolutionary science that is increasingly occupying the forefront of our social and political environment. If the authority of nature and biology has been kept at bay for much of this century, it has made a remarkable return in recent years, and is once again the ground of appeals to social policy and cultural righteousness. The contest over Darwinism, in one form or another, may turn out to be one of the more crucial debates of the next decade, and it is a debate that cultural critics and social theorists should be part of. (1996: 7)

For Sarah Kember this resurgence in Darwinism has involved a convergence of the biological and technical where, especially in artificial life and transgenic engineering, "there is an almost overwhelming sense of evolutionary possibility, and here more than elsewhere the evolution in question is more technological than biological, more informational than material, more possible than actual" (2005: 153). Central to this new revitalised reading of Darwinian evolutionism are new ideas about the essence of life that have emerged from the fields of genetics, cybernetics and informatics that are bringing together new scientifically legitimate meanings to the metaphors 'Book of Life' and 'Book of Nature' (Kay 1999: 225). Within this discourse, life has been refigured within the context of information and code. This informational evolutionism considers all life as self-organising, propagating, evolving informational units. This is an ontological shift that has displaced life from a material base to one of abstract form. Within this novel cybernetic neo-Darwinism, it is the gene and DNA that are placed at the forefront of what it means to be alive. Elizabeth Grosz stresses that the exploration of life traditionally found within the biological sciences should be central to theorist interested in the relations between subjectivity, politics and culture in order to "develop political strategies to transform the existing social regulation of bodies, that is, to change existing forms of biopower, of domination and exploitation" (2004: 2). Most famously described by Richard Dawkins as "the selfish gene" (1989) or more recently as our "common thread" (Sulston & Ferry 2002), the four nucleotide bases that make up the DNA of every living being (at least those found in carbon based chemistry) have, within this informational metaphor, been proposed as the code of life and as life itself. It has been work in genetics and

cybernetics, carried out during the mid-twentieth century, which has laid the foundation for this informational insight to life. In genetics:

> The conceptualization, breaking, and completion of the genetic code, 1953-1967, was one of the most important and dramatic episodes in twentieth-century science, a manifestation of the stupendous reaches of molecular biology. The so-called code – actually a table of correlations – outlined the logic of gene based protein synthesis, providing the key to what was widely perceived to be the "secret of life." (Kay 1999: 226)

Evelyn Fox Keller credits Watson and Crick as introducing the informational metaphor to the repertoire of biological discourse, although she also finds that as early as 1952 it was realised that "the technical definition of *information* simply could not serve for biological information... Thus the notion of genetic information that Watson and Crick invoked was not literal but metaphoric. But it was extremely powerful" (1995: 18-19). During this same period of time, the new interdisciplinary area of study known as cybernetics was also finding new informational ways of formulating life. For Katherine Hayles the period between 1945-1960 "marks the foundational stage during which cybernetics was forged as an interdisciplinary framework that would allow humans, animals, and machines to be constituted through the common denominators of feedback loops, signal transmission, and goal seeking behavior" (1996a: 12). As with developments in genetics, the core of this new science is the metaphor of information. In the last half-century parallel developments in genetics, cybernetics and the cross-fertilisation between the two in an emerging "cyberscience" (Keller 1995: 88) has brought the information and life sciences together to "fuse into a single technological and economic force" (Rifkin 1999: 3). At the centre of this 'force' is the figure of the gene, an informational entity containing the 'book of life' that forms the central control to all the processes that constitute life in a discourse of 'gene action'. Despite evidence that the locus of control lays not with the gene but in "complex biochemical dynamics... of cells in constant communication with each other" (Keller 1995: 28), this focus on gene action is sustained. In this set of dynamics, genes become part of a larger cellular and inter-cellular system, and there is a change of focus from 'gene action' to 'gene activation'. The discourse of 'gene action' has found a strength and persistence that Donna Haraway has termed '"genetic fetishism'" (1997: 141). For Haraway gene fetishism is the substitution of "the master molecule [gene] for a more adequate representation of units or nexuses of biological structure, function, development, evolution, and reproduction" (1997: 147). It is this focus on the gene, and specifically on the gene as an informational unit, that artificial life practitioners have transferred to

the digital emplacement of the computer, finding the gene's digital twin in genetic algorithms (GAs), most simply defined as computer strings of code that can self replicate. It is this interchangeability between organic genetic and computer code, a strong informational metaphor and an ontological shift to an essence of abstract form, which allows for the expansion of life into the digital sphere of the computer. Sarah Kember offers a definition of life common to both carbon and silicon creatures:

> Life is defined in terms of the genetic/computer code – or in terms of information. Organisms (both natural and artificial) are regarded as being information processing and replicating systems which evolve, self-organise and are autonomous. (2000: 34)

Here we find the ingredients to a posthuman formulation of life: a fluidity of information that is defined by form, not materiality, and by systemic process not material interactivity.

Reality

The strong informational metaphor and shift in essence from the material to form within the life sciences has prompted an ontological shift in the emerging sensibility of the posthuman. This goes beyond the definition of life to include the nature of reality itself and a new posthuman cosmology. Here, the universe is said to be made up of informational bits and operates as one (extremely large) cybernetic computer program. This new cosmology of the living universe, which will be explored further, is directly correlated with new digital emplacements and ecosystems, such as *Creatures* and other artificial life programs, as computational regimes. To be able to examine and account for this ontological shift, a close reflection of this thesis' epistemological and ontological positioning is in order. Bruno Latour has highlighted this need, stating:

> [S]cience students will have to take philosophy much more seriously; they even might have to redefine their own metaphysics in order to deal with the bizarre ontological puzzles revealed by their discoveries of the collective-things. (1992: 287-88)

At the centre of this is the conceptualisation of the 'real': "Reality is once again becoming the issue at stake" (Latour 2002: 22). This thesis avoids arguments structured along the typical realist versus social constructivist yardstick, answering Latour's call to "abandon this frame of reference [along the axis of

Nature to Society] and set up another standard" (1992: 276). Instead of moving right to left along a Nature-Society alignment, Latour suggests merging these two poles, having a single transcendence instead of two. In this manner we become able to speak of both the human and nonhuman origin of knowledge without the necessity of separating the two. For Latour, this has five consequences or 'modifications' to the Modern Constitution, the first being to lose the opposition between Nature and Society; "We live in a Society we did not make, individually or collectively, and in a Nature which is not of our fabrication. But Nature 'out there' and Society 'up there' are no longer ontologically different" (1992: 281). This leads to the second modification; that the social and the natural are a single focus of analysis "since both are the results of the practice of science- and technology-making" (Latour 1992: 281). This activity of nature/society making leads to the third modification – the "origin of reality" (Latour 1992: 282), that this production becomes the source from which natures and societies originate. The fourth modification is the central role of history through the productive role of actants in the origin of reality:

> [I]t is the experimental scene that produces and shapes new actants that then increase the long list of ingredients that make up our world... They are a new social link that redefines at once what nature is made of and what society is made of. (Latour 1992: 283)

The last modification Latour highlights has ontological implications. As there are no longer the two extremities to which ontological activity is focused, it is distributed amongst all actacts (or agents) engaged in reality making production. Latour sees this critically as a shift in perspective and focus from 'out there' and 'up there' to a new region which he tentatively terms 'down there' (1992: 287):

> There is no separation between the object and the society; we Westerners go on doing what everyone has always been doing, that is, growing "down there" collective-things that may end up being nature "out there" and society "up there." (Latour 1992: 289)

Aligning with Donna Haraway's claim that "Reality is an active verb" (2003: 6), Latour suggests that we are all actively involved in reality creation. Developing the ontological and epistemological positioning of this thesis 'down there' I incorporate a materialist positioning. In developing a materialist theory, Rosi Braidotti suggests, "new figurations are needed, to help us think through the maze of techno-teratological culture" (2002: 207). Karen Barad has offered such a positioning in 'agential realism' (1996, 1999), proposing science as a set of

productive material-discursive practices, matching Latour's non-Modern Constitution. Nancy Tuana also notes the problems underlying the dichotomy between realism and social construction:

> Our investigations are beginning to raise serious concerns regarding the adequacy of the metaphysical assumptions of realist positions. But our inquiries are also undermining the natural/cultural distinction posited or implied by social constructivist accounts. (2001: 221)

Barad, too, finds that by placing realism and social construction at opposite poles of a dichotomy there is no space for the realisation of the mutually constitutive 'intra-action' of being both materially situated *and* discursively constructed:

> The dichotomized positions of realism and social construction – which presume a subject/object dichotomy – can acknowledge the situated/constructed character of only one of the poles of the dualism at a time. Realists do not deny that subjects are materially situated; constuctivists insist upon the socially or discursively constructed character of objects. Neither recognizes their mutually constitutive "intra-action." (1999: 2)

Against this, materialist positions such as agential realism attempt to incorporate the realisation "that there are cultural *and* natural/material causes for knowledge claims" (Barad 1996: 162). It accepts that there is an 'out there', but one that is constantly being produced by ourselves and by other agents/objects in a constant flux of intra-actions. "There is a reality – but we are in the midst of it, literally and collectively making it up as we go along" (Heldke 2001: 93). Grosz reminds us that the real is necessarily larger than what is humanly known:

> The real must be *larger* than and *outside* the known; it must contain not only the known but also what knowing leaves out, the interstices, intervals, gaps between and within knowable units, the differences covered over by apparent identity, the open rather than closed context of all material events, whose influence and effects reach "even to the stars." (2004: 192)

Central to agential realism is Barad's reading of the scientific philosophy of physicist Niels Bohr, and especially of his conceptualisation of the constitution of phenomena – the relationship between what is observed (the object as phenomenon) and the observer (for Bohr - "agencies of observation"). Barad finds that, when examining the role of the agencies of observation in the act of observing phenomena, Bohr suggests "there is no unambiguous way to differentiate between the 'object' and the 'agencies of observation' – no inherent/

naturally occurring/ fixed/ universal/ Cartesian cut exists. *Hence*, observations do not refer to objects of an independent reality" (Barad 1996: 170). We are implicated in the reality of the objects we perceive; reality is a product of the intra-action between objects and agencies of observation. This intra-action generates significant implications that reflect and develop Latour's fifth modification:

> ... I want to suggest that the interrelationship between these conceptions of objectivity and realism actually point to a more general issue – the mutually constituting relationship between ontology and epistemology, the distinction generally drawn between epistemological questions and ontological ones cannot hold, once we understand "subjects" and "objects" to be part of a nondualistic whole, and once we understand the real to be constituted, in part, by the activity of inquiry. (Heldke 2001: 95)

For Barad this has the consequence that *"Phenomena are constitutive of reality.* Reality is not composed of things-in-themselves or things-behind-phenomena, but things-in-phenomena" (1996: 176). She designates the relationship between objects and agencies of observation as one of *intra*-action and not *inter*action to "signify *the inseparability of objects and agencies of observation* (rather than *interactions*, which reinscribes the contested dichotomy)" (1999: 5). These come together in the formation of agential realism:

> Agential realism is an epistemological and ontological framework that provides an understanding of sciences as "material-discursive" practices. These practices are recognized as being productive rather than merely descriptive. However, what is produced is constrained by particular material-discursive factors and not arbitrarily construed. Agential realism theorizes agency in a way that acknowledges that there is a sense in which "the world kicks back" (i.e., nonhuman and cyborgian forms of agency in addition to human ones) without assuming some innocent, symmetrical form of interaction between knower and known. (1999: 2)

Agential realism provides a number of benefits to a study such as the one this thesis proposes. Importantly, it recognises and constitutes cyborgian agency within its framework. This becomes crucial when examining an array of objects, other humans and nonhuman (and possibly nonliving) entities that are found within the game culture that evolutionary artificial life games bring together. Remembering that "any technology, insofar as it instantiates a program of action, involves a complex network composed of both human and nonhuman elements" (Hansen 2000: 43): in *Creatures;* Norns, Grendels, the ecosystem of Albia, the game itself, the computer, the player, game developers, and the extended network

of other players, game reviewers, the audience, family and friends all 'kick back' in the creation of reality, both in the digital emplacements on the computer screen and in material reality. They are all constitutive of a continually produced agential reality.

Secondly, adopting a materialist position embraces an embodied practice. For Barad "bodies serve as both the endpoint and starting point for objective accounts of our intra-actions. In other words, agential realism gives us an embodied account of objectivity" (1996: 185). Developing the idea of strong constructivism, Tuana stresses the point:

> What I believe must be added to strong constructivism is an enriched version of an embodiment hypothesis – the tenet that human ways of knowing, our concepts, meanings of terms, and modes of reasoning are grounded in patterns of bodily being. At an epistemological level the embodiment hypothesis is the belief that our concepts emerge from and are in part formed by the particularities of our bodies and of our bodily interactions with the physical world. At a metaphysical level the embodiment hypothesis involves a recognition of the always present complex interactions of material-social. (2001: 229)

When taking on issues of technoscience, technoculture, virtuality and artificiality, developing an embodied theory and methodology is critical. This avoids a subjectivity divorced from its materiality for immersion solely in the digital (the popular cyberpunk escape from the meat body). The concept of living through the body and the primacy of bodily experience, especially when dealing with practices and digital technologies that are commonly thought of as divorcing experience from the body, "stresses the fundamental role of (corporeal) embodiment as the necessary background out of which all acts of inscription emerge and take on meaning" (Hansen 2000: 27). As shall be developed throughout the thesis, I take embodiment to mean the experience lived through the body, in all its material, virtual, real and abstract forms.

Finally, a materialist positioning stresses the productive nature of phenomena and the intra-actions of objects and agencies of observation. Playing *Creatures* (and its peers) is a productive practice – new realities and new definitions of life itself are produced through play, and this concept will be argued throughout this thesis. Agential reality is not (only) representational; it is productive. Here, agential realism and the functional machinic philosophy of Deleuze and Guattari share common ground. The technological characteristic of video games is highlighted in

their production of reality. For Mark Hansen, technology is an ideal place to examine our encounters with the real:

> Technology... compromises a privileged "index" of the material stratum (Deleuze and Guattari), the real (Lacan), or the unmediated flux (Hayles). As actual forces immanent to the real, technologies furnish an immediate material source of movement (active force) that does not rely upon the activity of thinking for its ontogenesis. Yet because technologies so drastically and fundamentally impact the process of thinking, they seem to afford an ideal site for analysing the encounter between thought and the all-too-amorphous real. (2000: 19)

The role of technologies in agential realism and materialist positionings cannot be understated. They are measurement apparatuses and directly affect not only our perception and construction of the real (in our intra-actions with them), but also affect the practice of science. "Apparatus, in Bohr's sense are not passive observing instruments," Barad finds, continuing:

> On the contrary, they are productive of (and part of) phenomena. However, Bohr leaves the meaning of "apparatus" somewhat ambiguous. He does insist that what constitutes an "apparatus" only emerges in the context of specific observational practices. But while focusing on the lack of an inherent distinction between the apparatus and the object, Bohr doesn't directly address the question of where the apparatus ends. (1999: 5)

Whilst still wishing to retain the ambiguous nature of apparatus (where does the technology of the computer and artificial life programs end and a Norn begin?), it is of equal importance to fully acknowledge the role of technology in the production and direction of science. Further, that our apparatus and instruments of measuring are technologies that directly effect what is measured and how. This is not to imply a technologically determinist argument, the social is not predicated solely by technology; but to recognise the embodiment of the production of science in technology as much as the (more typical understanding of the) reverse. Technology is not just an outcome of science; it is constitutive of it. It is the constitution of science in its intra-actions with its instruments and technology that provides its senses, measurements, and the production of reality. The recognition of instruments/apparatus/technologies in the productive activity of science acknowledges the "material embodiments of science" (Ihde 1991: 45). Don Ihde explores this in what he terms instrumental realism:

> One clear and crucial domain in which this neglect is obvious is with respect to *instrumentation*. In contrast to its ancient antecedents,

contemporary science is clearly technologically embodied. Instruments
form the conditions for and are mediators of much, if not all, current
scientific knowledge. They are concrete and material operators within
scientific praxis. (1991: 45)

Recognising the mediated and contextualised nature of science through its
technological instruments means that they no longer remain invisible in the
production of a scientific object. Technologies are not only constitutive of reality
in instrumental realism; they are political. Making them visible aids in the
clarification of "the misunderstanding that such technologies are 'neutral,' when
in fact they are *non-neutral*" (Ihde 1991: 73). In his attempt to "clarify what is at
stake in the practice of science" (1998: 174) David Demeritt suggests a model of
artifactual constructivism where "the objects of scientific knowledge are the
outcome of carefully contrived practice, not pre-existing objects waiting to be
discovered and correctly represented by science" (1998: 177-78). Artifactual
constructivism stresses that machines and other agencies "matter" in "the
powerful and productive practices of science by which the reality of nature and
our socially constructed knowledge of it are produced and articulated" (1998:
181). This compliments materialistic positions in that it "does not deny the
ontological existence of the world, only that its apparent reality is never pre-given"
(Demeritt 1998: 178). Ihde finds that this has been best exemplified by the
growing biotechnologies of postmodern science:

> ... Postmodern science, *technoscience*, becomes a *productive* science in
> precisely the laboratory/factory sense. This in no way removes it from the
> close and necessary embodiment of science in its technologies. To the
> contrary, it blends the roles of science and technology such that it is
> virtually impossible to differentiate between these functions. And while
> physics remains the most costly and complex science... there are at least
> indications that the new technosciences of *biotechnologies* may even better
> exemplify emergent Postmodern science.
>
> The constructed, the manufactured entities of micro-manipulated entities
> are precisely the organic/inorganic junctures, and the cloned and gene-
> manipulated entities being produced are more clearly the products of the
> Nature/Culture ambiguities now almost paradigmatic of Postmodern
> science. (1991: 134-135)

Games and/as Science

Arguing that *Creatures* and other artificial life games/programs are converging
points of science and popular media places these as both a site of popular

entertainment and a site of (techno)scientific practice. Focussing on the media of the computer game warrants a further exploration of the ties that can be made between posthuman technoscience and popular media. This highlights questions such as do computer games count as (techno)scientific locations? How can they be considered within a larger technoscientific practice? Noel Castree and Bruce Braun have already highlighted the role of evolutionary computer games (here *SimEarth*) in the production of new natures:

> Indeed, in our emerging "network societies" there is now the promise of what Wark call "third nature" – that is, the simulated natures of everyday TV and magazines, games like SimEarth, or the extraordinary optics of the geographical information system (GIS) all of which provide new, powerful means of manipulating natures as "information." (1998: 4)

Castree and Braun stress the embeddedness of games like *SimEarth*, *SimLife*, and *Creatures* within a number of practices and technologies that are coming together in the production of new informational and posthuman natures. In the production of science as a set of practices, Joseph Rouse emphasises that the range of what constitutes scientific practice extends beyond the strictly scientific field:

> Undoubtedly we can identify more or less distinctively scientific practices by their relatively dense interconnections with other scientific practices and by the issues and stakes that arise through those particular interconnections. Nevertheless, the traffic in all directions across whatever boundaries can thus be demarcated will be too heavy to allow for any significant autonomy of a domain of scientific practices... The intentionality of scientific practices is often only fulfilled by such extensions beyond the laboratory and outside the field. (1999: 445)

Charlene Haddock Seigried also questions the boundaries erected between the practice of science and everyday experience. From the pragmatist philosophy of John Dewey, Seigried reverses the question and considers what the scientific method is:

> Dewey urges us not to follow science in its ever-increasing specialization and arcane, technical vocabularies and interests, but to direct our attention in the opposite direction, back to where the experimental method originated; namely to ordinary experience. In fact, in his view, the scientific method of observation, reflection, and testing is the formalization of the method of experience itself. (2001: 117)

She finds that in a pragmatist philosophy there is a concern only "with those aspects of the sciences that have relevance to everyday experience, either in

regard to issues that grow out of everyday experience or as they are reabsorbed back into it" (2001: 116). Evolutionary computer games both reabsorb and produce new experiences of what it means to be alive and definitions of life itself. Together with/as artificial life they form a constitutive part of the new life sciences that are fundamentally deterritorialising and reterritorialising the definitions of life; what our bodies are and our cosmology. Moving from the pragmatist philosohphy of Dewey to the functional philosophy of Deleuze and Guattari, these would be considered to be assemblages of machines. Deleuze and Guattari find machines everywhere, "Everywhere *it* is machines – real ones, not figurative ones: machines driving other machines being driven by other machines, with all the necessary couplings and connections" (1983: 1). Machines are productive forces that change, alter and redirect flows in the production of objects. Machinic production finds close ties with agential realism in that there is in both the material-discursive production of the real:

> [Man] does not live nature as nature, but as a process of production. There
> is no such thing as either man or nature now, only a process that produces
> the one within the other and couples the machines together. Producing-
> machines, desiring-machines everywhere, schizophrenic machines, all
> species of life: the self and the non-self, outside and inside, no longer have
> any meaning whatsoever. (Deleuze and Guattari 1983: 2)

Machines come together as assemblages; collections of machines assembled together to produce objects. *Creatures* and other evolutionary artificial life games and projects can be considered as such machinic assemblages, producing entities endowed with the status of life. This occurs within new natures under the guise of a cosmology that produces a specific ontological structure to reality within the framework of computational regimes. The machinic assemblages that *Creatures* and its peers associate with connect, converge and overlap the social and science. Within *Creatures,* players are both partaking in a popular form of entertainment medium as well as participating in cutting edge techno(life)science. It is in this way that we can speak of these games alongside science and as science practice. Michael Menser and Stanley Aronowitz state:

> Culture, science and technology, although distinct on specific levels, have
> been and continue to be inextricably bound to one another in such a fashion
> that each actually merges *into the other,* laying lines of contact and support.
> (1996: 7)

Creatures and its peers are tied to other assemblages across both scientific and popular social fields and to other assemblages that are also crossing borders[3]. Together, they are producing new territories of life, what it means to be alive, and our relation with the world around us. They are engaged in technoscientific practice that engages with and supports other technoscientific practices across the life sciences and popular media that are producing new entities 'down there' such as Norns and their (our) kin. In turn this produces new natures 'out there' and new posthuman cultures 'up there.' They are producing specific definitions on what it means to be alive (as informational forms), to be (post)human (as fluid cybernetic feedback loops within other such feedback loops), and our relationship with the world around us (as a deterministic computable program). *Creatures*, considered within a scientific practice, opens what Emily Martin has termed the 'citadel' of science as an institution and creates new currents and flows of information. This opens the study of science to the possibility that:

> The walls of the citadel are porous and leaky; inside is not pure knowledge, outside is not pure ignorance. This means the way is opened for a more complex, less flatly antagonistic attitude toward science than prevailed among some of us earlier. Scientific knowledge is being made by all of us; we all move in and out of the bustling city of knowledge production. (Martin 1996: 102)

Looking Ahead

Developing *Creatures* and its peers as converging points of science and popular culture and exploring the stories about and surrounding life that evolutionary computer games produce, this thesis is structured around the development and production of meaning through the activity of play. Chapter two places the thesis within the context of historic and recent literature in both computer game and science and technology studies. Taking a historic cue from media effects and the anthropology of player cultures, recent work in computer game studies has rejected a straightforward effects argument through the contrasting theoretical standpoints of narratology and ludology. Narratology, primary developed through literature and film studies, views computer games as textual media. Ludology focuses on the activity of play as simulation, striving to recognise computer games as a unique media form. Finding ground between these viewpoints, this thesis develops computer game play as an active interaction where the activity of game play produces both the game itself and the meanings built within and taken

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[3] Sarah Kember, in *Cyberfeminism and Artificial Life* (2003), maps out some of the cultural and scientific areas that artificial life is connected to and supports.

away from play. In exploring the production of meaning within play, the chapter recognises the need to relate computer game play into the greater cultural practices of which it is a part. Chapter two also reviews recent work in science and technology studies, expanding a 'Deleuzian episteme' that aligns with the materialist foundation of the thesis. Within this foundation the active production of play within computer games is recognised and built into a greater assembly of cultural and scientific production.

Arguing that the intra-actions produced through computer game play have real effects, bringing a number of agents both living and nonliving together in play, this thesis utilises a conceptualisation of cyberspace as spaces of intra-action. In order to consider computer games as spatial where real things happen and where agents produce play and meaning, a review of cyberspace theory and the tying of 'conceptual loose ends' is necessary. Taking from social geography and finding resonance with the materialist positioning of the thesis, chapter three builds a conceptualisation of cyberspace that incorporates both 'physical' and 'digital' space, and differentiates between the two. Within this conceptualisation it also considers our intra-actions within cyberspace as humans, developing an embedded standpoint that views the player as extended into the cyberspatial gamespaces created in computer game play. This replaces the more common conceptualisation of 'immersion' and similar travels in humans' use and habitation of cyberspace. The chapter also introduces Foucault's concept of heterotopia and considers the cyberspaces constructed through gameplay as examples. Considering gamespace as heterotopian further deepens an understanding of our dealings with and within digital space and its relationship with the physical.

Building upon the spatial aspects of gamespace developed in chapter three, chapter four investigates playing computer games as a productive practice. Following a participatory engagement with games, it develops a method of enquiry that traces how meanings are produced through the intra-action of play, and finds structuring elements that guide, open and limit the possibilities available in gameplay. It builds from the spatial aspects of cyberspace to consider gamespace as a structuring element of play. Closely partnered with this, the underlying rule based programming of game is also developed as a second strong structuring element. The chapter develops a sense of a game's culture by turning to how the player is able to make sense of this structured environment, where a player is introduced to and becomes part of the assembly of agents that come

together. This multi-directional model introduces the concepts of structures of feeling, the development of intuition and the structuring elements of narrative scaffolding. It also introduces mythic possibilities as elements that align players within the culture of a game and guide and structure gameplay. Building this game's culture, the chapter ties the production of meaning through gameplay to the stories that are produced within play, including what statements these are able to produce. Within evolutionary computer games two matched narratives are found; the paired technoscientific and spiritual stories of life itself and the cosmological framework formed within the posthuman.

Chapters five and six further investigate the technoscientific and spiritual narratives that surround artificial life and evolutionary computer games. Chapter five explores technoscience narratives of life itself, through definitions of life that draw connections with the life sciences allegiance with code, informatics and cybernetics through neo-Darwinian evolution, autopeiosis and cybernetics. It further expands these definitions, investigating the rhetoric and structure built around space and time within computational regimes. This also highlights the ties that are forged between the 'virtual universes' of artificial life emplacements, and our own material physical universe. Chapter six moves from the scientific discourse surrounding artificial life to investigate common sprititual narratives, exploring the concepts of Gaia, Mother Earth, Cosmic Christ and the living universe found within 'postmodern' spiritualisties. Embedded within this narrativity, the at once oppositional and complimentary figurations of a god of evolution (a patriarchal position) and god as evolution (an emergent systemic position) are found and the interplay between the two is examined, especially in relation to the positioning of the player and game system. In what at first appears to be contradictory and challenging god positions, a complimentary, if strained, arrangement within evolutionary computer games and postmodern spirituality is found. Developing the spiritual narrativity within evolutionary computer games and the progression of gameplay, the story of life as genesis is traced. This occurs through the three stages: the construction or worlds, the creation of life and change through evolution. This spiritual grand narrative is expanded upon and explored, connecting to artificial life's twinned scientific discourse.

Building the scientific and spiritual narratives of artificial life through evolutionary computer games, chapter seven traces a genealogy of games, finding a common ancestor in the *Game of Life*. The chapter continues through two early research programs, Richards Dawkins' *Blind Watchmaker* (or *Biomorphs*) and Thomas Ray's

Tierra, both highly popular with lay users and enthusiasts. Computer games by game producer Maxis such as *SimEarth* and *SimLife* complete the genealogy and prepare for a fuller investigation of the *Creatures* series of games. Throughout the genealogy, tracing the development of scientific and spiritual narratives that connect silicon and carbon, and digital and material together, these evolutionary computer games and programs are presented as heterotopian emplacements, in that they become perfected instances of neo-Darwinian and evolutionary definitions of life itself and computational regimes.

Focusing on the *Creatures* series of computer games, chapter eight examines in depth the development of a game's culture, structured around the dual conceptualisations of life as (techno)scientific phenomena and as vulnerable life forms in need of nurturing and care. This builds bonds of kinship and commonalities with carbon life. It explores the scientific discourse and meanings of life structured through play and the development of these through the playing out of a mythic discourse of construction, creation and change. Turning to the role and position of the player, the chapter explores the placement of the player as a patriarchal god figure and the interplay between this and the contrasting figure of the god within the system. These two positions of power are explored to discover how each becomes interdependent on the other, within computational regimes, in order to progress the system as universe. Throughout the chapter, the question of how it has become possible to consider silicon entities as living things is questioned, together with how the game's culture, including player involvement, develops the life status of silicon creatures and our relationship with this life.

The thesis returns to the Massumi quote introduced in chapter nine to conclude, asking "does it work?" when considering the new narratives and meanings of life, nature and the cosmos that evolutionary artificial life computer games are producing through play. It suggests that what is produced is a recuperation of Modern notions of time and space and a unitary definition of life and cosmo that needs careful consideration when applied to the emergent processes underlying artificial life theory. The chapter reviews how evolutionary computer games have actively promoted themselves as artificial life products, creating links with the life and biological sciences and incorporates a discussion of *Spore*. The meaning produced within play naturalises and normalises specific definitions of life steeped in neo-Darwinian evolutionism and cybernetics, and how our digital creations have become perfected examples of the essence of this life. Challenging such a unitary view and utilising Bruno Latour's program of political ecology, his

concepts of proposition and habit suggests an alternative framework to examine artificial life and our relation with these entities.

Chapter 2

Computer Games, Technoculture and Technoscience

Placed within the typically distinct fields of computer game studies and science and technology studies, this thesis draws from a wide theoretical net. It creates a converging point between disciplines as it considers evolutionary computer games as bringing players and other members of the assemblies brought together in gameplay, into the fold of media, technology and (techno)science. The thesis attempts to find shared ground between areas of interest. It postulates a unified theoretical vantage point that encompasses an underlying assumption of playing computer games as a productive practice, one that brings together an assembly of agents in the creation of meaningful (and hopefully fun) gameplay. It also seeks mechanisms in which computer games and play connect and are framed within the cultures and assemblages that surround them, including how these are connected and framed within games and play.

Turning to computer games as an area of academic interest, the recent field of computer game studies has attempted to find a theoretical vantage point it can call its own. This has been focused on the issue of narrative and simulation within computer games. The more recent work within science studies explored in this chapter and moving forward from the 'science wars' (and on the borderlands of science and technoculture) provides a converging point with cultural studies, and forms the backbone of the theoretical positioning of this thesis.

Computer Games as an Area of Study

Far from exploiting what Espen Aarseth has termed the "virgin soil" of computer game studies "ready to be plotted and plowed by the machineries of cultural and textual studies" (2004: 45), cultural and media studies (apart from a few notable exceptions) took some time to consider computer games as a serious area of study. Academics steeped in a heritage of film, literary and drama studies staked early claims in this field, largely assuming that computer games constituted a new form of media that could be subsumed within their theoretical frameworks of

narratology and textuality. Against this, an emergent branch of computer game studies, formed around the concept of ludology (the study of play) has rejected the notion that games are story-telling media, focusing instead on the notion of the act of playing as simulation rather than representation. These contemporary forms of computer game studies, largely crystallised after a formative year in 2001, have focused on mapping and debating the theoretical frameworks of narratology and ludology.

As an area of academic interest, writing on computer games predates the recent formation of computer game studies, with many of the typical responses new forms of media have come to expect, especially those intended for the young (and therefore vulnerable). The early promise of computers in the spheres of work, leisure and education where "computer systems are being developed to assist teaching and learning in the classroom and outside" and where computerised games and leisure activities "designed to fill time vacated by work" (Laver 1980: 47), heralded a future where computers eased work pressures, aided in the provision of education, and supplied new forms of leisure and entertainment. Despite early predictions that computer games on "domestic television screens" (1980:55) would provide a large and expanding market and that "viewdata systems" similar to the Internet would "establish informal links across and between communities, and perhaps eventually between nations" (1980: 56), Murray Laver's mapping of the computer's increasing absorption into everyday life was quickly subsumed by worries of computer/arcade game addiction (and the deviance that comes with addictive behaviour) and the influence games, violent games in particular, were having on youth. Initial forays such as Loftus and Loftus' study of computer games (1983) painted a bleak picture of games and players with a world of teen "video game addict[s], look[ing] forward to going to the arcade more than anything in life" (1983: 89). This sparked concern for a generation of young adolescent men (considered the typical video game user) ready to turn to deviant behaviours (stealing, truancy, general anti-sociality) in order to feed their addiction. The (media) effects that the games were having on this generation were also under scrutiny, reflecting similar concerns that other new popular media forms such as penny arcades, comic books, cinema, and television have held before them, which led Loftus and Loftus to genuinely ask "Do video games 'teach' us violence?" (1983: 97).

While the academic and social legacy of computer games as a dangerous social vice continues, more positive light has been brought to the field. As early as 1986

Brian Sutton-Smith's study of games and toys included computer games as a serious form of play. Functionally tying the practice of play into the cultures from within which they occur, Sutton-Smith finds that toys, games and computer games specifically overcome problems of adaptation:

> [Games] can be seen as models of adaptation. They exist to stimulate some adaptive problem that the group is having. They exist to reduce that problem to a scale that is manageable. They reproduce the two sides of the problem... and also the excitement that goes with the uncertainty of not knowing what the outcome will be. (1986:64)

It is this functional theorising on computer games that is lacking in the recent development of computer game studies; the documenting and building of ties and links between computer games and the culture(s) in which they are situated and are embedded within. Social commentators have continually suggested a tight bond between the games of a culture and the greater values and practices of this culture (McLuhan 1964: 235; Barthes 1972: 53; Gailey 1993: 81). Mark J.P. Wolf comments on the computer game as a cultural influence:

> We may also ask how video games are related to the cultures producing them, and what they say about those cultures. Video games have become well integrated into other cultural forms and media, yet perhaps overlooked as a cultural influence. (1997: 22)

Whilst recent attempts in computer game studies have made cursory attempts towards opening computer game studies to a more cultural perspective, there has not been any strong academic response to the question of the greater cultural aspects of computer games first raised by those like Sutton-Smith. Through introducing a concept of ideology in the underlying rule-based nature of computer games, Gonzalo Frasca makes a tentative first step in relating computer games back into the cultural realm. Moving from the representation of characters, backgrounds and settings, through manipulation, goals, and the availability of players to change the rules (2004: 232), Frasca attempts to introduce the intentionality of the game designers as ideology within the games. By denying computer games the ability to 'storytell,' Frasca's model stops at the level of game designers and players influencing gameplay through the enforcing and interpretation of rules. Henry Jenkins, in attempting to open computer game studies up to a nuanced concept of narrative, where game designers become 'narrative architects' (2004: 121), takes another step towards connecting games and culture. For Jenkins the environment of the gamespace allows for the development of narrative in one of four ways:

Spatial stories can evoke pre-existing narrative associations; they can provide a staging ground where narrative events are enacted; they may embed narrative information within their mise-en-scene; or they provide resources for emergent narratives. (2004: 123)

By keeping this narrative work at an individual and personal level, Jenkins (as with Frasca) fails to truly link computer games and gaming within cultural discourses. There is no connection made with cultural grand narratives, values or adaptations made within Jenkins' work. It becomes a separate task to extrapolate out to realise cultural work – for Jenkins, computer games evoke, enact or embed personal narrative work, and we then must embed this personal narrative within greater cultural narratives and values as a separate next step. This thesis, by taking the theoretical standpoint that computer games and particularly evolutionary artificial life computer games can be considered as assemblages connected to other cultural assemblages; an intimate bond between game and culture is established. The development of a game's culture, expanded upon in chapter four, also makes connections between culture and games.

There are four major aspects of computer games that computer game studies have made its focus and which aid in the development of the thesis argument. The first is narrative: are computer games a narrative form of media, are they stories? The second, simulation, is seen as the structuring element of gameplay. Conceptualised in opposition to narrative by ludologists, simulation views play as an active emergent process rather than as a pre-existing story. Next is space, further explord in the next chapter: what is the spatiality of computer games? Finally, embodiment: how can we relate action of 'virtual' gameworlds to the 'real' players' inputs on joysticks and keyboards?

Narrative

There is a major focus within contemporary computer game studies on whether or not computer games can be considered as narrative structures or at least have a sense of narrativity within them. From Barry Atkin's proclamation that "however much the computer game might be... 'more than a game', it is still a fictional form" (2003: 22) to the opposing yet equally proclamatory statement by Markku Eskelinen, "I think we can safely say we can't find narrative situations within

games"[4] (2004: 37) the topic has proved highly divisive within the field. As late as 2007, the division between ludology, narratology and "the issues at stake seem to have been blissfully ignored rather than resolved" (Simons 2007). Ludologists, keen in their quest to map out computer game studies as a unique area different from film and literary studies, have rejected the notion of narrative outright in favour of other models of play; most notably simulation. Finding such a move premature, Jenkins suggests that ludologists "are so busy trying to pull game designers out of their 'cinema envy' or define a field where no hypertext theorist dares to venture that they are prematurely dismissing the use value of narrative for understanding their desired object of study" (2004: 120). Although Jenkins balances himself by stating that playing a computer game "can never be reduced to the experience of a story" (2004: 120), he finds games to provide "immersive narrative experience" (2004: 123) where narrative activities such as story building occur (see also Wallis 2007: 69). Torill Mortensen suggests that the platform engine of computer games "creates the surprise and the events, while the interpretation process forms them into a story to be told and shared with other players" (2007: 299), where players are engaed in story creation from gameplay. This thesis takes the stand that both narrative and story building are important aspects of computer gameplay. This is reflectd by James Wallis when he suggests that gameplay is supported by games offering 'a way of creating a story within the structure of a game, which not only helps to structure the narrative but adds to interaction and competition" (2007: 69). In the building of the narrativity of computer games, however, care needs to be taken. Gameplay – although a narrative producing experience, is not textual in itself[5].

Aarseth equates the ability of computer games to produce narratives to that of 'real life':

> Ontologically, the capacity for generating memorable moments is something games have in common with real life. A story generating system does not have to be a story itself. In fact, while life and games are primary, real-time phenomena, consisting of real or virtual events, stories are secondary phenomena, a revision of the primary event, or a revision of a revision, etc. (2004: 50)

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[4] Eskelinen defines the minimal definition of narrative as containing a temporal sequence of events (plot) and a narrative situation (2004: 37).
[5] Chapter Three opens gamespace as an environment that can be read 'textually', invoking Soja's conception of firstspace. The activity of gameplay, although occurring within this space, is a productive and not textual practice.

Aarseth relates story telling as an after effect of gameplay; that stories and narratives are something taken away from games, but are not involved in actual gameplay. Challenging this, a necessary part of gameplay is the production and continual reassessment of strategy, decision-making and actions, all of which are continually being built through the experience of gameplay. "Games not only become 'stories' after the fact, but stories can be an important part of the decision making process" (Simons 2007). It is the ability to make use of perceptions of past actions in the determination of present ones that makes gameplay possible. It is exactly this aspect of gameplay that Wallis finds exciting:

> The challenge of simulataneously telling a story and playing a game – or if
> you prefer, telling a story while thinking not only of plot but also of tactics,
> strategy, and how to avoid the other players derailing you – is exhilarating.
> (2007: 69)

This is especially the case where players are required to repeat actions, through multiple 'lives' or similar game predicaments, in order to progress and improve gameplay. 'Story generating systems' are not after the fact; they are embedded within meaningful, and enjoyable, gameplay. It is this strategic aspect of gameplay that converges narrativity and game theory as "in order to determine an optimal strategy a game theorist (and a game player who calculates his or her chances) has to be able to compare the payoffs of all possible outcomes of a game" (Wallis 2007).

This thesis develops narrativity and story generation through the productive practice of gameplay, relating and mapping this against similar work in the production of life narratives. By treating computer gaming as a productive practice, it sidesteps the lugology-narratolgy debate on the issue of narrative and instead develops story generation and narrativity as a contribution to the production of meaningful gameplay and meaning within games. This ties in with the development of a game's culture. It then ties these into the statements that players can take away from gameplay, and how these work in the formation and reinforcement of cultural grand narratives in the playing through of mythic possibilities. Particularly valid in the new formations surrounding life itself, grand narratives have "returned with a vengeance with a variety of posthuman scenarios being offered" (Ansell Pearson 1997: 221). Evolutionary computer games are fertile ground for the exploration of such narratives.

Simulation

For those games theorists tending towards the ludologist standpoint, the rejection of narrative within games has opened up games as sites of simulation. For Aarseth, "the hidden structure behind... computer games is not narrative – or that silly abused term, 'interactivity' – but *simulation*" (2004: 52). For Aarseth "the computer game is the art of simulation":

> [I]t is the dynamic aspect of the game that creates a consistent gameworld. Simulation is the hermeneutic Other of narratives; the alternative mode of discourse, bottom up and emergent where stories are top-down and preplanned. In simulations, knowledge and experience is created by the payer's actions and strategies, rather than recreated by a writer or moviemaker. (2004: 52)

Considering computer games and computational environments as simulations predates ludology and computer games studies as an area of interest, and one of the basic modes of interaction we have with computers. Sherry Turkle has viewed contemporary culture as being increasingly marked by the logic of simulation, where "computers offer the possibility of creating and working within artificial worlds, whether to simulate the behavior of economics, political systems, or imaginary subatomic particles" (1984: 82). Turkle raises early concerns over the nature of the simulations we create in computers, along with our increasing infatuation with these digital worlds by asking the question of what happens if the computer simulations we produce are preferred to the 'real.' She views computer games as contributing to this as they "offer a chance to live in simulated, rule governed worlds" (1984: 79).

Within writings on the character of simulation, two themes are recurrent; one, of rule governed worlds; and two, of the preference of the simulation over the real. In analysing interactive fiction, considered by many as a precursor to video games, Robert Kelly finds within increasingly complex simulations "the realization that a perfect model, a superior imitation, *becomes* the reality it seeks to simulate" (1993: 52). He finds the danger lies within the underlying assumptions and rules upon which the simulation was programmed: "the game world would have us generate a fictional truth transferable to the real world, but it does so in a way that allows the user to generate no fictional truths for herself that are not pre-programmed into the game" (1993: 57). For Jesper Juul computer games are simulations whose "fictional world cues the player into making assumptions about the real world" (2005: 168). They both relate the rule-based nature of computer

programming and the assumptions used in programming the simulation to the 'truths' or statements players are able to take from the game. This is a structuring element of gameplay – the game can only operate in the manner it has been programmed and cannot break from the underlying rules of its program. Players have no choice but to play within these rules. The game simulation allows only a certain set of statements to be taken away from play, but it is exactly this manipulation with simulations that Turkle suggests as a way of learning about the world:

> Some people say that not only is knowing how to manipulate complex simulation surfaces all they need to know about computers, but that these simulations are the best way of learning about the world. Others find such notions deeply problematic and even dangerous. (1996: 63)

Although Turkle proposes that in video games the underlying "rules have given way to branching narratives" (1996:88), the programming of the game and the underlying assumptions used cannot be ignored in the structuring of gameplay. Finding an example in the evolutionary artificial life game *SimLife,* she finds that such games "teach players to think in an active way about complex phenomena (some of then 'real life,' some of them not) as dynamic evolving systems" (Turkle 1996: 70). The (game)world becomes structured by the underlying assumptions of its programming and these become transplanted back to the original. Turkle postulates such a scenario:

> Simulation games are not just objects for thinking about the real world but also cause us to reflect on how the real world has itself become a simulation game. (1996: 71)

It is this double reflection that is developed through the thesis: of our computer models simulating the 'real world', and this same 'real world' coming to be thought of in the same manner as our computer models.

Space

As simulational rule-based worlds, computer games have an obvious sense of space. Even early text-based interactive fictional games were often concerned with the exploration of new worlds and environments. Writers on the subject have developed both the presentation of space and the player's ability (or lack of) to explore this space, as well as the spiritual connotations such 'virtual space' may contain. Wolf finds that in the presentation of space, computer games share many

of the same conventions of cinematic use of space, although computer games also have some key points of differentiation:

> In a video game, not only the representation of space, but its very implication, depend on being programmed and actively created. Second, because the video game has no default structure for its off-screen space, that space can be shared and structured in new ways that did not develop in film or television. And finally, the video game, as an interactive medium, often gives the player some control over the point of view, allowing one to choose which spaces appear on-screen or off. (1997: 12)

It is this building of digital environments with a sense of space that is observed 'on-screen' and exists 'off-screen' as complete worlds that creates the allure of an endless cyberspace in computer games. Staub and Hussey have suggested that computer games and cyberspace more generally break away from the conceptualisation of material space as 'framed space', and create such an unframed spiritual space:

> But it is the abandonment of any idea whatsoever of framed space that the computer game makes its clearest statement about the nature of cyberspace. Indeed, what the computer game does is to substitute for material space the ancient concept of spiritual or sacred space as found in the art of medieval Christianity and Islam. This is space without end (Amen). (1998:180)

For Staub and Hussey computer games have offered sacred spaces that can be entered, explored and experienced at the player's volition. Approaching computer game space from an opposing perspective, Jesper Juul finds that it is actually the limits put on the spatiality of a game that structure game play, which places the player between what he has termed the rules and fiction of a game. Here, the digital environments of game worlds are not viewed as space without end. Quite the contrary, they are viewed with (often invisible) borders that limit the exploratory areas and aspects of the game and therefore guide the player in gameplay. For Juul:

> ... space in games is a special case. The level design of a game world can present a fictional world *and* determine what players can and cannot do at the same time. In this way, space in games can work as a combination of rules and fiction. (2005: 163)

It is the limitations placed on players in the movement around gamespace that Juul finds of interest; how the exploratory space of a game is limited by the design of the game, and how these limitations frame gameplay. As well as

creating the setting for the game, "the fictional world also influences the players' understanding of the game rules" (Juul 2005: 167). The space of a game is a structuring element of gameplay. It upholds the rules of the game and guides the player in gameplay through the distinction of explorable and off-limit (or non-existent) space.

Juul also relates and builds links between the space of the computer game and in the space that the game is played. He finds again that it is the rules of the game that separate gamespace from the space that surrounds it. Within the space of the game, the rules of the game apply. Outside of the space the rules of the game no longer are applicable:

> Rules separate the game from the rest of the world by carving out an area
> where the rules apply; fiction projects a world different from the real world.
> The space of a game is *part of* the world in which it is played... (Juul 2005:
> 164)

This thesis progresses this concept further as the case of computer games is a special instance of this general observation of all games. Unlike other games played in or on physical material spaces (such as a football field) where it is through a voluntary mutual agreement between agents involved in the game that the rules are obeyed, in a computer game adherence to the underlying rules and programming of the game is obligatory. The rules of a computer game determine what can and cannot occur in game play. On entering gamespace, the rules as the programming of the game establish what is and what is not possible. The player cannot break away from the rules within the gamespace. It is the rule-based nature of gameplay and especially the programming of computer games that limits and structures where and what the player is able to do in the game. For James Newman, "Video games present highly structured and, importantly, highly segmented experiences" (2002), but it is hiding of these rules in game design that allows the player "to *believe* she is in control" (Simons 2007). This thesis builds on this aspect of space and rules within games, considering gamespace as a structuring element of gameplay. By turning to work in social geography, and especially that of Soja and Foucault, the thesis builds a layered conceptualisation of computer gamespace. This can be read initially for its textual/semiotic context and secondly developed as a structuring agent in the production of meaningful action and gameplay. Developing the digital electronic spaces of computer games as special instances of space invoking Foucault's concept of heterotopia extends how we can examine the special status of computer games as spaces, as well as

the relationship between game and player. Exploring electronic digital space as a special instance also highlights defining features that it holds from physical material space.

Embodiment

When analysing and discussing computer gameplay, the question of embodiment should be high on the agenda as there is such an apparent contrast between the physical materiality of the player and corresponding digital drama of play on the screen. At first glance, gameplay appears to be a disembodied practice, with the player transported to the action and play, occurring within the 'virtual space' of the computer game, pixelated and displayed on the monitor. The action seems to be on the 'other side'; within the digital electronic space of the game the physical presence of the player seems forgotten in gameplay. This is far from the case. For Sutton-Smith, the adaptive problem of the computer game is to "beat the machine" through "physical skill and coordination of hand and eye, by strategy and by good luck" (1986: 66), reiterating the playing of computer games as an embodied practice. Embodiment, when attached to our encounters with digital electronic spaces, begs the questions – Where are we? And how do we reconcile our material presence with our 'virtual' or digital one? Following a tradition within technoculture studies of flow and movement between 'real' and 'virtual', Turkle finds environments in which players readily move into the gamespace in computer games, "with the computer behind them the video games provide imaginative worlds into which people enter as participants" (1984: 75). The inhabiting of virtual worlds by players, the movement between the body playing the video game and the player's presence within the gamespace all need close examination.

Computer game playing is usually conceptualised as either an immersion in or travelling to the gamespace by the player, finding cyberpunk oringins of a trajectory to escape the 'meat' body through digital transcendence. Martii Lahti finds that:

> One of the most often repeated and taken-for-granted assumptions in much
> writing on "cyberspace" is revealed in a tendency to treat new media,
> games included, as machines to realize desires for bodily transcendence,
> that is, an "out-of-body" experience. (2003: 158)

Immersion features highly in such conceptualisations; For Janet Murray, most famously, it evokes the powerful experience of travel to "an elaborately simulated

space" metaphorically relating the virtual experience of cyberspace to the "physical experience of being submerged in water" (1997: 98). It is the digital presence of the player within the gamespace that takes priority in such conceptualisations, Sutton-Smith's observations on the 'physical skill' that is needed to play games is neglected and forgotten. It is through new separations and distinctions between a disembodied mind and body in which such digital travels take place. Even when repackaged as the 'virtual body' (Ryan 2001) metaphors of mind out of body transcendence permeate; immersion, travelling, reaching a foreign land, being taken prisoner are all common (Ryan 2001: 93). Even setting aside full immersion momentarily, Marie-Laure Ryan finds textual and digital spaces offer the user 'travel':

> Yet if the nomadic, alienating space of postmodernism prevents an immersive relation, I would not go so far as to say that spatial immersion precludes travel. Textual space involves not only a set of distinct locations but a network of accesses and relations that bind these sites together into a coherent geography. (2001:123)

Even in instances when the material presence of the body is remembered, a distinction between the physical body and digital presence is created. For Lahti:

> This process relocates and doubles our body in such a way that it is simultaneously and interconnectedly present in two places at once: The player's body is next to the computer screen or television monitor, but her avatar, the "I" or vision that was part of the body, is travelling through and in the virtual space of the game opening behind the monitor. (2003: 164)

Metaphors of travelling or immersion require that a distinction and separation be made between the physical material embodiment of the player and his/her disembodied, out-of-body digital self as game agent, a contemporary interpretation of older mind to body dualities. Here, the ontological ability to translate the player as abstract information allows a new duality between the physical and informational self. Moving towards a more nuanced and firmly embodied conceptualisation of players' involvement in the cyberspaces of gamespace, chapter three examines the spatiality of 'cyberspace' and our involvement and intra-action within this space as humans. Specifically, by retaining our core physicality as a key aspect of human embodiment and considering player extension into gamespace, we can consider key questions regarding human involvement in the digital spaces we are creating. How are humans included (or excluded) in electronic digital space? What kinds of relationships can gamespace/cyberspace make with the 'real'? Considering

computer games as forging new "cyborgian relationship[s] with entertainment technologies, linking our everyday social space and computer technologies to virtual spaces and futuristic technologies" (Lahti 2003: 158), an embodied conceptualisation of play lets one explore the political and ontological considerations of these new relationships.

Incorporating Science and Technoculture

Often considered the closest realised example of William Gibson's fictional cyberspace, computer games have an academic heritage with technoculture studies. As I will explore in the examination of the spatiality of cyberspace in chapter three, the legacy of first wave technoculture studies allured theorists with the promise of radical new forms of identity, spatiality, community, and digital travels. Typically, these positions were formed within structures that at once formed an opposition and recuperation of more comfortable modernist frameworks. J Macgregor Wise (1997), developing three epistemes in which to explore and analyse our relationship with technology, would locate this first wave of academic response within the modern episteme; centred on issues of time, causality and identity. Wise's tri-fold of modern, amodern and Deleuzian epistemes, each a "hermeneutical horizon that results from a particular set of assumptions, and that determines the questions that can be asked of ourselves, our society, our technology, or of our environment" (Wise 1997: xiv), offers a framework to distinguish and structure theoretical conceptions of space, time and technology. Understanding each episteme aids in the placement of conceptual frameworks that find a legacy within evolutionary computer games, as well as grounding and positioning the materialist foundations of the thesis argument.

Wise finds the modern episteme the most prevalent and deeply entrenched of the tri-fold, as it has been central to philosophical conceptions of modernity and common-sense understandings of Western, industrialised society. Wise centres his exploration of the modern episteme on the Kantian notion of the separation of space and time, and the further separation between subject and object. Technology, within the modern episteme, confronts and manipulates time. It is transformative, converting time from 'natural' human time, or durée, into abstract time – sequenced, packaged and discrete. For Wise, this relationship that technology holds with time creates its most characteristic element within the modern episteme; its ability to seemingly collapse time and space. By abstracting time, technology attempts to master it, producing a disenchanted time that is

marked by sequence rather than as *a priori* form. Importantly, as explored through the thesis, it is this sequencing of time that has been adopted wholeheartedly within computational regimes, asserting a common ontological character between the computer ticking of sequenced programming instructions and the discretely sequenced divisions of a disenchanted time.

As a consequence of this pattern of sequence given to abstract time, the modern episteme relies on a notion of causality to explain relationships between terms. This focus frames discourses on technology as located either within technological or social deterministic models (or a combination of both), but, it is this positioning within a framework of cause and effect that creates the limitations of both social and technological determinism. Both views are abstractions that create contradictory positions when viewed within the modern episteme. With questions of causality, also comes the question of control, bringing the understanding that technology is meant to bring the future under human control. In the modern episteme control becomes linked with the Kantian self/other differentiation and is then conceived of as mastery. Accounting for modern technology, humans have created machines as slaves within our control, but humans are considered enslaved by this very same technology.

Moving from the modern to amodern episteme, Wise considers the conceptual model of the cyborg and actor-network theory as key motivators, with the work of Haraway and Latour formulating a response to the limitations of the modern episteme. Haraway's infamous ironic figuration of the cyborg forefronts the question of the borders between human and other and muddies distinctions, especially between human and technology, which the modern episteme held dear. The cyborg does not think in terms of difference, but rather in terms of alliances, articulations and spatial positioning. It is these that are also central to Latour's actor-network theory, considering social space in terms of agency, and the movement and influence of actors coming together within a network. Although not completely aligned with cybrgian theory, the actor-network perspective also stresses both the contingency of networks (they are not determined, permanent or universal) and their emergent qualities. They are rarely stable for long and continually introduce new elements and changing relationships between actors. For Latour, both humans and nonhumans can exert social influence within a network. This means that technologies are as much actors as humans are. Although not passive, actors do vary in the extent to which they influence or resist influence in the network. The network follows the mutual determinism of both

technology and society. Technology (artefacts and practices) needs to be perceived as impinging on human behaviour, as humans, in turn, shape technology. The focus here is not based on notions of identity, but of agency. For Latour, this erases the ontological split between Nature and Culture fortified in the modern episteme through the process of purification, where objects are either social or natural, but never both. Latour's project involves bringing new types of things to the fore – hybrids of nature and culture; in Latour's terms, the 'things down there'.

A focus on networks and spatial alliances in the amodern episteme denies the primacy of time over space as was found in the modern episteme. Instead a spatial view of technology is established where:

> Artifacts exist in space, manipulate and manage space, and, through networks constructed by the enlisting of multiple actors, establish lines of power and domination that crisscross space. (Wise 1997: 36)

While this places space prior to time, it still holds to (Kantian) distinctions between time and space. Wise looks to a third episteme to introduce a conceptualisation of assemblages within which one can trace numerous social actors across time and space, a non-random configuration coded to certain hegemonies. He finds such a response in Deleuze (and Guatarri) and so terms his third episteme the Deleuzian episteme. Within the Deleuzian episteme, Wise holds onto the amodern notions of artifacts as social actors, the construction of long networks, the deterritorialization of identity (through the proliferation of hybrids) and the social construction of time. In his use of the Deleuzian episteme, Wise attempts to account for differences in the distribution of agency without taking recourse to abstract macro-actors such as social forces. His argument is for the building of hegemony through technological systems, not only through the discourse deployed by and around that system or by any symbolic capital it articulates, but through affective investment and material asignifying practices, structures and constraints. A description of the relation between technology and language becomes crucial to any analysis of the social. Wise views this as what is missing from the amodern episteme, while some attempt to come to grips with the regularities that are perceived within and between actor-networks.

As introduced in chapter one, Delueze and Guattari consider that the articulation of technology and language is the function of a machine, defined as an apparatus of functions that redirects flows. Keith Ansell Pearson considers machinic

assemblages to be constituent of all systems: "from the 'biological' to the 'social'
and economic are made up of machinic assemblages, complex foldings, and
movements of deterritorialization that serve to cut across and derange their
stratification" (1997: 125). The thesis argument considers evolutionary computer
games as bio-technoscientific assemblages formed as social media. Any
technology, including a computer game, is necessarily part of a system of
technologies, being a system with both human and nonhuman actors. A
technology services and supports other technologies and is equally serviced and
supported itself. The form of a technology will have resonances with similar forms
of other technologies and technological systems. There are no singular forms,
only multiplicities, which means there is no technology that is fully unique. What
Deleuze and Guattari distinguish as the anthropomorphic stratum is in this way
marked by a differentiating machine that forms and organises substances. The
differentiating machine arranges artifacts (and people) in space, in spatial
arrangements, and by extensive movement. Another machine – a territorializing
machine – also works on the stratum. The territorializing machine invests
substances (formed matter) with intensity (such as affect). This sets the
possibility for mobility and attachment. Wise finds that the "processes of
territorialization intensify particular formations; the territorialization of any
substance is always in process" (1997: 68). Against this, processes of
deterritorialization de-intensify particular formations and therefore cut across
strata. This opens the stratum onto other strata and onto mythic territories or
abstract machines.

Within the Deleuzian episteme Wise describes, forms resonate with other forms;
territories open up onto other territories; assemblages are always aggregates, and
human space is always social. Social space includes the articulation of the
machinic assemblages (technology) and the assemblages of enunciation
(language). This double articulation defines a specifically human social space,
which resonates with the amodern episteme where we are reminded that
technology is always a social actor:

> Social space is a network of relations between actors (animate, inanimate,
> or both) that are themselves aggregates and themselves the result of an
> abstract machine of stratification. These relations are structured through
> the workings of the technical social machine, the semiotic collective
> machine, and differentiating and territorializing machines – all
> interconnected, mutually determining. (Wise 1997: 70)

Through abstract machines actors are comprised, distributed, valued, lived and connected. Here, agency is not a given, but distributed, differentiated and territorialized. Wise suggests that communication and information technologies are especially important sites for analysis, as both appear to embody technology (the device) and language (the content). He notes the ambivalent nature of technology through following its stratifications in the direction of increasing deterritorialization. As one descends lower towards the foundations of rational institutions, the more ambiguous the materials are from which the institutions are constructed, and the more they are compatible with a variety of different hegemonic orders. This for Wise introduces the political:

> Our mappings of social space become political, then, in that they seek a
> less dominated space in which to stand, when we advocate a molecular
> politics. (Wise 1997: 74)

It is such mappings of social space that have been taken up within the materialist perspective that forms the foundation of this thesis. Expanding a nomadic subjectivity within a materialist approach, Rosi Braidotti introduces an alternate foundation for ethical and political subjectivity. For Braidotti, "Philosophical nomadism rests on a cartography of our historical condition that highlights the relevance of a non-unitary vision of the subject" (2006: 11). The development of such a cartography forms a political mapping of social space that realises the conceptualisation of assemblages, tracing social actors across time and space found important in the Deleuzian episteme. Braidotti uses cartography as a way of linking embedded subjects within figurations:

> Figurations are not figurative ways of thinking, but rather more materialistic
> mappings of situated, or embedded and embodied positions. A cartography
> is a theoretically-based and politically-informed reading of the present. A
> cartographic approach fulfils the function of providing both exegetical tools
> and creative theoretical alternatives. As such it responds to my two main
> requirements, namely to account for one's locations in terms of both of
> space (geo-political or ecological dimension) and time (historical and
> genealogical dimension), and to provide alternative figurations or schemes
> or representation for these locations, in terms of power as restrictive... but
> also as empowering or affirmative. (2002: 2)

Here Braidotti takes from Felix Guattari who conceptualises cartographic mappings within models of subjectivity:

... every individual and social group conveys its own system of modelling subjectivity; that is, a certain cartography – composed of cognitive references as well as mythical, ritual and symptomatological references – with which it positions itself in relation to its affects and anguishes, and attempts to manage its inhibitions and drives. (Guattari 1995: 11)

Cartographies move beyond the amodern mapping of networks within space to consider, in Deleuzian terms, the various strata joining as vectors within the formation and continual production of assemblages. These strata are embedded with spatiality and historicity and include the subjectivity of the human and nonhuman agents within networks and assemblies that come together within an assemblage. Centralised on playing with the essence of life itself, evolutionary computer games tie themselves with similar life producing assemblages in what the Critical Art Ensemble have termed the Flesh Machine: the machinic processes and assemblages deterritorialising and redefining what 'life itself' is. Finding new definitions of life steeped within informational evolutionism and cybernetics, these games move the essence of life from a material to abstract informational ontological structure that has implications outside of merely defining life. Elizabeth Grosz suggests that in order to respond to such moves, there must be a re-examination of 'where we come from' (2004:2):

We need to return to, or perhaps to invent anew, the concepts of nature, matter, and life, the most elementary concerns of the cosmological and the ontological, if we want to develop alternative models to those inscriptive and constructionist discourses that currently dominate the humanities and social sciences, in which the transformation of representation is the only serious political issue, and where the body is of interest only in its reflection through discourse, its constitution in representation, or its mediation by images. (2004: 2-3)

This thesis turns to the new natures and entities (re)created within evolutionary computer games as a site for a cartographic mapping of new meanings – of life, nature and cosmos, actively produced through play, whilst finding connections with similar productions in other media and technoscientific assemblages. Don Ihde suggests that, similar to Descartes seeing and not seeing himself within his camera, we do the same with our cybertechnologies (2202: 86). These technologically enabled sites become places of exploration and intra-action between the world and us: 'seeing' a specific story and definition of life, nature and cosmos. Guattari views such examples of popular media as important in the investigation of human subjectivity:

> Should we keep the semiotic productions of the mass media, informatics, telematics and robotics separate from psychological subjectivity? I don't think so... [T]echnological machines of information and communication operate at the heart of human subjectivity, not only within its memory and intelligence, but with its sensibility, affects and unconscious fantasms. (1995: 4)

Similarly, Braidotti finds that one of the most 'distinctive traits' of contemporary culture is the convergence of previously separate technologies (2006: 30). Here she finds that:

> The distinction between bio-technologies and genetic engineering on the one hand and information and communication technologies on the other is untenable. They are equally co-present in driving home the spectacular effects of contemporary technological transformations, especially in terms of their impact on the gendered human subjects. (2006: 30)

Evolutionary computer games combine both bio-technoscience and communication technologies. The new silicon life that they claim to create and host is produced through the technology of computer games, blending bio-science and bio-technology with/in communication technologies enjoyed by players across the world. These games present silicon entities that present lifelike behaviour patterns and life histories that resonate with carbon and human life. Within a posthuman imagination, these silicon entities form interesting play-things that tell us about our own life, as well as poised as the next developmental stage of life on earth within an informational evolutionary standpoint. Katherine Hayles finds within these projections that there is "a tendency to extrapolate from relatively simple mechanical behaviours to much more complex human situations and a consequent redescription of the human in terms of the intelligent machine. These machine constitute, we are told, a new evolutionary phylum that will occupy the same niche as *Homo Sapiens*" (2005: 132). Within this story, silicon life is set on a path of succeeding humans as the dominant form of life on earth. It is exactly this rhetoric that Ansell Pearson finds in new forms of grand narratives and discussions of "life on earth taking pace in terms of the evolution of techno-organic life that has cultivated positive feedback loops between 'intelligence' and biology resulting in an accelerated evolution, with the increasing hegemony of artificial life over natural life being understood as a Lamarckian invasion and take-over of so-called dumb and blind Darwinian selection" (1997:148). This version life, offered within artificial life and the posthuman imagery it promotes, describes a specific and unitary vision of what it means to be alive; what living is and how the living are placed in relation to each other, their surroundings and the universe. Evolutionary computer games offer a means by which to examine, explore and

intra-act with this life. For Don Ihde, such technologies are 'prosthetic devices' allowing users new 'eyes' in the exploration of the world. Finding inspiration in Haraway's 'god-trick' he warns of how "'the eyes' made available in modern technological sciences shatter any idea of passive vision; these prosthetic devices show us that all eyes, including our own organic ones, are active perceptual systems, building in translations and specific *ways* of seeing, that is, ways of life" (Ihde 2002: 71 italics in original).

In response to the universalisation these offer, Bruno Latour calls for a practice of political ecology to challenge 'Science' as "the proliferation of smooth, risk-free matters of fact, with their improbable cortege of incontestable knowledge, invisible scientists, predictable impacts, calculated risks, and unanticipated consequences" (2004:27). Instead of rejecting any form of universalism outright, Latour argues for an incremental or emergent universalism that has been hard won through the practice and debate of 'sciences' (2002: 44). Similarly, Braidotti calls for a different approach to what she terms 'moral universalism.' For Braidotti, "The ethics of nomadic subjectivity rejects moral universalism and works towards a different idea of ethical accountability in the sense of a fundamental reconfiguration of our being in a world that is technologically and globally mediated" (2006: 15). Finding resonance with the materialist position of the thesis, Latour presents the challenge as one of political and scientific 'war':

> It is not the final goal [of universalism] that is to blame, but only the strange idea that it could be reached without being at war with real enemies. In contract to the history that sought to modernize, the West has to admit to the existence of war in order to make peace: to accept that it has enemies, to take seriously the diversity of worlds, to refuse to accept mere tolerance, and to resume the construction of both the local and the global... The common world we took for granted must instead be progressively composed, it is not already constituted. The common world is not behind us and ready made, but ahead of us, an immense task which we will need to accomplish one step at a time... The common world is now up for grabs. (2002: 29)

What is important for Latour is the separation of two previously confused elements: "on the one hand, the *multiplicity* of the new beings for which room must be made from now on so that we live in common; on the other hand, the *interruption* of all discussion by recourse to a brutally and premature unified external reality" (2004: 39). Evolutionary computer games challenge both elements. They produce a multitude of new entities and intra-actions between new and existing entities that need space, but do so within an ontological framework

that claims a unified external reality across digital and material spaces. The silicon creatures within artificial life, which claim to be counted as alive, do so through recourse to unitary definitions and conceptualisations of life, nature and cosmos that state common essences between digital and material. The concluding chapter of the thesis returns to Latour's political ecology, proposing possible elements of a debate to re-examine the new 'natures' and silicon entities artificial life produces, without resorting to an unquestioned universalism that equates digital and material. To gear the thesis towards this, there needs to be an examination of a fundamental aspect of artificial life emplacements: the new digital spaces they create and how these are being conceptualised, especially against physical material space. Historically, this has been viewed as the virtual and the real. The next chapter explores this common duality and reconfigures the relationship between digital and material in order to produce a nuanced conceptualisation of spatiality, which acknowledges the common elements of all space whilst retaining the distinctive characteristics digital and material space hold.

Chapter 3

Finding Space in Gamespace

In its history, cyberspace has been conceptualised as a place of human habitation, immersion and travels, with discourses often connected to utopian virtualities that have not firmly engaged with the real spaces created by computer games and other digital technologies. This has produced the need to tie conceptual loose ends in the consideration and analysis of computer gamespace. As Juul suggests when realising the structuring effect gamespace has on play (2005: 163), an understanding of the spatial is key in coming to a reading of the operations of gameplay. Coming to a conceptual framework of the digital space of gamespaces, and their relation with material space, illuminates the special character these spaces attribute. This chapter examines computer gamespace with the purpose of identifying spatial practice within such spaces, along with its relationship with material space. It traces a historic path that has paired digital and material space within specific shared discourses and, importantly, a common ontological backbone that intimately connects the digital with material. This is seen through the theoretical development of cyberspace, of which computer games have often been viewed as the most developed form. The chapter then turns to social geography to form an understanding of the importance of space and the spatial that has emerged in relation to the production and distribution of knowledge/power. In keeping with the materialist foundations of this thesis, a conceptualisation of space that opens up a trialectics of historicality/sociality/spatiality and knowledge/power/spacetime exists. This chapter bridges such a social geography to an understanding of the (non)spaces of cyberspaces and gamespaces.

Playing a computer or video game seems to offer a transposed and dual spatial experience – that is, the player seems to be present in at least two spaces at once, "in more than one spatial domain" (Taylor 2003). The first and most obvious is the player's physical presence in front of the computer, television or other monitor and games console. Through the physical interface of the keyboard, mouse and joystick, the visual interface of the monitor display and the audio

interface of the speakers, the player also appears to be transported into the space of the game. It is in this gamespace, visually pixelated and displayed on the monitor, where the action takes place; where input from the user is translated and presented as gameplay. This playing field is an electronic space, a digital space, and therefore a discrete space, mathematically pixelated through computer programming and displayed to the player in a format that s/he intra-acts within. It forms a prototypical, if not fully realised example of William Gibson's formulation of cyberspace. Conceptualised from within cyberpunk science fiction and transferring the transcendental desires of Virtual Reality, cyberspace has offered the promise of providing humans (and nonhumans) electronic communication technologies to inhabit and communicate through. From Murray's 'immersion' (1997: 98), Ryan's 'virtual body' (2001) and Stone's 'crossdressing' (1992), commentary on digital technologies has often offered romanticised notions of how (non)human actors use, are constituted by, and interact in the cyber-arena, usually through an underlying assumption that humans can, do or will inhabit cyberspace. Caught up in this transcendental trajectory and central to this conceptualisation of cyberspace as (non)space are the dialectics of the real versus virtual, actual versus imaginary, and physical versus digital. Such conceptualisations do not make clear their use of space, time and relationships with and between the 'real world' and 'virtual reality' or 'cyberspace.' It is within conceptualisations of human digital habitation that structures that connect material and digital space have been formulated. These connect with posthuman ideals that have abstracted information from its substrate.

Developing a nuanced understanding of digital space and our (human) involvement within these spaces, this chapter develops digital space and cyberspaces as real and actual spaces, but as spaces whose characteristics cannot be easily equated as identical to material space(s). Additionally, it recognises the plurality of cyberspaces in that there are a multitude of digital spaces, each needing to be considered in its own terms of spatial construction. The chapter turns to work in social geography to build a spatial model that is sympathetic to the materialist positioning of the thesis. From such a standpoint, gamespaces are acknowledged as social spaces in constant co-construction, in which questions of embodiment and emplacement can be addressed. This allows for a more sophisticated investigation into specific gamespaces, along with an exploration into our relationship with the digital spaces we are co-creating.

The Development of Cyberspace Theory – Finding Bodies in Space

Cyberspace matters both within and outside of the sphere of evolutionary artificial life computer games. Real things happen in the cyberspaces we produce, construct and intra-act within, forging human and nonhuman, living and nonliving assemblies, networks and assemblages that effect both cyberspace emplacements and in physical material world around us. As Rob Shields has noted, "these avatars, video-game characters, software agents and virtual objects not only stand in for flesh and blood persons and physical places but they can have significant and shocking impacts on the real-life status and well-being of people" (2003: xv). First wave technoculture studies trace and form a historical genealogy that continues to structure common conceptualisations of cyberspatial emplacements, especially the gamespaces of evolutionary computer games. Within these early conceptualisations cyberspace has been held as other space, removed from physical space due to its infinite quantity and 'non-real' disposition. Human habitation and community building also shaped early cyberspatial considerations, and through concepts such as travelling and immersion, as well as an early preoccupation with digital transcendence, produced ontological connections between digital and material. Framed within the paired dialectics of real/virtual, actual/imaginary, and physical/digital that have shaped these early conceptualisations, the (tele)presence of human and (non)living entities within digital (non)spaces leaves the reader with a lack of clarity. Considering cyberspace as a place of human habitation, fulfilling transcendental desires of escape from an imperfect world, highlights both effortless human movement between the 'real' and the 'virtual' and a privileged position cyberspace has held against the 'real' as 'other,' between the actual and the imaginary. Here, cyberspace becomes an other space in which humans could eventually move to, leaving behind the messiness of the 'real'. Within the posthuman and the cosmology of computational regimes, this conceptualisation has been structured and modelled on the construction of digital space. It is this model that has then been reflected back to material space.

In her investigation of communities and agency within the reciprocally constituting spheres of technology and culture, Allucquere Rosanne Stone (1991) traces the development of technoculture and cyberspace in four epochs, providing a vantage point for the mapping of the conceptualisation of digital space within first wave technoculture studies. For Stone, people are studied in a complex social

network that is mediated by little technologies that are delegated significant amounts of time, agency, and humour. Her four epochs trace conceptualisations, constructions and expectations of cyberspace as both a technology to communicate through and a space to inhabit. Stone's first three epochs trace the historical development of communication technologies – from the development of the academic paper and the communities of academic virtual 'witnesses' this literary technology brought together (first epoch), to the early communication technologies of the phonograph and radio creating communities of virtual audiences (second epoch), and early online communities formed around bulletin board services (BBS) such as CommuniTree in San Francisco (third epoch). It is Stone's mapping of her forth epoch through William Gibson's *Neuromancer* that exemplifies an early preoccupation with cyberspace as an imagined space, that humans can not only interact through and engage with, but also wholeheartedly inhabit. Here cyberspace realises the desires of its creators and designers and becomes a site of human habitation, leaving our physical 'meat' bodies behind, or at the least setting them aside for the moment. It is this metamapping of a future-present discovered through cyberpunk science fiction novels, as well as the dreams and desires of a technological elite, that Tiziana Terranova (1996a) describes as a productive guide to the future, where cyberpunk fictional texts form examples of new technological experiences. Reflecting the common themes of first wave technoculture studies, Terranova found the cultural theorist often "assumes that these texts and practices are the expression of an emergent 'new' sensibility: they are simply the avant-garde of a new relation to technology which will be shared by the rest of the world in the future" (1996a: 80). This meant new communication technologies were seen to be producing an epochal shift already mapped and guided by cyberpunk science fiction. By tracing her history from the starting point and creation of 'virtual' communities through the technologies of text and communication, Stone extrapolates a (future) trajectory where cyberspace becomes the entry point for the production of two things: an apparatus for the production of community, and an apparatus for the production of the body:

> Because cyberspace worlds *can be inhabited* by communities, in the process of articulating a cyberspace system, engineers must model cognition and community; and because *communities are inhabited by bodies*, they must models bodies as well. (italics added, Stone 1991: 103)

Although Stone reminds us that no matter how virtual the subject becomes, there is always an attached material body and consciousness is firmly rooted in the

physical. Stone's fourth epoch is reminiscent of transcendental desires of escape to an apparently new cyberspatial frontier. Inspired by what were new relationships and forms of interaction that electronic communication technologies were precipitating, Stone found the excitement of digital spaces in the postmodern modes of expression they allowed:

> The new spaces instantiate the collapse of the boundaries between the social and the technological, biology and machine, natural and artificial that are part of the postmodern imagery. They are part of the growing imbrication of humans and machine in new social forms I call *virtual systems*. (1992: 85)

For Stone these then new expressions allowed for alternative notions of community to form, not based on physical bodies and their proximity, but on virtually modelled bodies and shared interests. Her 'virtual' space is "an imaginary locus of interaction created by communal agreement" (1992: 84) where the concepts of distance (inside/outside) and the physical body took on new meanings. In such virtual space, communities came together not based on the proximity of presence, but on shared interests. Within these communities individuals were represented not by physical bodies but by created avatars. This led Stone to consider a form of 'computer crossdressing' where on-line personas lead quasi-lives of their own, separated from the 'real'.

Stone's forays into cyberspace acknowledge the ability for subject experimentation, change and fluidity. Kevin Robins has suggested that in cyberspace "there are possibilities for exploring the complexities of self identity, including the relationship between mental spaces and the bodily other" (1996: 8). Cyberspace became a new world to transcend our physicality and engage in new virtual interactions. It is this technoculture heritage of identity exploration that continues to shape writing on the body within computer game studies, where computer games are presented as offering the ability for human digital immersion and travels (see chapter two). Discourses of virtual travels at once highlight a new digitally formulated mind to body dichotomy as well as foreshadowing the creation of an ontological connection between material and digital spaces. Within this new equation, it is the ability to abstract humans as informational beings, separate and divisible, from their 'meat' bodies; popularised through cyberpunk 'jacking in' and Hans Moravec's (1990) infamous digital human futures, that has laid a foundation for a shared informational ontological structure between material and digital.

Found throughout a body of early technoculture writing, and one that reverberates within conceptualisations of artificial life emplacements and evolutionary computer games, a second underlying assumption is the vision of cyberspace, or the virtual space of the computer, as a singular utopian answer to the problems and deficiencies of the real. This typically heralded a common future that would be different and better than the present. Within this conceptualisation, the new electronic world became more desirable than the reality that we normally find ourselves surrounded by. Kevin Robins recognised this early tendency to crusade cyberspace as a utopian vision for postmodern times (1996), reminding us that a utopia is both a nowhere (outopia) and also something good (eutopia). Cyberspace has been attributed with this same vision – as a 'nowhere-something good'. This gave cyberspace an unreality usually attributed to utopias – as unrealisable (non)places of perfection. Robins finds that considerations of cyberspace as a utopian (non)place were driven by a feverish belief in transcendence, where technology had the ability to deliver us from the limitations and frustrations of an imperfect world. Here:

> [Cyberspace and Virtual Reality] have seemed to offer some kind of technological fix for a world gone wrong, promising the restoration of a sense of community and communitarian order. It is all too easy to think of them as alternatives to the real world and its disorder. (Robins 1996: 24)

For Robins, part of the imagery of the technologies of virtual reality, was the transcendental theme of "moving on from the old realities to a brave, new, virtual world" (Robins 1991: 55), with the advent and convergence of artificial intelligence, robotics, and animation technologies. Repeating themes of digital immersion and travels, Robins uncovers the belief that humans would find our true and full potential only when immersed in cyberspace, in what he considers the techno-fetishistic approach to new imaging technologies. Rob Kitchin reiterates this thematic, finding cyberspace often represented as a 'new world' or 'new frontier' "popularised as a place of exploration and discovery; an unmapped territory to be inhabited and economically exploited" (1998: 20). This is the idealisation of cyberspace as a new world; an ideal world beyond gravity and friction. Robins asks that we consider the possibility of inhabiting this other world of simulation, in a perfect symbiosis between technology and user:

> The real world that once was beyond is now effaced: there is no longer any need to negotiate that messy and intractable reality. The user is now reconceived as an aspect of, and operates entirely in terms of, the logical universe of the simulation. (Robins 1991:66)

Here, Robins foreshadows the development of computational regimes, which form exactly this 'logical universe of the simulation' and continue to constitute both humans and the 'messy and intractable reality' within its logic. The utopian thematic has been often repeated within early technoculture writing, including Mark Poster's postmodern new 'multimedia' world (1996), where unstable, multiple and diffuse subjects engage in a simulational and multiple reality. This opens up possibilities that were seen to offer the ability to "mime and to multiply, to multiplex and to improve upon the real" (Poster 1996:94). This is a cyberspace of not only limitless possibilities, but limitless space as well. Robins recognises that the favoured position cyberspace and Virtual Reality had been given as 'other' to a flawed 'real' and offers that these technologies "have seemed to offer some kind of technological fix for a world gone wrong... It is all too easy to think of them as alternatives to the real world and its disorder" (1996:24). While cyberspace and Virtual Reality offer spatial environments, within the framework of early technoculture studies, they were often viewed as other than 'real,' as both virtual and imaginary, offering a type of (non)place set apart from the actual real world. The cyberspace (post)modern utopia Robins describes is spatial, but a spatiality where virtual space is as a space removed, an elsewhere of cyberspace, even if such boundaries with the real remain muddied and confused:

> The new technological environments of virtual reality and cyberspace confuse the boundaries between internal and external worlds, creating the illusion that internal and external realities are one and the same. (Robins 1996: 13)

This internal reality of cyberspace became a place for salvation and transcendence. Similarly, Michael Heim (1991), when considering cyberspace, viewed it as a 'not-quite-actual' space, existing in contrast to the 'real,' but operating as if it were real space. Failing to find a utopian imaginary in cyberspace, Heim attempted to keep our experiences within cyberspace to the philosophical, associating cyberspace as the domain of the awesome and sublime – a place to escape and find alternative thoughts and feelings. Here, as before, cyberspace is identified as a (non)place that is there but not actual and intimately tied to the 'real' but separate and 'other.'

It is this theme, that the cyberspaces we create provide an ideal counterpoint to the imperfect world around us, which has been retained and developed within

artificial life and evolutionary computer games. Within digital artificial life emplacements, a utopian vision of neo-Darwinian and cybernetic definitions of life emerges, offering life itself digital transcendence from its current messy carbon based existence. As will be explored in chapters five and six, artificial life emplacements offer the realisation of a specific spiritual and scientific discourse on what it means to be alive; our natures and cosmology. This set of discourses centre on life as propagating strings of code, following simple first level instructions showing emergent intelligent behaviour, all in a computational regime of interconnectedness. Scientifically, these focus on the informatics and cybernetics of life as code, while spiritually the interconnectedness of all things is highlighted in a new spiritual cosmology. The cyberspaces that we are producing, inoculating and intra-acting with in the production of artificial life provide perfect partnerships and environments, with their rule based nature and discrete time (as CPU clicks) and space (as programmed pixels), for exploration of life itself within the scientific and spiritual idioms of neo-Darwinism and cybernetics. They become utopian spaces. `

Together, this conceptualisation of cyberspace couples the real with the physical and actual, and the virtual with the digital and imaginary. Cyberspace, as 'other' space, removed and separate from the 'real,' finds itself in a dialectical opposition with physical space. Doel and Clarke (1999) examine three ways in which the virtual and the real, the digital and the actual, and presence and telepresence have come to be understood, and offer a fourth standpoint that they hope reconciles and presents a more grounded approach to considerations of cyberspace. In their analysis, Doel and Clarke find that the virtual is invariably collapsed into and contrasted against a badly analysed version of the real. They find that this collapse usually takes place along two paths. The first path shows the virtual as a 'false approximation' of the real, and the second shows the virtual as a 'resolution' or the 'hyperrealisation' of the real. Similarly, in comparing the simulations of virtual worlds to maps, Rob Shields observes that each:

> ... end up taking on a life of their own. Somewhere along the way they begin
> to diverge, either when it is realised that no map can be so complete that it
> represents an actual landscape fully, or when they become prized as more
> perfect than messy materiality. As virtual worlds, they become 'virtuous',
> utopian. Virtual worlds become important when they diverge from the
> actual, or when the actual is ignored in favour of the virtual – at which point
> they become 'more real than real'. (2003: 4)

Doel and Clarke offer three versions of virtual reality that encompass these views. The first of these considers virtual reality as a simulation or false approximation of the real. In commonsensical terms, this is where the virtual is to the real as the copy is to the original, and as such has the attributes of being secondary, derivative, and supplemental. The virtual can never be anything more than a pale imitation of the real: a mere simulation. Here, the virtual is an incomplete approximation of the real. From this standpoint there is a strict separation of the real and the virtual; they are immutable and essential forms. In these versions of virtuality, it is virtual reality that lacks the real.

Doel and Clarke's further versions of virtual reality contrast with the first. Instead of the virtual as a copy of the real, they examine the argument that "the virtual is perfectly real" (1999: 266). The virtual as real prescribes a perfection of the real in two ways. The first, in what Doel and Clarke term 'suppletion,' displays the (hyper)realisation of the real. The virtual is here considered as a resolution of the real, forming a relationship to the real as the perfect is to the imperfect. This version is still devoted to lack. Rather than the virtual lacking reality and authenticity as a mere copy, however, it is the real that lacks virtuality. In a real world marked by scarcity, Doel and Clarke find calls for a society of creation and invention, where every conceivable possibility should be realised, even if only in thought. There is no radical disjunction of immutable and inalienable forms between the real and the virtual in such a system; the virtual is a dilated version of the real. Here, the virtual and the real are now distinguishable according to quanities (more or less) rather than qualities (powers and effects). The difference between the real and the virtual is measured in terms of the range and territory that they can command. It is here, and with Doel and Clarke's third formulation s(ed)uction, that we can place much of early considerations on cyberspace.

Moving beyond the suppletion of the virtual over the real leads to Doel and Clarke's third version of virtual reality, 's(ed)uction', or the virtual illusion of a final solution. This version of virtual reality views it as a final resolution to the fault ridden world given to us while reflecting the recurrent dreamwork of modernity, and modernist technoscience in particular, to decode and de-bug the world fully – to escape and have done with the world. It follows through the banality of suppletion to further find the fatality and extermination of the real. This is a fetishised version of the virtual, which amounts to living in the (tele)presence of a full realisation of the world's possibilities. In such a view the real is seen as a 'real drag' with its friction, extension and duration of matter in

extensive spacetime. Cyberspace, telepresence and virtual reality offers the possibility of going beyond the tedious gravity and friction of reality and offers Robins' brave, new, virtual world. The 'brave new worlds' of artificial life emplacements have been developed with suppletion and s(ed)uction as conceptual frameworks supporting them. As examples of life itself they have moved beyond the mere modelling and simulation of life (as a false approximation) and ask to be counted as living digital ecosystems in their own right, offering not only a suppletion of carbon based life, but also a s(ed)uction for life itself in its neo-Darwinian and cybernetic perfection. This is perceived as the next level of informational evolution. In this manner, silicon life becomes the benchmark for, and the future of, organic life (and not the other way around), moving from a mere approximation to exemplify life itself.

Returning to a second meaning of the virtual as 'perfectly real,' where the virtual is as real as the 'real,' Doel and Clarke suggest that discourses of hyperrealisation and ex-termination make the mistake of confusing the virtual with the possible or probable. Similarly, in building a relationship between the existing forms of the real and virtual and non-exisiting forms of abstractions and probabilities, Rob Shields builds a four-part definition of the virtual: "The virtual is ideal but not abstract, real but not actual" (2003: 43). Here, in contrasting the virtual against his notion of the concrete, Shields distinguishes the virtual from the actual (instead of the prior paring of the virtual against the real), giving the virtual credit as real but not actual. Care must be taken in defining what is meant by the 'virtual' in such a description, distinguishing the 'essentially virtual', the form of virtual Shields refers to here, from the 'digitally virtual', or the virtual commonly associated with cyberspace. Moving to cyberspace and the digitally virtual, Shields finds that "Cyberspace provides an example of the binding of the virtual, concrete, abstract and probable into a complex whole which has measurable impacts on everyday life" (2003: 80). The 'virtual' of virtual reality is not 'essentially virtual', it has actual qualities with real effects.

Doel and Clarke also recognise the already innate virtual feature of the real, where the virtual is not separable from the real, either as a false approximation (or mere simulation) or as a forced realisation (sublimation of real limitations; actualisation of latent potential). The real is always already virtual – Doel and Clarke argue that reality is the actual *and* the virtual. The illusion of the 'virtual', positioned apart from the real (and removed from it), finds momentum in the modernist desire for an unlimited realisation of the possible to its exhaustion of, and escape from, the

real. Through recognising the dual nature and folding of the actual and virtual, in that the actual is always also partially virtual and the virtual is always also partially actual, Doel and Clarke open up conceptualisations of cyberspaciality to the social production of space, aligning with social geography and the materialist positioning of the thesis. Cyberspace produces real spaces, spaces of intra-action, and spaces that structure and limit or offer possibilities in our intra-actions with(in) them. This is exemplified in gamespace, where space becomes a key element in the structuring and direction of gameplay and is integral for the player and other game agents in the production of meaning from play. Cyberspace, therefore, shares common ground with social geography, and this thesis' materialist positioning, through its continued social production. Exploring the social geography of Soja, Lefebrve and Foucault builds a framework to explore the spatial aspects of cyberspace, in its productive and structuring aspects.

Whilst sharing a conceptual framework in its continued social production, care must also be taken to recognise the differences that exist between the varierty of forms of space. Doel and Clarke observe that when considering cyberspace as a hyperrealisation of the real, it has been measured against the physical in terms of quantity and not quality, with cyberspace offering limitless possibilities against reality's scarce resources. When coming to an understanding of how the various (non)human, (non)living actors are constituted and use and make sense of cyberspace, considered as socially produced actual space, there needs to be a close re-examination of the qualities that these spaces hold, as opposed to the quantity of space they possess. Here, distinguishing between the associated qualities that make physical space and digital space distinctive gives insights into our relations with the various cyberspaces we engage within. Specifically, through acknowledging the molecular quality of physical space and the digital pixelated quality of cyberspace, cyberspaces acquire the distinctive quality of *other than* spaces, but otherness is related here to the quality and not the (potential) quantity of the space. Accounting for this difference in quality is especially critical in the ability to place humans within a digital framework, in how we are included and excluded in the cyberspaces and gamespaces we construct. Foucault's spatial configuration of heterotopology provides a manner of investigation into human intra-action in the cyberspaces and gamespaces of artificial life emplacements, in the production of these spaces, our positioning within them and how space becomes involved in the production of meaning that they are associated with.

Incorporating Social Geography

Social geographers Henri Lefebvre and Edward Soja highlight the social within spatiality and make clear the spatial's consistently fluctuating and constructed nature across space, time and the social. Their productive conceptualisation of space resonates with the materialist positioning of this thesis, recognising the always co-constructed attribute of space and the real. Taking from such a social geography, the distinctions that have typically separated cyberspace from the 'real world' dissolve, as both find common grounding within an understanding of lived space. This supports a nuanced understanding of cyberspaces as real spaces. A second insight of cyberspaces and gamespaces is made through Foucault with his concept of heterotopology, the examination of 'other than' places. Cyberspaces and gamespaces are analysed here as heterotopias, as emplacements that serve as places of alternative ordering within the social landscape.

Developing Lived Space

Edward Soja and his concept of Thirdspace (1996) aid analysis of cyberspace and its spatiality. For Soja, Thirdspace is where everything comes together: subjectivity and objectivity, abstract and concrete, the real and the imagined, the knowable and the unimaginable, the repetitive and the differential, structure and agency, mind and body, consciousness and the unconscious, the disciplined and transdisciplinary, and everyday life and unending history. It is an understanding of space that finds home with a materialist notion of production and a Deleuzian understanding of the lines, vectors and assemblages involved in such production. In Thirdspace, Soja makes a close connection and development of the work of Henri Lefebvre, as both find groundwork in the (social) production of (social) space and the spatial politics of the social processes of production and reproduction.

Lefebvre (Soja 1996) creates a fusion of (objective) physical and (subjective) mental space into social space through his critique of a 'double illusion' that reverberates with the similar realist-constructivist yardstick Latour challenges us to abandon (1992: 276). Within this double illusion, the first illusion – *the illusion of transparency* – makes space appear open to the free play of human agency, willfulness and imagination and is formulated within a constructivist framework. The second illusion, *the realistic illusion*, over-substantiates the world in a

naturalistic or mechanistic materialism or empiricism. This traditional realist account sees social space as natural and naively given, or naively, objectively and concretely present to be fully measured and accurately described. Within this understanding of space that cyberspace, in its lack of concrete physical attributes naturally available for objective measurement, becomes 'other' space paired with virtuality and the imagination. Spaces are viewed as wholly constructed, on the other hand, within the first illusion of physical and cyber transparency. There is no differentiation in quality between each type of space, and here we find Doel and Clarke's suppletion and s(ed)uction of the real by cyberspace.

Forming a critical attack on this double illusion, Lefebvre opens the way to a *trialectic of spatiality*; a production of space that agrees with the materialist positioning of this thesis. He insists that each 'field' of human spatiality (the physical, the mental, and the social) should be seen as simultaneously real and imagined, concrete and abstract, material and metaphorical. He develops this thematic trialectic through the three matched concepts: Spatial Practice, Representations of Space, and Spaces of Representation. Such a theme provides an ability to analyse the spatial quality of cyberspaces and aligns with a materialistic positioning. Gamespace is developed acknowledging the representational and represented aspects that these designed and programmed spaces hold. The development of spatial practice gameplay and our intra-actions in cyberspace require these.

Spatial Practice (or Soja's Firstspace) produces a spatiality that incorporates production and reproduction, where the spatial practice of a society is revealed through the deciphering of its space. Spatiality is given the quality of a substantial text to be carefully read, digested and understood in all its details. Human spatiality is defined primarily by and in its material configurations, and explanation shifts to an inquiry into how these are socially produced:

> The social production of Firstspace is treated as a historical unfolding, an evolving sequence of changing geographies that result from dynamic relations between human beings and their constructed as well as natural environments. (Soja 1996: 77)

Representations of Space (or Soja's Secondspace) is the dominant space of any society and is the storehouse of epistemological power. It is the conceived space of language, discourse, texts and *logos*. The imagined geography tends to become the 'real' geography, with the image or representation coming to define and order

reality. Spaces of Representation (or Soja's Thirdspace) is both distinct from the other two spaces and encompasses them. It is directly lived space; the space of 'inhabitants' and 'users'. It combines the real and the imagined, and is thought on equal terms (not privileging one over the other). Soja's Thirdspace and Lefebvre's most encompassing notion of social space comprise of all three spatialities: the perceived, the conceived and the lived. Spaces of representation team with symbols, politics and ideology, and with the real and the imagined intertwined. They contain all other real and imagined spaces simultaneously.

Traditionally, spatiality has been relegated to the periphery as reflection, container, stage, environment, or as an external constraint upon human behaviour and social action. Soja reasserts Lefebvre's emphasis on the importance of spatiality in knowledge formation:

> We are first and always historical-social-spatial beings, actively
> participating individually and collectively in the construction/ production –
> the "becoming" – of histories, geographies, societies. (Soja 1996: 73)

For Soja and Lefebvre, Thirdspace is seen as a 'possibilities machine' and is the starting point for a strategic reopening and rethinking of new possibilities focusing on the ontological trialectic of Spatiality, Historicality and Sociality. Doreen Massey finds similarly the attributes of possibility and production in space. In setting the groundwork for her defence of space, Massey (2005: 9) outlines three propositions as key for understanding the spatial. These resonate with Thirdspace and Spaces of Representation. Massey's first proposition is that space is a product of interrelations and constituted through interactions from the global to the miniscule, agreeing with the materialist formation of intra-actions between agents and assemblies. Her second is that within 'the sphere of the possible' space is predicated on the existence of multiplicity and plurality, which is especially important for explorations into cyberspace. Formed through the intra-actions of intra-relations, with distinct trajectories, space must be plural and multiple. In her third proposition Massey forges alliances with materialist theorising. Here space is recognised as always under construction:

> Precisely because space on this reading is a product of relations-between,
> relations which are necessarily embedded material practices which have to
> be carried out, it is always in the process of being made. It is never
> finished; never closed. Perhaps we could imagine space as simultaneity of
> stories-so-far. (Massey 2005: 9)

Recognising that cyberspace produces real spaces, an understanding of lived productive (cyber)spaces can be formed. This is a movement away from 'other' space, where cyberspace was conceptualised as an alternative utopian (non)place for a messy and scarce 'real,' to a understanding of 'other than' space. Here, cyberspace is acknowledged as just as real as physical space but set apart in its qualities or attributes. Built with computer bits, cyberspace is real space, discrete and represented as identically proportioned digital points or pixels, matrixed, knowable and definable. One can intra-act within cyberspace with real and meaningful effects. It is also a space that is not physically inhabitable by human bodies. Despite the desires and efforts of first wave technoculture studies and practitioners one cannot physically walk, jump or jack into cyberspace. The physical body remains in front of the screen. Building a conceptualisation of space that recognises this 'other than' concept further highlights and develops understandings of our intra-actions with these spaces. To do this, the thesis turns to Foucault and his development of spatiality through heterotopology.

Foucault developed his conceptualisation of spatiality centred on the paper 'Des Espaces Autres,' presented in 1967 (which Soja finds complementary to his own theory of Thirdspace). Foucault named his approach to space and spatial thinking 'heterotopology', moving out of modernist conceptions of space and time through the foregrounding of space over time, and spatiality over historicality. Central to the concept of spatiality between Lefebvre, Soja and Foucault is:

> ... that the assertion of an alternative envisioning of spatiality... directly challenges (and is intended to challengingly deconstruct) all conventional modes of spatial thinking. They are not just "other spaces" to be added on to the geographical imagination, they are also "other than" the established ways of thinking spatially. They are meant to detonate, to deconstruct, not to be comfortably poured back into old containers. (Soja 1996: 163)

Recognising the 'other than' quality of cyberspace is a recognition that there are no 'old containers' in which it can be subsumed by established modes of thought. Realising cyberspace as real negates its propensity for suppletion or s(ed)uction, denying the all too easy inclination to view such space as 'other' (non)space as not quite real, imaginary or some how hyperreal. Recognising the differences between physical and digital space challenges conceptualisations of human cyberspatial travel and habitation. There is also the recognition that cyberspace,

gamespaces and digital emplacements of artificial life have real specific relationships with physical material space, in the manner they are co-constructed, and the use and production of meaning within these spaces and how this production is related back to physical space. Foucault's heterotopology and his conceptualisation of heterotopias provide a framework in which to position cyberspace emplacements of artificial life worlds and gamespaces.

Foucault (1998) describes contemporary space in terms of emplacements, defined by the relations of proximity between points or elements. In formal terms, these can be described as series, trees and lattices. This creates a space that both recognises and is critical in the production and workings of networks and assemblages, and the relations that have brought them together. We are not living in a homogenous and empty space, but in a space that is laden with qualities:

> ... we do not live in a kind of void, within which individuals and things might be located. We do not live in a void that would be tinged with shimmering colors, we live inside an ensemble of relations that define emplacements that are irreducible to each other and absolutely nonsuperposable. (Foucault 1998:178)

Of interest to Foucault are the emplacements that have the curious property of being connected to all the other emplacements, in such a way that they suspend, neutralise, or reverse the set of relations that are designated, reflected or represented by them; those emplacements that are linked with all the other emplacements and yet are at variance somehow with them. He finds that these types of emplacements come in two varieties. The first of these are utopias; emplacements of no real place. Utopias are socially perfected or the reversals of society and are spaces that are fundamentally and essentially unreal and non-actualised. The second are heterotopias:

> There are also, and probably in every culture, in every civilization, real places, actual places, places that are designed in the very institution of society, which are sorts of actual realized utopias in which the real emplacements, all the other real emplacements that can be found within the culture are, at the same time, represented, contested, and reversed, sorts of places that are outside all places, although they are actually localizable. (Foucault 1998: 178)

Within heterotopology Foucault gives six basic principles to the systematic description of heterotopias that can be utilised when analysing the cyberspaces of gamespace. The first is that all cultures establish heterotopias; they are a

constant of every human group. They take forms that are very diverse and there is no absolute universal. Secondly, each heterotopia has a precise and specific operation within society, and the same heterotopia can have one operation or another depending on the synchrony of the culture in which it is formed. The third is that a heterotopia has the ability to juxtapose, in a single real place, several emplacements that are incompatible within them. The fourth is that heterotopias are also connected with temporal discontinuities. Heterotopias open up onto heterochronias. While the first four principles frame our conceptualisation, Foucault's fifth and sixth principles become central in an understanding of both our intra-actions with and in cyberspace and the meanings that are produced and extrapolated back to the material physical world. His fifth principle shows that heterotopias always presuppose a system of opening and closing, that both isolates and makes them penetrable at the same time. They can offer what appears to be pure and simple openings, but which generally conceal curious exclusions:

> Everybody can enter these heterotopian emplacements, but actually this is only an illusion, one believes he is going inside and by the very fact of entering, one is excluded. (Foucault 1998: 183)

Through entering a cyberspatial emplacement, we are at the same time excluded. Humans, despite desires for cyberspatial immersion, are simply not digital. Laurie Taylor finds that in playing a computer game "taking in my own actions does not allow me to pass through the screen, but only to act on the screen because the screen acts as a divider until I can find a way into the game space" (2003). The last principle is that heterotopias have a function in relation to the remaining space that is spread between two extreme poles. They can have the role of creating a space of illusion that denounces all real space, which are heterotopias of illusion. In the case of evolutionary artificial life computer games, however, they can create a different real space – as perfect, as meticulous, and as well arranged as ours is disorganised – these are heterotopias of compensation. Artificial life emplacements offer such heterotopian emplacements of compensation for neo-Darwinian and cybernetic definitions of life itself.

Return to Cyberspace(s)

Relating the work of social geography to the analysis of cyberspace, three things become possible that allow a nuanced investigation into spatial practice and gamespace. These are an acknowledgement of the real qualification of

cyberspace, recognition of the qualities cyberspaces offer, and the multiplicity of cyberspaces. These three elements come together to allow an investigation into specific gamespace emplacements and patterns of spatial practice. They allow an investigation into space within the spatial categories of the concrete, abstract, virtual, and the probable. In exploring the virtual, Rob Shields suggests "the solution is not to debate the reality of the virtual, but to develop a more sophisticated theory of the real and the ways in which the *virtual* and the *concrete* are different really existing forms," (2003: 21) and how they relate to each other.

Cyberspaces as Productive Constructed Space

Through the development of social geography, the social, productive and continually co-constructed dimensions of lived space are recognised. Space is acknowledged as a lived space of intra-actions with interrelations that are continually in a productive process of co-construction. Within the same framework, cyberspace is also recognised to be more than its virtuality. As lived space, cyberspace includes aspects of the abstract, virtual, concrete and the probable or possible. The bringing together of these aspects under a common lived space allows the past dialectics of real/virtual and actual/imagined that have been employed to set cyberspace apart from the 'real world' to be challenged, dissolved and set-aside. First wave technoculture studies, associated with the virtual as imagined and dialectically opposed to the 'real world,' have left legacies of suppletion and s(ed)uction that still inform artificial life emplacements, conceptualised as hyperrealisations of life itself. These offer a perfected transcendental form of silicon life that becomes the benchmark for unruly carbon life to conform. By changing tac and incorporating the multiplicity of relations that come together in these cyberspace emplacements – human, nonhuman, living, nonliving and those whose life status is under debate – within a social conception of space and cyberspace, an investigation into the spatial practices that both produce and continually construct artificial life emplacements, and shape relationships of power within them, can occur. Gamespaces have always held this productive quality. Investigating interactive fiction (the digital predecessor of computer games), Robert Kelly finds that the construction of digital space "operates by involving the reader in the construction of a fictional world that operates only through the action of the reader... As both part of the narrative process and as co-creator of this fictional world, the user can therefore come to 'inhabit' the narrative" (1993: 52). Acknowledging the role of the player in the construction and manipulation of space within gamespace, and the

strategic importance of spatiality, takes an analysis of gamespace out of a solely semiotic investigation.

The Distinction of Cyberspace

Whilst maintaining a spatial framework of cyberspace as constantly and continually co-constructed, the unique qualities of cyberspace must be acknowledged. Cyberspace is a social space, but it is also a different space; an 'other than' space included within yet distinguished from the physical space around it. Doel and Clarke remind us that cyberspace as a virtual reality has been commonly compared to real space, in terms of quantity. Cyberspace, that is, has been conceptualised as a limitless space encompassing all possibilities, compared to the limited space of lack found in the real. Turning this comparison around, the thesis looks to the qualities of virtual reality as cyberspace that distinguish them from the physical. Acknowledging cyberspace as perfectly real does not necessitate that digital space and physical space hold identical properties. Each needs to be recognised for their similarities as well as their differences. Cyberspace can be defined by its pixelated structure, as mathematically defined points (or vectors) coded by bits and bytes. The co-constructions of cyberspace form discrete spaces, and this discreteness can be found throughout. From the 'zeros' and 'ones' that make up each discrete 'bit' of information (as zero or one, off or on) in the programming that supports cyberspace emplacements, through the execution of each program through the timed discrete CPU clicks of the computer hardware, the mathematical mapping of cyberspace (typically finding a Cartesian gridwork), the precisely defined size of 'virtual worlds' (allotted memory space) and the discretely packaged pixels displayed on the monitor, cyberspace is defined throughout by its discrete nature. It is this pixelated and discrete underpinning that contributes to the classification of cyberspaces as other-than heterotopias. Recognising cyberspace as heterotopian is important for analysing the ontological frameworks, and for conceptualising the bodies that are found on both sides of physical-digital borders.

Cyberspace's pixelated character provides a number of qualities that offer it a unique position. As it is pixelated, cyberspace is discrete; it is a space that is discretely defined by pixelation, programming and the execution of this programming. As with any product of computer programming, cyberspace is logically founded on rules. Cyberspace emplacements both obey and conform to

the programming underlying the running of the program. Sherry Turkle, examining the rule-based property of computer games, finds that "[a]t the heart of computer culture is the idea of constructed, "rule-governed" worlds" (1984: 66). Although she finds that more recent games have become more opaque in their programming and are now pushing ever more 'realistic' simulations, where "rules have given way to branching narratives" (1996: 68), it must be remembered that computer programming is inherently logical and rule based, no matter how complex and emergent the programming. It is exactly this structure within logical mathematical rules that affords cyberspace its association as the ideal computational regime. Rob Kitchin, tracing computational regimes through Benjamin Woolley, finds that:

> ... at the heart of cyberspace lies a fundamental belief in the mathematical structure of nature, in the computability of the universe. The idea that the world can be understood through mathematics – that mathematics is the alphabet of creation... is a belief in the aesthetics of a natural order that can be revealed in and by mathematics and then be reproduced – and heightened – in virtual worlds. (1996: 58)

Unsurprisingly, computer generated digital worlds display exactly this mathematical understanding. Within evolutionary computer games it is the wholesale transfer through acts of suppletion and s(ed)uction of this Platonic logical mathematics to the physical under scrutiny. This move denies both the fundamental differences between molecular and digital space and the availability and formation of political resistance. For Massey:

> Any assumption of a closed instantaneity [for example, a computable universe] not only denies space this essential character of itself constantly becoming, it also denies time its own possibility of complexity/multiplicity... If this is the imagination which is to replace modernism's temporal alignment of regions then it is a move... to a claustrophobic holism in which everything everywhere is already connected to everywhere else. And once again it leaves no opening for active politics. (2005: 77)

Also highlighted, in considerations of cyberspaces as heterotopian emplacements, is our ability or inability as humans to enter and inhabit these spaces. We are reminded of one of heterotopogy's basic principles – that heterotopias are spaces of exclusion – that one is actually excluded upon entering a heterotopia. Despite conceptual frameworks of travel and immersion and being grounded in an embedded and molecular body, we are excluded from cyberspace as not digitally

constituted. We are unable to fully make the ontological jump from molecular to pixelated. Kitchin, through Sobchack, finds that "cyberspaces are spaces that are entered and interacted within from the site of the body: it is the fingers that type or move a joystick, it is the whole body that enters a virtual reality space, not just the eyes or the brain" (1998: 83). This entrance is exclusive, as the physical body does not enter cyberspace. Kitchin/Sobchack agree that "ideas of disembodiment are largely misnomers" (1998: 83); there is no division of self in our intra-action with(in) cyberspaces, we are always coming from an embedded practice. Arguing for the inescapability of an embodied subjectivity, Michelle Kendrick finds that "the bodiless entity that hypothetically exists in cyberspace depends, in myriad ways, on the referent of the corporeal body in front of the computer. The relationship between the embodied user, the creation of 'alternate' subjectivities in cyberspace, and the technology of the computer, is tightly intermeshed" (Kendrick 1996: 152). An embodied practice, therefore, denies complete cyberspatial immersion or habitation, as the physical body must always be accounted for.

Cyberspace emplacements do have qualities of the heterotopian/utopian mirror, though, especially in considerations of the posthuman. In cyberspatial emplacements we see ourselves where we are not, even if this is mistaking our digital intra-actions for telepresence. We see ourselves where we are absent, reflected back to us as our digital posthuman selves. Moving from computer programming and cyberspaces as a simulational model to that of suppletion and s(ed)uction, our reflected posthuman selves question whether it is cyberspace or physical space that is actually being reflected. We no longer look for material qualities in our cyberspace reflections; we start to look for posthuman digital qualities in ourselves, projected to us and reflected back from new posthuman subjectivities. Sherry Turkle finds the 'threat' of the simulated worlds in cyberspace is that they may be preferred to the 'real':

> Computers offer the possibility of creating and working within artificial
> worlds, whether to simulate the behaviour of economics, political systems,
> or imaginary subatomic particles. Like Narcissus and his reflection, people
> who work with computers can easily fall in love with the worlds they have
> constructed or with their performances in worlds created by others.
> Involvement with simulated worlds affects relationships with the real one.
> (1984: 82)

Evolutionary artificial life computer games can be said to follow this pattern. The digital environments and entities that have been created as simulations and

instances of life and nature in turn affect the life and nature they model. This is moved further to cyberspace as suppletion rather than simulation as Turkle later considers that:

> Simulation games are not just objects for thinking about the real world but also cause us to reflect on how the real world itself has become a simulation game. (1996: 71)

We must be wary of the manner in which our intra-actions with/in cyberspace are extended, developed and projected back as posthuman. As Robert Kelly comments, "The game would have us generate a fictional truth transferable to the real world, but it does so in a way that allows the user to generate no fictional truths for herself which are not pre-programmed in to the game" (1993: 57). We cannot lose site of the social co-construction of cyberspace as lived space. Our posthuman cyberspace selves are never innocent; they are caught in the operational power of spatial representations of cyberspace as a strategic location.

The Multiplicity of Cyberspaces

Sharing common underlying structures, cyberspatial emplacements possess many commonalities, but are also recognised in their plurality. Cyberspatial emplacements take many forms and typologies and each one is unique. As an emplacement, each cyberspace realises its own spatiality. Jennifer Light stresses the importance of not oversimplifying cyberspace emplacements to a singular framework by comparing the concept of 'the city' to cyberspace:

> Like reducing complex differences among cities to an oversimplified single truth about 'the city' there is a risk in similar portrayals of cyberspace. As in other eras, electronic communications and other technologies have multiple, sometimes contradictory effects... Writings about a generic 'cyberspace,' like writings about 'the city,' are troublesome since there are differentiated cities and differentiated cyberspaces. (1999: 127)

Cyberspaces, then, are multiple: there is no singular cyberspace just as there is no singular space or city. Massey recognises this important facet when ensuring in cyberspace that "multiplicity is fundamental" (2005: 91). Gamespaces, like cyberspaces, also need to be recognised as distinct forms of cyberspace offering graphically complex digital emplacements, and because gamespaces and cyberspaces are digital rather than physical, there is no need for them to resemble the layout of physical space. It is usual, yet for Massey 'ironic', for graphic interpretations of cyberspaces to follow a Cartesian spatial convention,

and what follows is a specific mapping of space. Space is built according to a three dimensional x-y-z matrixed gridwork, or is at least presented as such (many game spaces exist in two or two-and-a-half dimensions, as is the case with *Creatures*, but retain visual cues of three dimensional space).

Gamespaces, and cyberspaces more generally, are spaces that are presented to the player-user through monitors, screens and other visual technologies. These act in the same manner as a frame or window, presenting a vantage point for viewing into the cyberspace emplacement. Mark Wolf reminds us that the 'off-screen' space in a computer game can be as important as what is currently on view (1997:12). Gamespace may not always be visually available to the player. Intra-actions between other game agents, and even the player's lack of attention to off-screen spaces, can have impact of gameplay. In increasingly complex computer games, with increasingly intricate spaces and independently minded game agents, activity out of the player's sight and direct involvement impacts gameplay and the continual co-construction of space, reality and the interrelations of the assembly of agents involved in gamplay. This is especially true for artificial life emplacements where the creatures that inhabit these digital spaces operate through independent programming and actively intra-act with each other and their environment, independent of player-user intervention or supervision. Wolf also highlights the importance of understanding space for the player in successful gameplay as "the video gameplayer has a stake in the navigation of space, as knowledge of the video game's space is oftern crucial to a good performance" (1997: 13). Massey considers the increased speed of communication new technologies are allowing:

> ... the really serious question which is raised by speed-up, by 'the communications revolution' and by cyberspace, is not whether space will be annihilated but what kinds of multiplicities (patternings of uniqueness) and relations will be co-constructed with these new kinds of spatial configurations. (2005: 91)

Moving cyberspace out of its cyberpunk heritage of new utopian worlds of limitless possibility and promised habitation, then, builds cyberspaces as co-constructed lived spaces of human and nonhuman, living and nonliving intra-action. The gamespace emplacements of evolutionary computer games bring together an assembly of agents formed for the production of play. This assembly is formed by both human agents of players, game producers and programmers, observers and other participants as well as nonliving and artificial life entities that

call these digital emplacements home. The assembly brought together at once both continually co-constructs the social space of the game as well as producing play through its intra-actions. The next chapter examines this assembly as the formation of a game's culture.

Chapter 4

Games and a Game's Culture

The games of a people reveal a great deal about them. Games are a sort of artificial paradise like Disneyland, or some utopian vision by which we interpret and complete the meaning of our daily lives. In games we devise means of nonspecialised participation in the larger drama of our time. (McLuhan 1964: 238)

For Marshall McLuhan, games, as the "extensions of social man [sic]", become the "faithful models of a culture" (1964:235). Christine Ward Gailey has echoed this view, stating that "Games played in a society embody the values of the dominant culture; they are ways of reinforcing through play the behaviors and models of order rewarded and punished in the society" (1993:81). Roland Barthes joins this sentiment when he declares: "All the toys one commonly sees are essentially a microcosm of the adult world" (1972: 53). All find in games and gameplay a meaningful connection with the culture in which they are situated. The assemblies that come together in the co-construction of computer games – in their spatiality, play and in the production of meaning – are intimately tied to other cultural assemblies and assemblages. E. F. Provenzo in his study of the 'Nintendo generation,' and drawing from McLuhan, develops the computer game as a 'cultural text' that is a part of the computer's selection and amplification of the culture in which it is situated (1991:74). He positions computer games as powerful teaching aids and important sites of cultural transmission. Leslie Haddon also places the computer game as a part of the 'cultural industry' alongside film and music (1993: 134). Although claiming computer games as culturally significant, through recognising games as social spaces of the intra-actions of the assembly of agents brought together in gameplay, care should be taken when suggesting a 'textual reading' of computer games. They cannot simply be read; there is no ready-made text present at all. Computer games involve the active involvement of play in gamespace. Conceptualising computer games as specific spatial emplacements that bring together assemblies of agents in the construction of space and production of play (and meaning) opens up a materialist conceptualisation of games that considers games as emplacements in which play occurs, in a productive and collective manner. With this in mind, this

chapter looks to develop a cultural examination of computer games and gameplay that considers the assemblies of agents brought together and how these are structured to produce common meanings and a culture through gameplay, and how these can be related to the greater culture in which they are located.

Computer games, where the player is implicated within the assembly in the production of gameplay, problematise any uni-linear and consumption lead model, and demand instead a multi-directional model of meaning production and dissemination. A multi-directional model, therefore, provides the player a critical role in the production of gameplay and brings together the various agents (human and nonhuman, living and nonliving) that are involved in the culture of a computer game – the assembly of agents that are involved in the production of play. Acknowledging the collective assembly involved in the production of play highlights the production of common meanings between agents, or of a common sense for the game. This is especially important between the producers and players of the game, and between multiple players, as defining, and critical agents within the assembly. It is also important to recognise the dominant position key agents within the assembly hold; not all positions within the assembly are equal.

Within computer games, the player finds an active role in the *production* of play (further than an active role in *decoding* or *consumption* of the text). As an active participant, and recalling computer games' rule-based character (as computer programming), it is necessary for the player to have some understanding and play 'by the rules' to use and enjoy the game. Computer games are structured and structuring spaces where the player must engage with and play within the programming of the game in order to produce effective game play. This thesis investigates the creation of a game's common sense in the production and maintenance of a game's culture through the use of structures of feeling, intuition and hegemony. Structures of feeling introduce the player to the game's culture and the common sense of the game, incorporating various items available before gameplay even commences. Articles such as game packaging, instruction manuals, associated websites, and introductory video vignettes all come together to align the (potential) player to the culture of the game. The intuitive nature of computer games (in their positioning and inclusion of the player through the interface) reinforces the common sense of the game's culture and naturalises this through gameplay. Finally, the game's culture can be effectively thought of in terms of hegemony, recognising the different agents' ability to negotiate new

positions in the game whilst acknowledging the dominant position within the game culture of key agents, such as the producers of the game and the game itself. As a hegemonic order the active positions of all the agents within the game culture are considered in the production and maintenance of meaning for the game and its culture.

Developing the common sense of a game within a hegemonic order of a game's culture leads to the final level of analysis this chapter proposes for the study of the production of meaning within computer games and gameplay. How computer games structure gameplay to aid play's translation into meaningful narratives is covered, and how game elements allow players to produce stories and meanings from the games they play. Story telling and the ability to produce game narratives are essential elements of effective play, both from and during. The mythic possibilities of a game open the game to a reading of myth (from Barthes) and locate game elements that structure play. In this way, the player is structured through the retelling of mythic grand narratives by the progression of gameplay. Narrative scaffolding, similarly, are those game elements which structure play so that the user is able to construct a coherent narrative from gameplay. Both mythic possibilities and narrative scaffolding aid the player in the creation of sensible gameplay, and in the ability for the player to create stories and narratives. Both can be analysed with consideration to what kind of game experiences and narrative computer games make possible within their procedural rule based structure.

Developing a game's culture through the production of intuition, common sense and structuring elements opens computer games up to an embodied and experiential reading. Such a reading can consider how agents including game elements co-construct and structure gameplay and how these translate into the production of meaning. It observes what kind of experiences computer games offer and how these experiences can be related back to the greater culture in which the game is situated.

Studying Evolutionary Artificial Life Games

Since childhood, I have had an active interest in computer games and new media. From arcade halls and home game systems, from the Atari 2600 forward, computer and video games always formed part of my leisure activities, played alone and with friends. Strategic and 'sim' styled games have always held a

particular interest, engaging many hours of play with popular titles such as *SimCity*. The activity and involvement needed to engage with and manipulate simulational game environments held the challenge of both understanding the simulation model of each game and how to control or influence game occurrences.

While studying for my Masters this interest in gaming, combined with a brief academic history in the biological sciences, gained a fresh academic angle under the guise of new media studies. The outcome of this was the production of a dissertation (Mackie 1998) focusing on the original *Creatures* game and its inclusion of artificial life technoscience. At that time my study was structured within a foundation of textual studies, examining the narrative that players play through within games, but also moving beyond a simple textual analysis to show interest in three specific areas: aesthetics, space and fable. The results formed the groundwork of this thesis, showing how scientific and spiritual narratives and discourses of artificial life combine to give meaning to the field, and how these have been translated as a primarily Jeudo-Christian fable told through gameplay. From a scientific discourse of emergence and connectionism, to gameplay structured within a contemporary genesis story, *Creatures* and its predecessors displayed a converging point of science and popular culture.

The dissertation opened a number of avenues for further research and examination that formed the early framework for this current thesis. This was initially based around the subjects of the definition and story of life that artificial life produces, and how is this being connected with carbon life. Findings from the dissertation pointed to a unitary epistemological position of life itself presented within artificial life, which then made crossovers between silicon and carbon. There was room to explore this proposition and position further, as well as the definitions of life that have and are being used to argue that artificial life produces actual instances of silicon life, and how this is being translated and related to carbon life. *Creatures*, evolutionary artificial life computer games and popular research programs form ideal locations for study, bringing together science and popular culture. The assemblies that evolutionary artificial life computer games form, the assemblages they create and the other cultural and scientific assemblages these games associate with, bring together a diverse collection of individuals, cultural spheres and entities. Transversing popular culture and computer and biological sciences, these games and popular research programs produce new definitions of life itself and new relationships between humans and

computer-generated creatures we now call kin. They construct new spaces, (re)creating nature and producing a new cosmology of holistic interconnectedness. They reterritorialise definitions of life itself and introduce users to silicon life, forging new relationships of nurturing and kinship between silicon and carbon.

As such, evolutionary computer games become contemporary examples of Don Slater's concept of the diarama (1995), a foundation from which games are positioned in this thesis. A diarama is a model for science produced outside of its usually closed gates, providing a space in which a general audience can experience its wonders. Slater investigates the diarama as "spaces of absolute virtuality" (1995: 218) where the real is (re)created, a reminder of Doel and Clarke's formulation of suppletion. Evolutionary computer games display the same attributes as the diarama, as virtual spaces in which nature has been (re)created. For Slater, diaramas produce two types of wonder: wonder at the experience of being transported into a fully realised unreal world, and the wonder at the (hidden) technology that makes it possible. It is this production of wonder that constitutes science as a cultural experience:

> Science as a popular cultural experience is constituted through a demonstrable capacity to make nature wonderful, to make it do wonderful things, to have a command over nature's own principles which offer the power to make it perform at will and according the ends of human imagination and excitement. (Slater 1995: 226-7)

Slater typifies this command over nature as 'natural magic' – the power of science and technique appearing as a new form of magic (to those who do not understand them). The 'trick' of this magic is to hide the apparatus and technique (technology) that makes it possible to make its representations (or simulations) of nature. As shall be illustrated, it is common within artificial life emplacements to forget the technologies of the computer hardware and underlying programming that support and define how these digital ecosystems work. Slater associates the ease of this trick with a degree of realism:

> In the form of magical representation, the technical accomplishment of realism is the basis not of knowledge of the world but of the production of simulated worlds, worlds in which we can pleasurably inhabit through the very opposite of the modern attitude – by suspending our *dis*belief. (1995: 232)

Artificial life computer games move a step beyond this pleasurable inhabitation of a new world; the player is fully implicated in the production and demonstration of the world and science through gameplay. Beyond the traditional diarama that individuals were immersed within but not actively involved with, computer game players are found to be active participants within the space. Evolutionary artificial life computer games are found within a specific game genre, typically referred to as 'god-sims' for the god-like position the player is placed in. This reflects the position and power that players have in their influence in the production of gameplay. Given this level of involvement, a key player position found within these games is one of a researcher, with players actively using games to perform research experiments. The traffic between game and research program, therefore, is heavy; they cross over and share the usually sanctified sphere of science and technoscience, often conceived as an impenetrable 'cultures of no cultures' (Martin 1996: 99). To this end, early Maxis releases *SimEarth* and *SimLife* have found second lives as populist artificial life research projects and high school biology teaching aids, moving beyond their status as entertainment games. Scientific research programs such as *Tierra* are also freely available and actively distributed to hobby-ists and general users, creating a similar path from research program to entertainment tool.

As spaces of active involvement and lay scientific production, evolutionary computer games hold a great deal of knowledge. Investigating the integration of spatial, temporal and interactive media that come together within multimedia, Florian Brody finds that the computer has occasioned a shift that complicates the relationship of text and memory. Complimenting the diarama as a space where knowledge is held and shared, Brody's memory theatre is a space of exploration:

> When we see books as spaces that we are able to enter and explore, much like a house, we find ourselves in memory spaces, similar to the theatres used in the classical *ars memorativa*. The Memory Theatre... was a theatre that would contain the concepts and the knowledge of the world. By entering the theatre, one would gain access to that knowledge and be able to grasp the concepts contained. (1999: 142-143)

In developing a Memory Theatre, Frances Yates (1966) finds that there has been great effort made towards achieving a detailed attempt to use the principles of the art of memory in association with the heavens, to form a total world-reflecting system. In describing his own Memory Theatre, Robert Fludd finds it to be a totality, "I call a theatre (a place in which) all actions of words, of sentences, of particulars of a speech or of subjects are shown" (from Yates 1966: 331).

Investigating evolutionary computer games, especially in conjunction with artificial life research projects, the definition of life that is presented can be examined in such a totalising manner. This is especially significant when the model of artificial systems is transferred back to the 'real' in acts of suppletion and s(ed)uction, where computer models (both of computer 'game' and 'research project') hold and become the total knowledge of living models. Gamespace, therefore, holds the potential of memory holding the concepts and knowledge of life itself.

For this thesis, studying these games and research programs – the gameplay that ensues and the meanings of and about life that gameplay produces – I have conducted a game ethnography, actively playing the games that this thesis details and investigating the various forms of media attached to gameplay. This includes engaging with official, unofficial and player websites, news forums and user groups as well as following press reviews and coverage. This form of participant engagement and visual anthropology is similar to others studying computer games (see, for example, Pearce 2007: 311). Playing, watching others play and discussing gameplay has highlighted how such an investigative method of researching games needs special consideration, including the questions we ask of them and how we formulate a response. The introduction of players to a game, learning and manipulating the mechanics of gameplay, how players relate and position themselves within both game and player communities, and the narratives and stories taken away from gameplay, move beyond a textual or ludic reading of games. This chapter explores this development of a game's culture with the purpose of developing a framework in which to analyse and discuss cultural perspectives of games and gameplay.

With open-ended games typically found within evolutionary computer games, and especially within the *Creatures* series, a game's culture is particularly significant in the development of gameplay. Usually played on a PC, evolutionary computer games place the player in an overseeing role, charged with the care and maintenance of a digital ecosystem and its inhabitants, with no completed end state. There is no set of achieved goals that aim towards the player 'winning' the game; the game continues as long as the assembly collectively continues its intra-actions.[6] Gonzalo Frasca (2001) differentiates such endless games as *paidea* – games with no 'winning plot' – as compared to those of *ludus* – games with rules

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[6] The exceptions here are notable for the modernist narratives of escape they recuperate. In SimEarth, for instance, a successful game ends ironically with all civilised life escaping the Gaian planet it supported, leaving the planet lifeless.

and plot that end in victory or defeat. Evolutionary artificial life computer games are openended, which allows the assembly more autonomy in the shape and path gameplay takes, and often ludus style 'sub-plots' will be introduced within the game, with more defined goals and objectives coordinated between players. These can range from attempting to achieve certain traits and characteristics within the creature population, achieving a desired number of generations within the population, or overcoming environmental stresses (purposely) introduced to the digital ecosystem. It is players' involvement in the greater game's culture, the intra-action and collaboration between players and the flexibility of the game's mechanics that contribute to the ability to support a variety of play styles and game goals. Within this flexibility, however, there is also a convergence of play and meaning taken away from the game, and this hegemony must be accounted for. A cultural perspective to games and gameplay allows for both. It is in the development of a game's culture that this thesis turns to investigate the meanings and statements about life that evolutionary computer games produce through gameplay.

Computer Games as Assemblies – the Multi-Directionality of Intra-Actions

The first challenge that computer games hold in the development of an understanding of the production of meaning is recognising computer games' distinctive nature as a media form. There is no ready-made 'text' available to be read, decoded or analysed. Computer games are simulational, spatial and played with and within. Any narratives or stories taken from games are produced through the activity of gameplay. It is this challenge of a media form that is both interactive and simulational, whilst giving at least the air of a 'cultural text' that has formed the basis of much of the discussion between narratology and ludology within computer game studies. Within media studies, the classic encoding-decoding model implies a linear media system of production to consumption of media messages. This has always been inherently problematic; producers and consumers are neither solely producers nor consumers, they are always partially both. Lev Manovich makes the point that all media is interactive, in the production of text, emphasising the active decoding of text. He warns of the danger of a purely physical interpretation of 'interaction':

> When we use the concept of "interactive media" exclusively in relation to
> computer-based media, there is the danger that we will interpret
> "interaction" literally, equating it with physical interaction between a user
> and a media object... at the expense of psychological interaction. The

psychological processes of filling-in, hypothesis formation, recall, and identification, which are required for us to comprehend any text or image at all, are mistakenly identified with an objectively existing structure of interactive links. (2001: 57)

Computer game players, placed in a concretely active position, within the assembly of agents brought together in the production of play, challenge the use of an encoding-decoding model to examine computer games and play so that it is no longer feasible to think conceptually of a uni-directional flow of 'textual' production and receivership. In their position of active production (rather than active consumption), game players contest both the directional flow of messages and the existence of any ready-made text ready. There is no game without play. Without being played, the game is only a potential. The player is therefore critical in the production of gameplay; play is based in and a result of intra-action.

That is not to say that there are no opportunities within computer games for 'textual' readings. Reminded of Soja's conceptualisation of Secondspace, and contrary to ludologists' insistence that games hold no opportunity for textuality, gamespace is open to a semiotic spatial analysis. This is especially fruitful in the analysis of evolutionary games where the (re)creation of nature as a technology (as computer cyber/gamespace) is key to the games' formation. As the digital environment in which play occurs, and nature is (re)created, gamespaces become new natures, the 'natural' environment that sets the stage for the drama of life itself. In his investigation of the objects of modern living spaces, Jean Baudrillard recognises the importance of design and 'atmosphere' in the production of meaning:

... both mobilise the values of play and calculation – calculation of function in the case of design, calculation of materials, forms and space in the case of atmosphere. (1996: 30)

A semiotic reading of the gamespace becomes a key feature of the relationship between technology and nature in evolutionary computer games, bringing together both design and 'atmosphere.' An analysis of evolutionary games, however, must also go beyond a semiotic analysis to investigate how these gamespaces are co-constructed and structure social order, intra-action and experience. Gamespace is a constructed space, and is continually co-constructed by the assembly of agents brought together through play. Recognising this continually returns thought to how the player and other agents are implicated in the production of play. As spatial environments, computer games are structuring

environments in which play occurs. Being programmed, gamespace is also structured space by design.

The computer game (in that it is associated with specific rules of engagement and simulation, and of memory) and the game player join together as key agents within the assembly brought together in the production of gameplay. It is the computer game's programming that structures what may or may not occur in the game, creating the parameters of gameplay through rules and directing the user in play. The game player must decipher and understand the rules and navigate through the gamespace in order to have meaningful gameplay. Newman pinpoints this relationship in what he terms the 'On-Line' experience:

> The On-Line relationship between primary-player and system/gameworld is not one of clear subject and object. Rather, the interface is a continuous feedback loop where the player must be seen as both implied by, and implicated in, the construction and composition of the experience. (2002)

Reminded of our materialist position where assemblies are made up of agents that need not be human or living, gameplay becomes the product of at least two agents: the computer game and the player. And we must critically include the producer(s) as agent(s) as well, in their key role of structuring the underlying rules of the game (programming), and of programming the game characters and other game elements, both in their operations and aesthetics. Here, we can begin to produce a multi-directional model for the production of gameplay, which at the same time recognises the various roles and importance of the different agents within the assembly. This expands upon an encoding-decoding model as it places the player in an active productive position, highlighting the very networked intra-actions involved in gameplay.

Opening an understanding of gameplay as a productive practice problematises the linearity of meaning transmission in gameplay. The player, the game producers and the game itself, in its spatiality and underlying structure of programming and rules, present a skeletal outline of a multi-directional model. The production of gameplay can be further expanded to include the greater variety of agents that come together to form a game culture, and take part in the production of stories taken from gameplay. T.L. Taylor finds that it is just such an expanded notion of gameplay and networks which is key in the production of individuals as players:

Most people come into game culture through their networks and learn to be gamers within specific social contexts... We should not overlook the power such introductions provide in both legitimating inhabitation of that space and providing the tools to stay... This is instructive because it means the paths into game culture are vital. (2008: 53)

An active game culture is key to understanding evolutionary artificial life computer games, where game playing communities – web-sites, newsgroups, forums, etcetera – become important parts of gameplay, and where game objects and 'game characters' in the form of artificial life creatures also shape the production of gameplay. As predominantly open-ended games of paidea, which do not have any specific pre-defined winning 'goal' (other than a broad and ever present goal of progressive evolution through reproduction and genetic engineering) the possible goals of the evolutionary computer games are often defined and debated within this larger assembly. This could be the breeding or genetically engineering specific artificial life creatures or species with certain characteristics, to attempting to 'correct' or 'rehabilitate' creatures with 'challenging' behavioural patterns. The larger assembly may help define game goals (and therefore the production of meanings from gameplay), and can also contribute to the variety and breadth of the game through the inclusion of the trading of creatures, the development of new game tools, the hacking and development of game programming code (all in an programming environment similar to open sourcing), and through debate on newsgroups and web forums. The Internet is a key factor in the ability to take gameplay to this level and in the production of a game's culture.

Bringing in an wider range of agents to the production of play, it is possible to further open the multi-directional model outlined above (for what will be termed *immediate* gameplay) to a more developed model that further deconstructs the directionality of meaning production (termed *extended* gameplay). An extended model recognises the contribution to the development of the game (and gameplay) that a range of agents can make, and also acknowledges the feedback of such production to the producers of the game. Through extended play, the game producers also become active receivers, incorporating new game elements and styles of play developed by players, and the extended assembly involved in the production of play, into new editions and updates. It is hard to deny the amount of labour many players devote to the playing and development of computer games, especially games such as *Creatures* where players have

developed new Norn species, game objects and even new digital ecosystems. By taking this involvement in gameplay, players produce new aspects of the game while further extending it. In turn, the producers of the game incorporate these elements, and new aspects of gameplay can be incorporated into new 'official' additions to the game or to later versions. A fuller multi-directional model allows for the development of players as (at least) partial producers of the game, and for producers to be (at least) partial receivers of new game elements. A multi-directional model gives breadth and diversity to the various roles in the production of gameplay and meaning, and in the continued production of the game itself.

By recognising the variety of agents that are involved in the production of a computer game and gameplay, an extended multi-directional model also highlights the concept of a game's culture. This culture develops from the assembly involved in the production of the game and gameplay and finds importance through moving the underlying rules and assumptions found in the game's programming and simulation into common sense through a process of naturalisation. The move from rule or procedure of computer programming to common sense of a game's culture is paramount in naturalising and normalising the statements that can be taken from gameplay. In evolutionary games, where the common sense of the game is formed around the production of new definitions of life itself, a game's culture can be analysed by observing how the discourses of the technoscience of artificial life are incorporated and translated into the common sense of the game. Gameplay is critical in the development and maintenance of a game's culture. It also sets up the common sense of a game and brings a player into the game's culture, through structures of feeling, how an intuitive sense of game play is found through the player's position and the interfaces within gameplay, and how a game's culture can be thought of as a hegemony.

Structures of Feeling – the Development of Common Sense

Raymond Williams developed the concept of structures of feeling to describe the manner in which a culture comes to develop and structure itself: unplanned and yet seemingly willed. A structure of feeling defines for Williams "a particular quality of social experience and relationship, historically distinct from other particular qualities, which gives the sense of a generation or of a period" (1977:

131). Structure of feeling is introduced to the analysis of computer games to provide a means to investigate how computer games bring the player into a game's culture, as a member of the assembly of agents involved in the production of gameplay, and how players begin to structure the common sense of that culture. For Taylor, becoming a computer game player is 'deeply informed' by such things as "how people come to know about a game, get reiews of it (formal or informal), get their hands on it, and indeed have people to play" (2008: 53-4). These structures of feeling occur within social networks and form a game's culture. In developing Williams' work, Michael Pickering (1997) finds, in structures of feeling, a unit of analysis that defines and describes a sense in which particular activities are combined into a way of thinking and living for a particular time and place. He finds that structures of feeling:

> ... arise out of the need to give shape and identity to the localised nature of characteristic social experiences, and to articulate a group's sense of itself in the social world, as they can then act back on subsequent experiences by structuring the ways in which such experiences are understood as characteristic and significant. Emerging from the urge to understand what is experientially new and different for a generation or group, and to express a sense of identity which crystallises in differentiation from what has been inherited from the past, structures of feeling come to mediate the group's collective understanding of social experiences and of relations between the social world and a group's place within it. The movement is one of thinking about the process of living to living through the product of that thinking. (1997: 33)

For computer games and a game's culture, structures of feeling introduce (potential) players to a game's culture; how the underlying rules and simulation of the game are translated and presented to the player or others coming to the game, and how these become common for the members of a game's culture. It hopes to form a cohesive group definition to the assembly involved in the production of a game and gameplay. This is an important step in the production of gameplay; it is almost impossible to play a game without at least some set of basic understandings of its culture, to have a feel for the game. (Potential) players can grasp a game and its culture by being able to develop a feeling for what the game is about, how gameplay is likely to proceed, and how they as players are brought into and intra-act within the game and gameplay. Structures of feeling are most prominent in the early development of a cultural assembly, or in times of cultural change, when new structures of feeling are developed. In computer games this can be seen in a player's initial gameplay. This can also go further to a potential player's initial contact with a game: browsing game boxes in a shop,

reading a review, or discussions with other players. For James Wallis, the ability of players to be able to create a feeling or a 'story structure' for a game comes from "the game's seting and the assumptions that people take from a game's components and packaging" (2007: 77). It is these initial contacts with the game in which structures of feeling are most pronounced, or when a game's culture makes a radical shift in which new structures of feeling are formed. It is the lived experience of becoming part of a computer game's culture:

> It refers to how social events, encounters and relations in solution, in a 'lived' experience of the present, are met, and how meanings begin to be made of them... [C]onceptually it is directed to the ways in which experiences are culturally experienced and responded to by a particular social or distinctively generational group. (Pickering, 1997: 34)

This 'lived' aspects of structures of feeling forefronts the experiential characteristic of computer games. When examining computer games as sites of production of play through the intra-actions of an assembly of agents, the first step is to understand how a computer game produces common experiences of gameplay amongst players and members of its assembly. Structures of feeling provide a means in which to investigate how such common experiences are developed, by exploring how a common feel for the game is created. It is this development of a common feel for a game that moves to the creation of a game's culture, developing further the production of common meanings of play through the development of common sense. Structures of feeling within games and gameplay lead players to come to common understandings and experiences of a game and gameplay.

In computer games, there are a number of sources we can look to in order to find structures of feeling at the player level. Primary sources such as game packaging, the instruction booklet, any pre-game video vignettes, the ways in which the game presents itself and official websites all aid in the presentation of a feel for the game, conveying to the player the type of game and what to expect. This provides the beginnings of the development of the game's common sense. Here, indicators reflect most closely the intent of the producers of the game, as it is here that the producers have the most direct control over material. These important sources of information are often also the first contact (potential) players will have with a game and its culture. Secondary sources can also play an important part in the development of structures of feeling for a game. These include press articles about the game (such as game reviews), discussion forum boards and other

sources of discussion for gamers on the Internet, and, as the game's culture develops, player led websites. Secondary sources also indicate how much a game's culture reflects the feel initially developed by the producers of the game. As the thesis will return to later, in an exploration of hegemony in a game's culture, these secondary sources reflect negotiated positions within a game's culture and can reflect changes such negotiations have made in the structures of feeling. An investigation into the structures of feeling that these present reflects how a game has been taken up by those who play it, review it, or otherwise interact within the culture.

Structures of feeling are generated in the first place to make sense of the process of everyday social life (Pickering 1997), or when applied to computer games, to make sense of a game, gameplay, and a game's culture. Pickering places structures of feeling within the ideological, coming before (or after) the formation of an ideological position. Aligning structures of feeling to the positioning of the thesis, it is preferable to place structures of feeling within the discourses and grand narratives of a culture. They draw from and are accommodated by cultural grand narratives, aligning to the stories that can be told and statements that can be taken away about or within a cultural assemblage. This is an important bridge between a game's culture and other cultural assemblages with which it associates. The structures of feeling for a game can be traced through the cultural assemblages that produce the game and those in which the game is played and discussed. For evolutionary computer games we can look to our converging cultural strands of artificial life (the technoscience of the life sciences), computer game media (the culture of computer games), and present Western society. A movement from structures of feeling to grand narratives furthers a game's cultural development. It is through developing cultural narratives in gameplay that games resonate with other cultural assemblages, aiding in the creation of effective gameplay and production of meaning from play.

Structures of feeling align new players and other agents with a game's culture. Through gameplay, these move towards a production of common sense within the game and its culture. Through intuition these begin the translation to become 'natural,' how gameplay becomes second nature or intuitive. Within gameplay, intuition orientates the player, through positioning, interface and gameplay.

Intuition – naturalising play

In the building of common sense within the assembly of a game's culture, and especially for the player, intuition develops from structures of feeling. Intuition signals the manner in which the player is positioned and intra-acts within a computer game, aiding in the naturalisation of gameplay. Specifically, intuition examines how the player is brought into the game through positioning and interface. The ability to create intuition is an aspect of game design; poor design often leaves players frustrated as 'the controls don't make sense' when there is no intuitive correlation to how the player uses input devices, the interface with what occurs on the screen in gameplay and the underlying rules of the game. Therefore, intuition is not a given in gameplay, and poor design in this area often equates to a game's early demise (due to lack of playability). It is in these poorly designed games where intuition (or the lack of) is most prominent, as it is this highlights when it is not working. When Wallis finds that "too great a density of rules or a single rule in the wrong place can destroy the cohesion or effect of the story" within gameplay (2007: 79) this has a great deal to do with the failure in playability and development of intuition. On the other hand, Newman finds that "there are few good games with bad controls. Few good games feel bad" (2002). Intuitive gameplay naturalises the translation from player input and interface to intra-action in gameplay. The player is positioned within the gamespace and operates game controls in such a manner that the physical manipulations of input and translated gamespace actions are aligned so that interface is not noticed as friction in play. It is the ease in which the player becomes a part of the game, and his/her actions become habitual, that develop a game's intuitive characteristic. Intuition incorporates the creation of habit (Wise 1997: 76), but is also more general.

Intuition is important in the study of computer games as it formalises and naturalises the player's positioning(s) and role(s) within the game. Intuitive items such as "knowledge of standard game mechanics, interface practices, and even genre conventions are powerful factors in computer game play", but Taylor finds that these "are equally overlooked by researchers" (Taylor 2008: 63). Such factors should form points of interest for gameplay analysis as intuition further builds and reinforces the developing common sense of the game. Creating an intuitive feel for gameplay further establishes and naturalises discourses and grand narratives played out through the game. As with structures of feeling, intuition moves gameplay to a feeling of 'as it should be,' making the position(s) and role(s) of the player and his or her relationship with other agents in the game appear normal and mundane. Within the assembly, brought together in the

production of gameplay, intuition recognises the active productive role of the player in the production of gameplay. It also acknowledges how the game, as an agent within the assembly, effectively structures play by defining what roles, character positions and movements it allows the player. The player is largely limited in play to the position(s) made available by the game, as structured by the underlying programming, but it is through his or her intra-actions with the game's collected assembly that gameplay occurs, and these positions are negotiated. Intuition takes these defined (and negotiated) positions and makes them 'second nature'. In doing so it de-emphasises the limitations of the player's positioning, movements or possible intra-actions made available in the game. It hides the inherent structured and structuring nature of computer games and conceals the manner in which the game guides and directs play, defining the parameters in which gameplay can occur. Intuition can be traced through the player's position in the game and the interface of input into the game, and further investigates how these structure gameplay and reflect the common sense of a game's culture. Genre is also key to the development of intuition; games of a common genre will often produce an expected intuitive style of play.

Player positioning within gamespace is an early indicator of the intuition of a game. A player's position incorporates both point of view (i.e. how the player is placed within the gamespace) and what roles are available in gameplay. Within evolutionary artificial life games, the point of view is universally positioned as a (participatory) observer of the world, looking from above down, into the gamespace, and is often characterised with roles such as caretaker, scientist, god, or parent. These become part of the repertoire of roles the player is offered, assumes and negotiates within the game. Roles can be many and varied and often different roles are played simultaneously or scrolled between. Torill Mortensen likens the variety of roles players can take in gameplay with those from everyday life, with more than a fleeting reference to Erving Goffman and *The Presentation of Self in Everyday Life* (2007: 300). She finds that what she celebrates as the 'role-playing high', the elated feeling of successfully adopting a role in gameplay "is balanced somewhere between believing in your own play and still being aware that you are controlling the act" (Mortensen 2007: 303).

Intuition can be analysed not only in the position of the player within the gamespace, but also by how the player (as an agent within the assembly) is positioned in relation to the other agents involved in gameplay, in proximity and power. For evolutionary computer games the position of the player within the

game is uniformly one of a god-like overseer, looking down onto the ecosystem and creatures. This player positioning groups the family of evolutionary games together as a genre (usually referred to as a 'god-sim,' together with other simulation model games) and can be examined in how it relates to the physicality of the player in front of a monitor as window, effectively looking into the world (of a gamespace). A godlike position looking from outside, above and through the 'window' of the monitor has obvious relations with both the scientific (as scientist looking through the microscope) and spiritual (as protector overlooking the flock) discourses of artificial life. How this godlike position relates to the positioning of the other agents in the game (artificial life creatures, game elements, manoeuvring the gamespace, etcetera) with regards to issues of power and control can also be examined.

Intuition encompasses not only how the player is positioned within the game, but also how the player intra-acts within the game. The player's movements, intra-actions with other game agents and manipulation of the settings within the game are a combination of the player's physical manipulation of input devices and game interface (joystick, keyboard, mouse, monitor) and the corresponding actions within the game world. Intuition makes these two activities seamless; there is no friction between the physical input of the player and the corresponding digital actions in the gamespace. The input device(s) become a cybernetic and cyborgian extension of the player, both physically in front of the monitor and virtually in the game. They interpret the player's game play from molecular to digital action. Intuition makes this input seem seamless, in that the player is not continually reminded of the process of input, but instead gameplay seems to flow seamlessly from input to action. The formation of habit is a key feature of intuition in input; learning new controls is much less intuitive than when mastery of the controls has become habitual. Genre finds an important role here. The establishment of standard input control across similar games increases the intuition of a game; there is less to learn and an expected style is created and appears normalised across different games. As with the positioning of the player, the creation of intuition in player and game intra-action should be examined in how it structures and guides game play, along with what does it allows or limits. The types and ways of input and their translated screen actions reinforce the positioning of the player and further this position through action. Taking evolutionary 'god-sims,' the position of god is reinforced and moved on by the types of actions the player can perform in the game (such as the ability to kill or remove unwanted creatures).

The intuition of the game strengthens its naturalisation and reinforces the development of a game's common sense. Moving on from the structures of feeling within the game, intuition incorporates the player into the game and gameplay, and decreases the friction between the physical and the digital so that the player's position and actions appear seamless. Intuition makes the underlying structure and programming of the game invisible, or at the very least does its best to conceal it. Through positioning and intra-action it creates naturalised game play through the formation of habit. The act and process of playing the game becomes part of the game's common sense. Whilst the game has a structuring and guiding effect on this position and the direction of play (which intuition at least partially veils), it is also through these guides that players can negotiate their own style, position and meaning in the game's culture and gameplay.

Hegemony

The members of a game's culture consist of an assembly comprised of a variety of agents and agent positions, including the producers of the game, players, game elements and characters. They can also include others who have involvement with the game through an extended game network. The evolutionary computer games of this thesis often have a high level of game community involvement in (extended) gameplay. This can range from the trading of creatures and other game items and the development of new game additions, through to the constitution and negotiation of what constitutes 'fair play' and game goals (moving paeida games to incorporating more ludus elements). Whilst the involvement of the extended game assembly initially takes from the common sense found within the game itself, it does not need stay there. Development of meaning, common sense, and positions of power is limited only by the need to make sense in consideration of the underlying programming of the game; that it is compatible with the range of possible gameplay. In negotiating positions within the game's culture, agents are in a position to negotiate and reconfigure the accepted common sense of the game. Examining this through the use of hegemony allows for the possibility of the movement and development of meaning within the culture, whilst acknowledging the dominant positions that key agents hold, such as the producers of the game.

Hegemony is a concept originally developed by Antonio Gramsci to provide a means in which to describe the complex interlocking political, social and cultural

forces in which the dominant classes (for Gramsci – the bourgeoisie) maintain their dominant position. For Williams (1977), hegemony goes beyond concepts of 'culture' as 'a whole social process' and 'ideology' and recognises the dominance and subordination in inequalities between classes:

> What is decisive is not only the conscious system of ideas and beliefs, but the whole lived social process as practically organised by specific and dominant meanings and values. (Williams 1977: 109)

He continues:

> It is a lived system of meanings and values – constitutive and constituting – which as they are experienced as practices appear as reciprocally confirming. It thus constitutes a sense of reality for most people in the society, a sense of absolute because experienced reality beyond which it is very difficult for most members of the society to move, in most areas of their lives. It is, that is to say, in the strongest sense a 'culture', but a culture which has also to be seen as the lived dominance and subordination of particular classes. (1977: 110)

Hegemony is therefore the result of the process of lived experience: a realised complex of experiences, relationships, intra-actions and activities with specific and changing pressures and limits. Incorporating hegemony to the study of computer games, gameplay and a game's culture, two important aspects are highlighted. The first is the importance of experience in the production of meaning within gameplay. Through the experience of play (both in immediate and extended play), the player is implicated in the co-construction of the reality of the game. Critically, this reality is limited in scope by the parameters of the underlying computer programming, and developed and co-constructed by the assembly of the game coming together under the game's culture. This leads to the second aspect – the importance of a shared developed culture (and production of meaning) from gameplay – especially in consideration of the collaborative intra-actions found in the extended play of evolutionary computer games between players.

Hegemony is also important in that it acknowledges the dominant position of certain members of the culture or assembly. In a game's culture, as with other areas of the 'digital economy' (Terranova 2000), we must take notions of domination and subordination out of their strictly Marxist framework of class or class formation. Elaborating on Maurio Lazzarato's concept of immaterial labour – labour associated with an 'informational content' and 'cultural content' – Tiziana Terranova finds:

> Immaterial labor... is not completely confined to a specific class formation. Lazzarato insists that this form of labor power is not limited to highly skilled workers but is a form of activity of every productive subject within postindustrial societies... [I]n the young worker, the "precarious worker," and the unemployed youth these capacities are "virtual," that is they are there but are still undetermined. This means that immaterial labor is a virtuality (an undetermined capacity) that belongs to the postindustrial productive subjectivity as a whole. (2000: 41)

Terranova's account of 'Free Labor' in the 'digital economy' allows the problematisation and restructuring of not only the issue of class, but also of what is considered labour, both of which are fruitful in an investigation of hegemony within a game's culture. She stresses that the concepts of work and labour (typically associated with being paid) need to be separated out; the equivalence between labour and employment needs to be rejected and reworked. Terranova finds that there is much labour involved in the digital economy that is not considered as work or employment. Recognising the importance of (free) labour in the production of culture (and especially digital culture) and without taking away from the fact that playing a computer game is just that – play, a game's culture becomes associated with a great deal of labour. Game websites, new additions to games, newsgroups, reviews (paid and unpaid), magazine write-ups, and even gameplay (in both its immediate and extended sense) all entail labour to produce and maintain, albeit intended and (hopefully) realised under the conditions of enjoyment and/or play. In this collection of labour, it is the concept of 'general intellect,' the ensemble of knowledge constituting the epicentre of social production, that Terranova borrows from the Italian autonomists, which comes to form the dominant position within a game's culture's hegemonic order. Whilst recognising the collective nature of knowledge labour that goes into the general intellect, recognising the (non-class bound) hegemonic nature of a game's culture allows the privileged position of key actors to be acknowledged. Without denying the diversity of play styles, goals and so on that are found within a game's culture, the dominant position of the game itself and the game producers must be recognised at the epicentre of production. This is especially the case with the open paeida style of evolutionary computer games. Cultural production within gameplay and its associated labour takes from and returns to the game. It realises a central and dominant position within its culture. As with the digital economy that Terranova examines, computer game culture relies on its players and the collective assembly as productive subjects in the creation of culture.

Bringing in the concept of hegemony allows a way of examining this production. Barry Smart (1986) moves hegemony away from Gramsci's theorisation of ideology to focus on relations of 'truth' and 'power.' For Smart:

> Hegemony contributes to or constitutes a form of social cohesion not through force or coercion, nor necessarily through consent, but most effectively by ways of practices, techniques, and methods which infiltrate minds and bodies, cultural practices which cultivate behaviours and beliefs, tastes, desires, and needs as seemingly naturally occurring qualities and properties embodied in the psychic and physical reality (or 'truth') of the human subject. (1986: 160)

The dominant position of the game can be examined through the types of labour that it invokes, how it naturalises a specific statements formed within a game's culture, and how it supports specific dynamics of power in play. This can also be extrapolated back and connected to the general culture(s) within which the game's culture is located – to techoscience, media and popular culture. Bringing in a hegemonic component to the study of a computer game allows the lived experience of play to be acknowledged, while realising the dominant position of the game in the production of (immediate and extended) play. Gameplay and the maintenance of a game's culture involve a vast amount of labour (both paid and unpaid) in a variety of guises.

The challenge of alternative and oppositional play[7] can also be examined within the exploration of hegemony. Williams (1977) suggests that nearly all initiatives and contributions, even when they take on manifestly alternative or oppositional forms, are in practice tied to the hegemonic. He suggests "the dominant culture... at once produces and limits its own forms of counter-culture" (1977: 114). Gameplay can be examined in such light – investigating if oppositional (independent) game play can exist and what forms this might take. Within evolutionary computer games, alternative and oppositional styles of play challenge the claimed life status the artificial life entities assert within the game.

Narrative(s) of Play

Gameplay is experiential, built from the multitude of intra-actions between the various agents that come together within the assembly of the computer game. This chapter so far has examined how agents are brought together as an

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[7] Williams distinguishes between alternative (contributions made within or against an hegemony) and oppositional (contributions that are irreducible to the hegemony and are independent of it).

assembly within a game's culture and how this culture is defined and negotiated, through the development of common sense and hegemonic structures. These have been developed through lived experience. The thesis now turns to look at how this experience can be viewed within narrative and how narrative becomes an important ingredient to the construction of coherent gameplay. Through the production of gameplay, there is the paired production of meaning, making sense of both the game and gameplay. The production of meaning is at least partially structured through the production of narrative, giving the statements formed through gameplay a story. Mortensen finds the development of 'story creation' within gameplay important as it is here that "all players present their characters' motivation, decisions, and desires" (2007: 299). Developing narrative within gameplay, and story creation thesis turns to personal narrative and work on the self as narrative by Kim Worthington (1996). As with Worthington's desire for a coherent (if not fixed) conceptualisation of self, bringing a narrative aspect to gameplay provides a coherent framework for both gameplay and the production of meaning. Incorporating narrative at this stage is to recognise the creation of stories in the construction of games, as with the self (Worthington 1996:8). As the self is a narrative project, playing a computer game is similar – the user effectively plays out a 'life' through play. Games involve a player through intra-actions over space and time, especially those such as paieda evolutionary games that have no defined goal or end point and continue over many sessions. It is narrative structure that brings events together as coherent gameplay that would otherwise be random. A player realises game identity(-ies) through such coherency, realising roles and purpose to his/her actions. Being able to conceptualise gameplay as narrative and story allows players to be able to create a coherent sense of character-self and a coherent sense of history (play). Taking from Worthington:

> ... the construction of a subject's sense of selfhood should be understood as a creative narrative process achieved within a plurality of intersubjective communicative protocols. In the act of conceptualizing one's selfhood, one writes a narrative of personal continuity through time... [I]t recognizes that a narrative of self provides the human subject with a sense of self-continuity and coherence that enables the projection of desire and intention towards an imagined future. In short, it allows the subject to function as a purposive, morally responsible agent. (1996: 13)

It is important to stress that the terms 'narrative' and 'story creation' in no way suggest a set story (either already written, waiting to be read, or once written not open to revision). Narratives of play are provisional and are open to revision,

change, and reinterpretation. They are (re)written to reflect the changing focus of play throughout a game; as strategies change, as new play styles emerge, as new game events alter the meaning of prior events and as gameplay is produced. Narrative brings continuity to gameplay, in that past actions reflect upon and help define the present course of action. They give history to play.

> One of the characteristics of narration is temporal and spatial emplotment: narratives are concerned not with isolated moments or particular acts, but with *sequences* of acts and events. They are orderings and interconnections of phenomenological perceptions, or of the memories of these perceptions, in time and space. In the process of narration, discrete moments and acts are contextualized: they are enmeshed in a history. (Worthington 1996: 14)

Narrative gives meaning to past events and actions (Worthington's 'phenomenological perceptions') in the context of current intra-actions. This is a vital aspect of gameplay; in the production of coherent gameplay there needs to be a connection between events and meaning over time and space. That is, the framework of play, tactics, strategy, game advancement and intra-actions can only make sense within narrative structures in which present actions are connected to (current definitions of) prior events.

As structured and structuring spaces, computer games can be examined in how they limit, shape and develop possible narratives of play. Again, it is possible to look to the underlying programming of the game and the game's culture to determine how play is defined and shaped within narrative structures. The thesis divides game elements that provide a sense of narrativity into two groups: mythic possibilities and narrative scaffolding. Each aid in the production of coherent gameplay, relate the game within similar assemblages and the culture of which it is apart, and are intimately linked to the production of meanings from gameplay. Mythic possibilities are game elements that shape play so that the player and other agents in the game play through and act out cultural mythologies and grand narratives. They tie the game back into the culture(s) in which it was developed and used. Similarly, narrative scaffolding is the game elements that provide tools for history making within the game. Here, how the game evokes memory-work on the part of the player (and other agents) is examined in the production of narrative. Together mythic possibilities and narrative scaffolding give insight into how the game allows and shapes narratives of play.

Mythic Possibilities

Examining the narrative possibilities of a game at the level of myth links the game('s culture) with the cultures in which the game is produced and played. In using the term myth, this thesis incorporates Roland Barthes and his development of myth as a semiological system. For Barthes, myth forms a second-order semiological system; a metalanguage for a culture (1972). Marina Warner offers a definition of Barthesian myth:

> A myth is a kind of story told in public... it pretends to present the matter as it is and always must be, [and] at its heart lies the principle, in the famous formula of Roland Barthes, that history is turned into nature... Myths offer a lens which can be used to see human identity in its social and cultural context... Myths convey values and expectations which are always evolving, in the process of being formed, but... never set so hard they cannot be changed again, and newly told stories can be more helpful than repeating old ones. (1994: 13/14)

As a story telling metalanguage, myth transforms history into nature, creating an inductive and a factual system instead of a semiological one (Barthes 1972: 131). In myth, how stories are naturalised is important; making things seem natural, reflecting and forming the grand narratives of a culture. For Barthes, myth does this through its formation as depoliticised speech through its offering of history as nature; the production of myths naturalises and normalises its content:

> In passing from history to nature, myth acts economically: it abolishes the complexity of human acts, it gives them the simplicity of essences, it does away with all dialectics, with any going back beyond what is immediately visible, it organizes a world which is without contradictions because it is without depth, a world wide open and wallowing in the evident, it establishes a blissful clarity: things appear to mean something by themselves. (1972: 143)

Bringing myth to a formation of narrative through gameplay must recognise the experiential nature of gameplay; instead of being presented with mythological representations as image[8], the player acts out myth through gameplay. Instead of 'reading' myth, the player is involved in its re-enactment; s/he 'lives' the myth through the development of gameplay. The game, therefore, presents myth as a possibility – myth is presented in game play through game elements and the player realises myth through involvement with these elements. These are typically game events or styles of play that the player must adopt or play through in gameplay. By realising the mythic possibilities of a game players shape their

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[8] Barthes examines the photographic image in his exploration of myth.

game narrative within the metalanguage of myth and grand narratives. Along with the other techniques this thesis explores in the development of a game's culture, mythic possibilities formulate the naturalisation and normalisation of gameplay. As with the other devices incorporated within a game and gameplay, it makes game play seem natural, or rather 'as it should be'.

Further to the development of a game's own culture, mythic possibilities tie such a culture back to the culture(s) in which the game has been developed and used, and with other assemblages. A game's culture can generate its own set of myths, but how computer games incorporate and make use of the existing myths and grand narratives of a culture is of interest in the production of meanings from gameplay. Mythic possibilities link evolutionary computer games back to the cultures that constitute them and engage with other similar assemblages. Especially evident within evolutionary artificial life computer games are the twinned and entwined discourses of cybernetic and neo-Darwinian definitions of life itself, in its spiritual and (techno)scientific grand narratives of interconnectivity, emergence and informatics.

Narrative Scaffolding

Mythic possibilities tie computer gameplay to the stories of the culture(s) and shared assemblages that surround it, and of which it is a part. Narrative scaffolding adds to the production of meaning within computer games in two ways. The first, how it frames gameplay and narrative through game elements that structure and guide how the game must be played (i.e. specific rules such as the amount and availability of food for creatures incorporated into the programming of the game engine), explores how these aid in the making of coherent events through time and space. Narrative scaffolding structures what is possible in gameplay and attempts to frame and hide the limitations of play through techniques to guide the unfolding of gameplay. It supports the procedural rule-based programming of the game, aiding in the production of intuition in the game by providing the parameters of the game in a manner the makes sense in gameplay.

The second is the manner in which it incorporates history to the development of narrative. Of concern is how game elements aid in the production of narrative, through the use of prompts, to create and record game events and elements that give a sense of life history. In short, narrative scaffolding aids the production of

narrative through developing memory work in gameplay. Celia Lury has mapped how memory is a critical aspect in the construction of an individual:

> Questions of memory have always been entwined with the construct of the individual... One of the most important ways in which memory has come to have this role is through the creation of narratives of self- and collective identity. Indeed, narrative is perhaps the principle trope that has enabled a continuity of consciousness organised on the basis of a concrete-qualitative sense of time and its manifestations: experience, subjective recollection and the individual... However, so it has been suggested here, the creation and pervasiveness of images has also had a profound – if often unrecognised – significance in modern self-understandings. (Lury 1998: 105)

Lury ties memory with the construction of not only the modern possessive individual, but also of the contemporary self, whose self-identity she finds to be "continually being reconstituted in novel – technologically mediated – ways" in the development of "prosthetic (auto)biographies" (1998: 106). Adopting Lury's terminology in our analysis of narrative in games, in game play the constitution of a (game) self-identity is constantly mediated through the technology of the game in the production of a prosthetic (auto)biography. Game elements aid and mediate memory-work throughout gameplay. These provide the player tools in which to create plausible self-identiy(-ies) through self and game narratives. Lury terms this as prosthetic, taking from Strathern, whose postplural individual is an aggregate of many parts:

> For Strathern, the postplural individual is no longer imagined merologically, but is instead a constellation of implanted elements, parts without social or natural depth.
> In this scenario, the individual in postplural society is made up not of parts of other domains, but of parts accreting with other parts, strategic assemblages adjacent, coeval parts within the frame of a single form: memories substituted for one another, organs transplanted form one body to work alongside those of another's, hues of cloth juxtaposed with colours of skin, hair and eyes. This is no longer a culture of *synthesis*, but one of *prosthesis*. (Lury 1998: 16)

The computer game acts in a prosthetic manner, as a memory theatre holding the entire knowledge of the (game) world, and as a tool for memory in the creation of history and the self-identity of the player (and other game agents). These game elements are considered in this thesis as narrative scaffolding, which act as both a structuring tool – guiding and framing gameplay – and as a device that

structures how play is interpreted into narrative history. Gameplay is constantly intra-acted through narrative scaffolding. Alison Landsberg (1995) finds with her own conceptualisation of prosthetic memory[9] a generative force:

> Memory... is not a means for closure – is not a strategy for closing or finishing the past – but on the contrary, memory emerges as a generative force, a force which propels us not backwards but forwards. (176)

Here, narrative scaffolding acts not only as a device that frames gameplay and aids in the creation of history, but also as a device that affects current gameplay. Its prosthetic nature, in that it acts as an experiential and memory device interchangeably with those of the player and other agents, means we must examine it critically. Alongside mythic possibilities, we must question and examine what experiences are created or encouraged by these devices, how these devices accredit or deny certain experiences, how (and where) these experiences are stored and prompted as memory, and how these game devices shape possible narratives. Neither mythic possibilities nor narrative scaffolding can be considered as innocent; both return to the naturalisation and normalisation found within a game's culture.

A Game's Culture

Evolutionary computer games (re)create nature and life through gameplay and bring together our converging cultural strands of artificial life, media and culture. This chapter has developed a conceptualisation of evolutionary computer games and gameplay as an active productive practice. Computer games are considered here as emplacements in which the intra-action gameplay occurs. In the production of gameplay, computer games create cultures where various agents (game producers, game characters and objects, the player and game communities) come together in the production of immediate and extended play. In its continued co-production by the assembly brought together in play, gameplay has been explored as an experiential practice. A return to cultural concepts of structures of feeling and hegemony help investigate the formation and project of a game's culture, and have also introduced intuition in the positioning

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[9] Landsberg examines prosthetic memory as "the power of the mass media to create experiences and to implant memories, the experience of which we have never lived" (1995: 176). In the use of prosthetic memory, this thesis is concerned with the first of these assertions, the power to create experiences, as well as exploring how 'memories' are considered worthy of being memories, where these memories are stored and how they are used. I am not using 'prosthetic' in her sense of 'implant' as the player lives through the experiences of the game and these are not foreign to them.

of the player within the game and assembly, and in the creation of common meanings and common sense in gameplay. In investigating the game's culture this chapter has looked at how computer games naturalise and normalise a game's culture and the player's position, role and power within the game. In introducing a sense of narrativity and story generation to computer games it has investigated the game elements that guide and allow for the production of narrative within gameplay, highlighting the importance of narrative in the ability to produce coherent stories from play, and influence over current play. The chapter has drawn from similarities between game narrative, self as narrative and identity work. It has specifically highlighted two areas of narrative – mythic possibilities and narrative scaffolding. Mythic possibilities tie computer games to the cultural meta-language(s) that surround them. Narrative scaffolding reflects the limitations and assumptions of the game's programming and invoke memory work on the part of the player.

The mythic possibilities of evolutionary computer games structure gameplay through the production of narratives that follow the journey of construction, creation and change. This structure has entwined scientific and spiritual narratives that shape gameplay and the production of meaning. Scientifically, the discourses of artificial life, and the rhetoric this technoscience employs in claiming the life status of silicon entities with shared essences with carbon life, makes connections between silicon and carbon, digital and material. Chapter five traces scientific models of connectionism and emergence within cybernetic systems of feedback and control within artificial life and the specific definitions of life these processes support. Such definitions and artificial life emplacements go beyond definitions of life to implicate the operations of nature and the universe, within conceptualisations of computational regimes. Within such cosmological models of closed space and discrete time and space, a deterministic model of reality is formed. Chapter six continues the analysis of the mythic possibilities evolutionary computer games hold, through an analysis of the spiritual dimension of artificial life and computational regimes. Intimately connected with the scientific discourses traced in chapter five, postmodern spiritualities find a divine presence within the emergent properties of connected systems. Reflecting scientific/spiritual models such as Gaia, the spiritual within the cosmology of computational regimes finds divine forces with the interconnectedness of all things and the emergent forces of evolution. Both spiritually and scientifically, the emplacements of evolutionary computer games and artificial life emplacements become perfected instances of model definitions of life, nature and cosmos.

Chapter 5

Artificial Life: The Technoscience of Life Itself

This chapter investigates the technoscience of artificial life, the discourses and narrative the field constructs and the statements it produces about life itself. Artificial life binds biological and computer sciences together and has close relations to molecular biology and genetics. In its most general sense, artificial life has been proposed to both model life-as-we-know-it, and can also investigate life-as-it-could-be (Langton 1996: 8). By doing so, artificial life makes a shift in ontological underpinnings, involving a movement from investigating artificial life phenomena as simulational models of living things to considering artificial life phenomena as living things in themselves. It does so through the importation of biological metaphors into the rhetoric of computer programming, allowing artificial systems to be comparable to other living systems. It is this jump between simulation and synthesis that such a proposition creates interest in the stories that artificial life relates about life itself, our natures and cosmology. This reterritorialisation has social and political implications and aligns itself with other similar movements that have occured in the life sciences, most notably within evolutionary genetics. Elizabeth Grotz highlights life's political aspect in that "life is always politics: it is always about the perserverance of one or many groups at the cost of others" (2004: 256). In the translation and communication of narratives made about life especially, from and between a 'scientific' sphere to a 'cultural' one, the political and social implications of the rhetoric of artificial life and the life sciences is pronounced. Kember suggests that for cyberfeminists, and cultural theorists more generally, to truly relate with science and technology they "must engage with current trends in science and technology with a critical awareness of how they are naturalised culturally and with strategic investment in dialogue rather than dismissal" (2003: 51). This chapter provides an overview of the field of artificial life, how artificial life is aiding a (re)definition of life itself, along with mapping the conceptual field surrounding artificial life practice.

While examining the scientific discipline of artificial life, specific statements about what it means to be alive and the definition of life itself become apparent.

Artificial life aligns with both scientific and spiritual discourses that produce a specific rhetoric surrounding life. Doyle has investigated "the rhetoric of secrets, codes, and programs" that life finds itself in and that artificial life has connected with (1997: 113). Doyle outlines a rhetoric of artificial life steeped in genesis stories of re-birth, exploration (especially outside of life 'as we know it') and alliegence with a scientific discourse of information and code (1997: 110-23). Kember and Helmreich have outlined the development of the scientific disocourse of artificial life, from a dual heritage within the computer sciences and a life sciences increasingly centred on informatics and code (Kember 2003: 63-67, 2000; Helmreich 1997, 1998). Most notably, in her development of the posthuman, Hayles has traced a development of a discourse of artificial life that "as a second instance of life... affect[s] the definition of biological life as well" (1999: 235). She traces levels of narrative that develops the science of artificial life, naturalises this and creates relationships between humans and silicon creatures (1999: 223-39). Paired with chapter six, investigating the spiritual discourse artificial life connects with, this chapter builds upon this academic heritage and details the scientific discourse that surrounds artificial life.

Historical Developments

The study of artificial life takes three directions: wetware (artificial biological life), hardware (robotics and other embodied 'life' forms), and software (computer programs instantiating emergent or evolutionary processes) (Hayles 1996: 147). The focus here is on software artificial life, the variety utilised within evolutionary computer games. Software artificial life has developed from a historical foundation in cybernetics, informatics and molecular biology, finding intellectual ancestors in Alan Turing and John von Neumann (Boden 1996). The origins of computer science can be traced to Turing in the 1930s, and in the 1950s he published a mathematical paper on morphogenesis, which proved to be important to analytical biology. Von Neumann was a pioneer of artificial science, whose work on the digital computer in the 1940s prefigures AI experiments of the 1950s. His theoretical research on cellular automata, including self-reproducing systems, laid both the foundation for artificial life and was seen as a key development in the life sciences (Kember 2003: 69). He recognised quickly the growing importance of cellular automata within the natural sciences (1961: 288). Cellular automata operate within a computational 'space' consisting of an x-y grid of many cells. The state of the cell (either as empty or filled, or as differentiated colours) changes according to a defined rule set that is determined by the state of neighbouring

cells. In this way, the system moves in discrete time-steps, with all cells of the grid advancing to their newly defined state together. After each global change over the computational space, the rules are applied again for the next time-step. One of the founding computational biologists, John Holland describes the discrete deterministic nature of cellular automata:

> The basic "physics" of each model is specified by a cellular automaton... In effect, the underlying physical space is treated as a regular tessellation of the cells (the "geometry"), so that each cell has its neighbors arrayed in the same way – they all fit the same "neighborhood template". In this tessellation, each cell is in one of a finite number of states at any given instant t, the set of possible states being the same for all cells. The cell's state at time $t+1$ is completely determined... by its state and that of a specified set of neighboring cells at time t. moreover, the algorithm for determining the next state, the transition function, is the same for all cells. The result is a uniform (discrete) geometry and a set of laws which hold at each point in that geometry. (1976: 386)

Von Neumann was interested in the spontaneously generated order of cellular automata following simple rules; the regular patterns and behaviours the grids would display through generations. It is these cellular automata that importantly form the basic units of life within new (posthuman) models of life itself (Kember 2003: 70). As early as the 1950s, Von Neumann was creating links and crossovers between cellular automata and 'natural' organisms that foreshadow the recent work and claims of artificial life:

> Natural organisms are, as a rule, much more complicated and subtle, and therefore much less well understood in detail, than are artificial automata. Nevertheless, some regularities which we observe in the organization of the former may be quite instructive in our thinking and planning of the latter; and conversely, a good deal of our experiences and difficulties with out artificial automata can be to some extent projected on our interpretations of natural organisms. (1961: 288-289)

In the 1970s, Holland further developed cellular automata by describing model 'universes' for the study of comparable "abstract counterparts of basic kinetic and biological operators" (1976: 385). This lays further strong foundations for the development of a computational model of life and the universe. Still viewed as simulational models, computational universes find increasingly similarity and equivalence to natural systems:

> The model universes are unabashedly artificial, but they have been selected with a careful eye to established properties of natural systems. Progressive

elaborations of the basic model should yield fair approximations, and simulations, of natural systems without altering the basic points proved for the original model. (Holland 1976: 385)

It is these properties, of discrete spatial cells and discrete units of time, that have been elaborated into complex models of computational regimes that not only model our own natures and universe, but have come to define them. As will be elaborated later in the chaper, contemporary practitioners and theorists including Grand, Hayles and physicist Edward Fredkin have developed computational regimes that encompass models of life within greater cosmological models.

Whilst cellular automata had built strong references with life, the development of evolution within these computational spaces took some time to unfold. John Holland made a formal definition of genetic algorithms (GAs) as early as the 1960s, but it was not until the 1980s that GAs were implemented. At that time, the term 'artificial life' was coined and the first artificial life conference held in 1987, with American artificial life researcher Christopher Langton defining artificial life as 'pursuing the discovery of what life is, as well as how life is possible' (1996: 8). Langton's own definition of life views it as abstract phenomena centred on the concepts of self-organisation, self-replication, emergence, evolution, and the unpredictable gap between genotype and phenotype. Within such a definition, it is information processing that is considered fundamental to life itself, and informational (intentional) concepts from theoretical biology were incorporated into the dictum of artificial life, including genetic 'code,' with its accompanying 'reading,' 'interpreting,' and 'transcription.' It is this emphasis on information, informatics and code that has been the key defining feature connecting silicon and carbon life, pairing replicating strings of computer code as the digital equivalent of DNA and genes. Defining biological processes at the informational level (independent of their underlying biochemistry) was seen as useful, as the same process may be instantiated by different mechanisms in different species. As a framework for life, it has been claimed that artificial life is both reductionist and anti-reductionist by its practitioners; reductionist as it finds high-level phenomena dependent on the simple interactions between lower-level processes, and anti-reductionist, because higher-level phenomena are treated as real properties – they are seen as neither extractable nor predictable from the attributes of lower level agents.

In the early 1990s, Thomas Ray developed the simulation of evolution and co-evolution of 'digital organisms,' or GA sequences of machine code, running on his

now infamous program *Tierra*. *Tierra* is prototypical of many evolutionary artificial life programs and also forms an excellent example of artificial life operations (chapter seven investigates *Tierra* in more detail). In *Tierra* digital organisms (variable length GAs) 'compete' for CPU time and memory space within a virtual computer or 'soup,' mimicking terrestrial organisms competing for energy (food) and geographical space. With purposely programmed imperfect execution, maintenance and copying of the organisms' codes, *Tierra* develops a model of biological mutation, and with the memory allocation prevented from reaching capacity through the removal of the old and defective, a computerised model of death (the 'reaper function') is also modelled. When mutations do occur most will be 'sterile' (as they will show fatal program errors or be unable to copy themselves), but others may reproduce successfully, which incorporates an evolutionary process. Evolution is grounded in complex probability distributions that can be varied precisely in *Tierra*, providing an experimental medium for the quantitative study of evolution. The occurrence of evolutionary leaps within *Tierra* is notable, where a sudden change in species ratios after many generations of relative order can lead to new equilibriums. In the late 1990s *Tierra* expanded to a global 'biodiversity reserve' consisting of linked computers over the Internet. Ray's ultimate aim is the production of new life, which is reflected in his preferred term for artificial life, 'Synthetic Biology' (1993). Unlike some artificial lifers such as Grand, for Ray metabolism is inessential to define a being as alive and a living system needs only to display self-replication and be capable of open-ended evolution to qualify as life. In this sense, Ray claims the creatures of *Tierra* are in fact alive.

Across the field as a whole, various artificial life projects explore the effects of various mutation rates and population sizes, and differing degrees of interaction between populations, in a similar vein to *Tierra*. Other projects in artificial life have focused on problems studied in ethology, in the modelling of actual neurophysical mechanisms and the construction of mobile or simulated artificial animals or 'animats.' Some artificial life projects consider the specific behaviours of identified species, whilst others address cross-species behaviours such as flocking (the most famous being Craig Reynolds' Boids (Langton 1996: 66-67)), fighting, pursuit/evasion, or communicative strategies. This is not to imply or give an overall congruence or shape to artificial life. To the contrary, even the scientific status of the field has been questioned. Jason Noble (1997) separates two things from what is generally brought together under the artificial life banner. One, that artificial life is a particular style of simulation technique, and two, the use of such

techniques to address certain questions in biology. By revisiting an admittedly 'disreputable' model of analytic versus synthetic structure, Noble suggests that artificial life creates methodological sloppiness in its confusion between analytical and synthetic modes. Whilst recognising the continuum between analytical and synthetic, Noble returns to the definition postulated by the logical positivists – analytical statements being 'true' by virtue of the meanings of the terms within the statements, and synthetic statements finding 'truth' in the examination of the world. Under such a definition Noble finds artificial life to be analytic, in that "it involves using a computer simulation to see what logically follows from a certain set of assumptions" (1997: 6); artificial life instantiations find truth within the terms of the programs themselves; the program runs as it does and shows the results that it does solely as a result of its programming. Simply, artificial life systems behave as they do because that is how they were programmed to. This becomes problematic when artificial life presents complex emergent phenomena as being of interest in its own right (as postulated by Langton), even though the simulation that gives rise to it is arbitrary and theory-free. Noble finds that an artificial life result, taken on its own, constitutes an analytical finding that only shows that a certain set of assumptions imply a certain outcome. He disagrees with artificial life practitioners such as Langton and Ray who would 'have their cake and eat it too' by considering artificial life as creating empirical data and evidence, without considerations of its relationship to terrestrial biology.

Artificial Life and Life Itself

This thesis focuses on the metaphors and assumptions artificial life makes, in order to make sense of and validate itself as worthy of study. It traces how these are connected to similar stories within the life sciences and how these are being translated into specific narratives and discourses about what it means to be alive, our natures and cosmologies. Specifically this chapter examines the reterritorialising movement these metaphors and assumptions are having within the life, biological and computer sciences, as seen in Langton's infamous summation that artificial life models 'life-as-we-know-it' and creates 'life-as-it-could-be' (1996: 8). Langton envisages artificial life to model and show insight into the inner workings of carbon-based life forms, and to also take life itself to new previously unavailable and unimaginable possibilities in the synthesis of completely new living beings. For Kember, it is this type of modelling that artificial life performs that "revisits and awakens the question of life left hanging within both philosophy and biology" (2003: 63). Langton, in his overview, displays the

movement of artificial life as simulation to synthesis that suggests new responses
to such a question of life. He takes artificial life from being a model of life to
constituting life:

> The 'artificial' in Artificial Life refers to the component parts, not the
> emergent processes. If the component parts are implemented correctly, the
> processes they support are genuine – every bit as genuine as the natural
> processes they imitate. The big claim is that a properly organized set of
> artificial primitives carrying out the same functional roles as biomolecules
> in natural living systems will support a process that will be 'alive' in the
> same way that natural organisms are alive. Artificial Life will therefore be
> genuine life – it will simply be made of different stuff than the life that has
> evolved here on Earth. (1996: 68-69)

As with the other bolder claims from within the strong artificial life component of
the field, the artificial of artificial life is reducible to merely 'man-made' or *in
silico*, rather than as a referent to artificial life being an imitation, simulation or
mere model of life. The definition of life itself finds an ontological shift with such a
redefinition of artificial, to find itself structured within the parameters of form,
rather than of substance (Kember 2003: 3). Here life can be made of 'different
stuff,' the contitutuing referent for the different forms of life is 'emergent
processes.' This desire to take life outside of its carbon confines supports and is
necessitated by a definition of life itself, unattached and denying of any material
basis for life.

Moving from the simulational modelling of life to the synthesis of life is a critical
movement as it at once both deterritorialises and reterritorialises what is meant
to be alive, while producing new definitions of life itself and restructuring the
gamut of things that are allowed to constitute life. It is an ontological movement
from a previous mechanical metaphoric essentialisation of the body and life itself
to an informational or computational one. This move is both expansive and
reductive. It expands what can be considered as alive as it reduces (and modifies)
the criteria needed to qualify as life. This double movement allies itself with a
similar transformation that has occurred within the main body of the life sciences
and reflects the timeframe of historical developments within artificial life.

Reading Life Itself

As introduced in chapter one, during the post-World War II period molecular
biology underwent a discursive and ontological shift, moving to represent itself as

a communication science aligned to cybernetics, information theory and computer science. Lilly Kay (1997) has mapped a genealogy of this shift and the metaphors it has created, tracing to the 1950s. Then, molecular biology embraced the view that organisms and molecules could be considered information storage and retrieval systems, and heredity became a system of communication, guidance and control. Kay notes how the ideas and terminology of information theory became pervasive in the 1950s and 1960s, and cites the examples of Robert Sinsheimer's 'Book of Life' (which considered the genome as being able to be read and the information in the chromosome as the written word) and François Jacob's description of heredity in terms of information, messages and code as typical of this new discourse. The history of informatics within biology can also be traced back through Erwin Schrödinger and his 1943 lecture series at Trinity College, Dublin and accompanying book *What is Life?* (Murphy & O'Neill 1995). Schrödinger proposed two elements vital to the subjects of heredity and thermodynamics in the study of life. He viewed heredity as the passing of information or *order from order* between generations. The maintenance of a metabolism was the ability of organisms to create their highly improbable ordered structure against the second law of thermodynamics. This was thought of as *order from disorder*. Schrödinger viewed by *order from order* and *order from disorder* with equal weight, with subsequent work within molecular biology on the discovery and structure of DNA supporting Schrödinger's views on *order from order*. It is this aspect of his work that has dominated the life sciences over the last half a century.

Informational representations of heredity had preceded study of the DNA structure and were not solely the outcome of DNA genetics or the discovery of the architecture of the double helix in 1953. Instead, lines of communication between molecular biology and the then new technosciences of cybernetics, information theory and the nascent computer sciences had been open since at least 1950. These new sciences shared a common alignment with the study of information. For Kay, the move to an informational metaphor within the life sciences is actually a double metaphor as information theory also works on a metaphorical level:

> With few exceptions, the information concept has been developed loosely in biology, in its nontechnical sense, and thus as a double metaphor... [I]t was only in the decade following World War II that information became for the first time a physical parameter and a mathematically defined concept amenable to study... But contrary to its earlier use, information in the mathematical theory of communication implied that information did not inform, that it had to be thought of in a manner entirely divorced from

content, subject matter, and meaning: it had no semantic value... Indeed, the transportation of the information-theoretical idioms into heredity presents an enormous cognitive complication for it then functions as a metaphor of a metaphor, thus leading to a deconstruction. (1997: 27-29)

It is this double metaphor – considering information as content and treating heredity and DNA as information – on which contemporary molecular biology is based and in which artificial life is firmly entrenched. Kay finds that the informational tropes and scriptural representations present in molecular biology since the 1950s have provided powerful models and analogies in the interpretation of data and in experimental design. She suggests that the double metaphor of information has "linked the biosemiotics of molecular biology to communication technosciences, and through cultural semiotics it [has] constituted the imaginaries of postwar technoculture, of the Missile Age and the Computer Age" (Kay 1997: 30-31). It is within this framework that artificial life has flourished and is able to fortify itself as a part of the life (techno)sciences (Kember 2003: 34). As this thesis will return to, the movement of this double metaphor has been developed through cybernetics into new computational models of the universe itself, conceptualised as computational regimes. Here, the universe is understood to operate as one (extremely) large computer program, offering a deterministic model of life and the cosmos, and, as we shall see, mirrors Steve Grand's theorising behind the artificial life programming constituting *Creatures* and his other Artificial life research (Grand 2000, Kember 2003).

Defining (Artificial) Life Itself

As with the life sciences more generally, artificial life can be mapped in numerous directions. While self-organisation forms a key concept to all, there are three broad definitions of life that can be traced, and find resonance within artificial life: evolutionary, autopoietic and cybernetic. All three form varying relationships with information, self-organisation, embodiment, and evolution. From the evolutionary perspective, it is reduced to information processing systems that follow a (neo-) Darwinian evolution pattern of 'natural' selection. Here, the body is put to one side, allowing dynamic information processing to form the primary area of study. Focus within the evolutionary definition is placed on the code or program of life; bodies form a necessary but unimportant part of life's equation. Against this, from the autopoietic standpoint following Manturana and Varela, life is seen as a self-sustaining system, and as such must be definable from its surrounding

environment (Boden 2000). A key focus of this standpoint is the differentiation of an organism from its environment and is therefore a concern with embodiment. The third definition of life is the cybernetic, from which life is a collection of negative feedback loops coordinated towards the realisation of a larger positive feedback loop (that of reproduction). On its surface, a cybernetic definition of life appears as a development of evolutionary and autopoietic definitions, as both evolution and metabolism are implicated within its framework. A close examination, however, shows the cybernetic definition to be an original position of its own and non-reducible to either evolution or autopoiesis. It is within such a cybernetic definition that Grand places his artificial life creations as found in *Creatures*.

Prior to an individual examination, there are a number of statements that form a standard set of assumptions common across all definitions. Although firmly within the evolutionary perspective, Christopher Langton (1996) presents a broad overview of the artificial life field. For Langton, artificial life is key in the ability of biology to provide generalised principles of life. Traditional biology, the study of life on earth, is limited in its reliance on carbon-based chemistry. Langton questions the top-down mechanistic approach of biology, against this he suggests artificial life, as a dynamic and synthetic approach, illuminates the principle of dynamic self-organisation on which life depends. Artificial life's foundational assumption is its openness to the possibility of the study of life in other-than carbon instantiations. Langton proposes three assumptions for the study of life that allow for different chemistries, and therefore artificial life (as digital informational silicon-based chemistry). These three principles figure the ontology and essence of life itself as form, positing the abstract nature of information and the reducibility of life systems to information processing.

The first is that the goal of synthesis takes a broad scope and includes any biological phenomena; from viral self-assembly to the evolution of an entire biosphere; the second is that there is no reason for attempts of artificial life to be limited to carbon chain chemistry. The third is that the synthetic approach leads beyond known biological phenomena to display life-as-it-could-be. Artificial life can and should move from modelling carbon-based life forms to developing and evolving new life forms with no direct correlation in carbon chemistry. For Langton, the practice of artificial life is attempting to synthesise evolution in computers, irrespective of the results mirroring analogues in the 'natural' world. Underlying these three principles is an informational formulation of life itself and

an assumed transcendental and fractal view of information; information is not bound to, and is separate from, the size and form in which it takes. Life patterns, as information, find commonality regardless of size or material construct. This awards Langton the ability to postulate that life processes are mirrored in different sizes and scope, and they need not be limited to carbon chemistry. Life can be translated into chemical/digital substrates other than its historic carbon based biochemistry as found on Earth. For Langton, artificial life is a new computational paradigm based on the natural processes of transcription/translation and replication of DNA that support living organisms (1996). Life itself is information:

> Computers should be thought of as an important laboratory tool for the study of life,... one simple-to-master piece of experimental equipment devoted exclusively to the incubation of information structures. (Langton 1996: 50)

In this way, computers support 'informational universes', within which dynamic populations of 'informational 'molecules' engage in 'informational 'biochemistry.' What is considered the logical *form* of organisms is abstracted from its biochemical wetware, becoming the foundation of life itself: "Life is a property of *form*, not *matter*, a result of the organisation of matter rather than something that inheres in the matter itself" (Langton 1996: 53). This is arguably the dominant paradigm within artificial life as a technoscientific program, along with the claim that life is a type of self-organising phenomena.

Claus Emmeche, in structuring a move from information to artificial life, has postulated the following seven central points: (1) artificial life deals with life as it could be and so is *the biology of the possible*; (2) artificial life follows *the synthetic model* as it attempts to synthesise life-resembling processes or behaviour exhibited by real life organisms; (3) the behaviour and generalised processes are just as genuine in artificial life instances as the behaviour exhibited by real life organism, so it exhibits *real (artificial) life*; (4) As the matter of which it is constructed determines neither actual nor possible life, *all life is form*; (5) many units and simple rules at the bottom form *bottom up construction* which gives rise to coherent 'global' behaviour at the general level; (6) artificial life uses *parallel processing* as many processing units working along side each other; (7) artificial life gives *allowance for emergence*, the whole that is created when many semisimple units interact with each other in a complex (nonlinear) fashion (Emmeche 1994: 17-20). As with Langton, Emmeche provides a window into the underlying assumptions and metaphors within artificial life. Although his

description exemplifies how a range of metaphors borrowed from the technology of the time are often employed to describe the nature of organisms, Emmeche posits that the relationship of living systems, theoretical biology and artificial life is one of analogy, rather than simulation or metaphor. This important movement gives force for viewing artificial life as actual life in an artificial construct. Artificial and carbon life under such a vantage are interchangeable. The informational forms are the identical; it is only the building blocks that differ (and are often ignored or reformulated as different forms of information themselves). This is made allowable by postulating the same assumptions underlie both silicon and carbon life (based in the deep assumption of a common essence to all life), and through forgetting and mistaking the metaphors that make such conceptualisations possible.

Artificial life phenomena appear to have been given the status of life through association. Computer programmers, (heralding from computer science, the life sciences, or elsewhere) borrowing metaphors and terminology from molecular biology and genetics, have attempted and succeeded in producing programs that generate life-like behaviours in a computer environment. Following from this, the emerging posthuman sensibilities found within computational regimes turn this association on its head to define carbon life through our resemblance to our new digital silicon kin. The digital universes and other ecosystems and emplacements hosting silicon life become heterotopias for this new essentialisation of life itself. They become idealised emplacements where definitions of life and life systems operate perfectly.

The next section explores three definitions of life itself and how these are being made use of within artificial life. Each of the evolutionary, autopoeitic and cybernetic definitions of life produce specific statements regarding life and how it relates to the non-living world. In aligning with definitions that structure life around allegiances with code, information, emergence and evolution, artificial life not only validates itself as a scientific discipline, it also reinforces and becomes exemplars of these definitions in action.

Evolutionary Definition of Life

The evolutionary definition of life is structured within abstract informational theory (or informatics) and is arguably the most common working definition within strong artificial life, especially from the 'American perspective.' Also

termed the genetic defintion of life, the evolutionary view can be given this broad definition:

> The *genetic definition*, which is also an evolutionary one, views life at the level of the population: life exists when a system consists of certain units (organisms) that can reproduce and transmit their genes (the genetic instructions about the creation of the unit, the phenotype) to a successive generation. The system must also be capable of mutation, so that new information can arise and certain instructions can be altered. (Emmeche 1994: 35)

The evolutionary definition is strongly linked to biologists who in varying degrees rally to the standpoint of neo-Darwinism. Richard Dawkins is a major proponent of this standpoint, made (in)famous by his 1976 seminal work *The Selfish Gene*. For Dawkins and others who prescribe to this, Darwinian evolution should be analysed correctly at the level of the DNA structures of living systems. It is the code of DNA that evolves over successive generations the bodies that the DNA inhabits are necessary but additional parts of the equation. In this genetic fetishism, describing the 'survival machine' (the fleshy part of us – our bodies – that protects the genes inside), Dawkins prefers "to think of the body as a colony of genes, and of the cell as a convenient working unit for the chemical industries of the gene" (1989: 46). Dawkins reduces bodies to carriers and industrial sites of the maintenance and reproduction of genes. It is the (DNA) code (or more specifically the genes – the bits of DNA that code for genotypic attributes) that is the qualifier of carbon life, as it is the (computer) code that qualifies strong artificial life as silicon life. We see the parallel rhetoric of both strands of strong artificial life and neo-Darwinian theory. Strong artificial life not only seems to support the neo-Darwinian perspective, but also proves it in an act of suppletion and s(ed)uction. Artificial life has become the litmus test of neo-Darwinian life.

"In the beginning there was information" (Emmeche 1994: 14). For artificial life phenomena to be counted as instances of life, there needs to be the acceptance that life is fundamentally information processing and that information is an abstract concept, independent of material structure. From the evolutionary standpoint, life is a logical set of informational systems transcending physical embodiment. It is the information contained within the organism's carbon DNA or silicon algorithms that life itself is reduced to. These attributes allow many strong artificial life practitioners to claim that artificial life produces actual instances of life. Coupled with Emmeche's seven central points to the vision of strong artificial life, the evolutionary definition highlights its (ultimately) reductionist program.

From this standpoint, those who stress that reproduction and evolution are the strong measures in the qualification of life find that denying certain artificial life phenomena the status of life because of their silicon base is unsustainable. This follows from the ontological premise that life itself is defined by its abstract formation rather than material structure, and that the basic foundation of life is informational systems. It is this informational ontological structure that has found resonance within the contemporary life sciences.

Autopoietic Definition of Life

Similar to Schrödinger's second focus on thermodynamics and the concept of *order from disorder*, autopoiesis focuses on the self-organisation of the organism (*order*), and its ability to define itself from the surrounding environment (*disorder*). In her overview of the life sciences field, Boden (2000) finds no universally agreed definition of life, but does find typical features, including self-organisation, emergence, autonomy, growth, development, reproduction, adaptation, responsiveness, evolution and metabolism, with a general agreement of the core role of self-organisation, "the emergence (and maintenance) of order, out of an origin that is ordered to a lesser degree, by means of fundamental, and autonomous, structural development" (2000: 117). Self-organisation is a key construct, necessarily involving some of the other defining items from her list (emergence, autonomy, development) and finding the remainder as special cases of it (growth, reproduction, adaptation, responsiveness, evolution, metabolism). Boden looks to Humbert Maturana and Francisco Varela, who consider that life is a specific type of self-organisation termed *autopoiesis in the physical sense*, which defines an essential role for metabolism.

Autopoiesis is a neologism introduced by Maturana and Varela in 1971 to designate the organisation of a minimal living system, and became emblematic of a view of the relation between an organism and its medium (Varela 1994). Derived from the Greek for 'self producing,' the ability for an organism to define itself against its environment and create an 'identity' is key within the autopoietic framework:

> An autopoietic system – the minimal living organization – is one that continuously produces the components that specify it, while at the same time realizing it (the system) as a concrete unity in space and time, which makes the network of production of components possible. More precisely defined: An autopoietic system is organized (defined as unity) as a network

of processes of production (synthesis and destruction) of components such that these components:

    i.   continuously regenerate and realize the network that produces them, and

    ii. constitute the system as a distinguishable unity in the domain in which they exist.

Thus autopoiesis attempts to capture the mechanism or process that generates *identity* of the living, and thus to serve as a categorical distinction of living from non-living. (Varela 1994: 5)

In autopoiesis, identity amounts to a self-produced coherence; an autopoeitic mechanism will maintain itself as a distinct unity as long as its basic structure of processes is kept intact in the face of perturbations. As with the evolutionary neo-Darwinian definition of life, life is considered to be processual and is not bound to the particular material substances we are currently familiar with on Earth. In other words, life does not necessarily need to be made of a carbon-based chemistry; the process of life could theoretically occur in other mediums. Autopoiesis differs from the evolutionary definition, however, as even while it is not dependent on a particular materiality, autopoiesis concerns itself with bodies. Unlike evolutionary definitions, where the body is negated to an abstracted definition of information, autopoiesis situates itself within a material structure, as it is an entity's ability to define itself from its environment that constitutes its life status. Varela finds that an actively constructed identity is essential – what is meaningful for an organism is precisely given by its constitution as a distributed process (1994). From the viewpoint of the organism, it is this constructed identity that defines the entity against its exterior world. Varela finds that this gives "rise to the handling of its environment without the need to resort to a central agent that turns the handle from outside – like an *élan vital* – or a pre-existing order at a particular localization – like a genetic program waiting to be expressed" (1994: 8). The autopoietic definition is positioned against that of evolutionary definitions and standpoints, where life is reduced to the expression of such a genetic program.

Autopoiesis denies as philosophically fundamental or empirically universal, the roles of reproduction and evolution within life, foundational features of the evolutionary neo-Darwinian definition. Evolutionary defined artificial life gives little emphasis on metabolism, if not ignored entirely. Yet metabolism helps explain one of the fundamental questions in biology: how living bodies organise and maintain themselves as integral physical systems. Boden (2000) finds that there are three senses of the term metabolism, of which the strongest third sense is

found in biology, but not in artificial life. Metabolism, in this third sense, is the use of energy budgeting for autonomous bodily construction and self-maintenance. Maturana and Varela define metabolic self-organisation (as a type of autopoiesis) as the essence of life, as it is logically and biologically prior to the properties in the 'typical' criteria for life.

Within Maturana and Varela's autopoietic theory is an emphasis on the self-production of the organism's boundary as a unitary system. As autopoiesis (in terms of life) occurs in material space, life requires both embodiment and the self-creation of a unitary physical system through the spontaneous formation of a physical boundary. The basic phenomena considered here is the formation of a cell membrane that both bounds and constitutes the cell as an autonomous vital entity, distinguishable from its environment (Varela). For virtual creatures, its boundary is neither created nor maintained by itself, but by computer engineers. Boden finds that the term 'boundary' is even inappropriate given the nature of "the host of electronic processes scattered across an ever-changing set of memory locations" (2000: 128) that constitute such creatures. The coding that makes up a digital creature, therefore, may be, at any given time, separated in a number of different locations in a computer's memory; there is no necessity for a digital creature to be a unitary bounded memory block, separated apart from other memory. Therefore, the requirement of a boundary in a strict autopoietic framework rules out strong artificial life; artificial life 'creatures' do not have defined bodies. Additionally, as reproduction within this viewpoint is not core to the definition of life and is a secondary (and not necessary) property of autopoiesis, evolution – as it requires both reproduction and inheritance – is also secondary and not a key feature of autopoiesis. Maturana and Varela do not deny the universality of reproduction and evolution in practice, but deny its philosophical necessity.

Cybernetic Definition of Life

The study of cybernetics developed during the post-war period as a collaboration between mathematician Norman Wiener and physiologist Arturo Rosenblueth, emerging from a wartime project on fire-control apparatus for anti-aircraft artillery (Wiener 1948: 14). Its initial focus was on communication and control through systems of feedback, and was originally seen as a novel view of human mechanics that aligned the biological body closely with informational computing machines. Hayles finds that after the Macy conferences from 1946-53, the study of

cybernetics moved in two different directions (1996a: 16). The first of these, centred on reflexivity, found focus in enforcing cybernetic systems' rules back onto themselves in order to produce and engage in ever increasing complex behaviour. This viewpoint privileged "change over consistency, evolution over equilibrium, complexity over predictability" (Hayles 1996a: 16). Within more recent cybernetic research she also finds that reflexivity has been developed further by the concept of emergence, proposing that cybernetic systems can create a self-organised "world unto itself, independent of the larger reality in which it is embedded" (1996a: 17). It is from such grounding that a cybernetic definition of life is construed. Biologist Bernard Koreniewski has presented a formulation of the cybernetic definition of life that, as with the previous definitions, has the aim "to formulate possibly a minimal definition of life (a living individual), which would apply not only to the life presently existing on our planet, but also to the first living organisms of the Earth, as well as to life-like phenomena existing presumably on other planets in the universe" (2001: 275). It is a definition of life of the possible, not (just) the actual.

Koreniewski begins with three underlying assumptions or properties of living systems; life is composed of individuals who reproduce and evolve generation to generation. Reminiscent of the evolutionary definition as it examines life at the group level – negating the individual body – the cybernetic view incorporates the body and bases its viewpoint on the individual, as "a living individual is defined within the cybernetic paradigm, as a system of inferior negative feedbacks subordinated to... a superior positive feedback" (Koreniewski 2001: 277). The superior positive feedback loop is specifically the act of reproduction. Koreniewski offers a functional definition of life in the cybernetic, where the purpose of an individual is set out in its replication or reproduction:

> The full set of negative feedbacks (regulatory mechanisms), working on different hierarchical levels and representing the cybernetic aspect of the function of a living individual, has the "purpose" of sustaining the identity of the individual. In turn, the only "purpose" of this identity is to reproduce itself in as many copies as possible. Furthermore, from the cybernetic point of view, the identity of a given individual is nothing but such-and-not-another unique complex of negative feedbacks. (2001:278)

Unlike the autopoeitic view, where an individual is defined through its maintenance of a boundary with its environment through the self-organisation of metabolism, within the cybernetic definition, the individual is defined as a full set of feedback systems within itself and between itself and its environment that can

achieve the positive feedback of replication. As the cybernetic definition does not define the individual apart from its environment, cybernetic feedback loops can be internal and/or external to the organism, incorporating the individual and its surrounding environment. This definition means that Koreniewski does not necessarily view an individual entity as the basic unit of life; it is a single system, which means that in some cases (such as an ant colony) Koreniewksi finds cybernetic life occurring at different levels.

Artificial Life and Cyberbiology

The cybernetic definition of life returns us to the exploration of the artificial life programming and philosophy of Steve Grand, British artificial life researcher and the programmer behind *Creatures*. Sarah Kember has engaged with Grand in a dialogue between scientific practice and cyber-feminism, creating a conversation that involves critical engagement with the goal of shared understanding and communication (Kember 2003). At first, Grand's position reminds of the autopoietic defnition in locating how his vision of artificial life operates; the artificial life programming is 'inspired by animal biology' where:

> Each creature has a neural network responsible for sensory-motor coordination and behavior selection, and a "artificial biochemistry" that models a simple energy metabolism along with a "hormonal" system that interacts with the neural network to model diffuse modulation of neuronal activity and staged ontogenetic development. (Grand, Cliff, & Malhotra, 1996: 1)

Unlike models such as *Tierra* following a strictly evolutionary definition, this incorporates a model of metabolism within its programming. Metabolism is a key feature within the autopoietic definition of life and Grand's artificial life research has been associated with an autopoietic framework (Kember 2003: 198-200). Grand himself credits the membrane as the "cell's most significant feature (perhaps even its defining characteristic)" (1998a: 5), echoing the self-definition focus of autopoiesis. Although Grand's artificial life creations can simulate metabolism, he also recognises the importance of the environment in the production of intelligence:

> Intelligence cannot be abstracted – we have to build a whole organism. Neither can intelligence exist in a vacuum – it has to be embedded in a self-consistent environment. Life is the sum total of all the feedback within the organism, and between the organism and its environment. (2000, 146)

For Grand, intelligence is a strong measure of life; the ability of an entity to react and adapt meaningfully in its environment. He believes, however, that there is no essential differentiation between the organism and its environment; the essential boundary making within autopoiesis is noticeably absent and even denied in Grand's work:

> The division between organism and environment is not a real boundary, but a convenience dreamt up by our own brains – the universe is really just a single jumble of interactions. (2000: 146)

It is the self-production (and maintenance) of a boundary that Varela and Manturana view as one of the central definitive aspect of autopoiesis, and leads them to infer a cognition on all living things in the formation and maintenance of identity. Grand finds that intelligence arises from emergent processes that are not necessitated by a boundary forming essentialism. He does not base the cognition of an entity in its division between itself and its world, but sees the living and non-living joined in a continual process of flows and interactions in an overall continuous environment or living unitary beings. For Haraway, this has the result that "Organisms become components of a particular type (biotic components), often highly interesting, but not ontologically special, in cybernetic systems sciences" (1981-82: 252). There becomes no differentiator between the living and non-living; both are examples (although at varying degrees of complexity) of informational systems of communication and control. Although Grand places great importance on the role of metabolism within his artificial life creations and his definition of their alive-ness, distancing him from an evolutionary standpoint where bodies and bodily processes are forgotten, neither does he fully align with autopoiesis. It is this denial of differentiation between the interactions that form living processes and other interactions (chemical, and so on) that Grand relies upon to be able to claim that artificial life programming creates actual instances of life. Life is not found in the formation of, and separation from, the environment of an entity for Grand, but in the emergence of intelligent behaviour:

> A computer cannot be intelligent or alive. Nor can a computer program. But a computer can be used to create a cyberspace. Inside that cyberspace we can construct first-order objects and use algorithms to emulate their behaviour. These objects are not alive or intelligent either, but they can be pieced together to build a second-order assemblage that is. Our task is not to program in intelligent behaviour, but to enable such behaviour to emerge from simulated objects that embody the cybernetic properties from which life emerged in the natural world. (2000: 147)

Grand's cybernetic view finds life in its formation. It also maintains a broad evolutionary focus; it follows the view that it is the propagation of informational systems that provide this form and constitutes artificial life entities as actual life:

> To complete the picture, we must ensure that the recipe for this emergent phenomenon is not hard-wired but is able to be passed on from generation to generation and modify itself in order to persist on longer timescales, as the environment changes. Our creature will be fully alive and intelligent only if its future lies in its own hands, and to give it this autonomy we must relinquish direct control of its design. In short, the plans for how to assemble our creature should be coded in its genes. (2000:147)

Here, we realise Grand's second key feature of life: it can reproduce. Aligning to Koreniewski's cybernetic definition of life, the essential features of life for Grand are: one, that the system reacts and adapts to and within its environment (shows intelligent behaviour) through a system of interaction between first and second-order feedback mechanisms; and two, that it reproduces. Grand has termed this approach 'cyberbiology' to move it away from evolutionary forms of artificial life (Grand 1998c: 72). Cyberbiology expands upon, and is not reducible to, an evolutionary view; as in evolutionary artificial life single entities do not react or adapt to the environment, only the 'species' does through evolving through generations. For Grand, this is key to be able to claim that the creatures he designs under such a model constitute life (at the second-order). His initial premise that both living and non-living entities are a flow of matter, and that the matter in a living entity is constantly changing, brings him to the conclusion that one cannot differentiate between the material mass that is termed living and that which is not. The matter in a living being was once not living and will at some point be discarded as waste and will be not living again. It is this continual transfer of matter between living and non-living that causes Grand to question the need to fundamentally distinguish between living and non-living systems. He considers both 'a jumble of interactions', even denying the existence of matter at all (Kember 2003: 112). His focus on cybernetic systems of informational processing, within this jumble, weights his framework firmly within abstract formation. This is non-reducible to the autopoietic viewpoint, which while not specific to any given materiality and also considerate of form, retains a materialistic viewpoint. In autopoiesis it is the manner in which matter forms itself (and separates itself) which forms the definition of life.

Grand's cyberbiology offers a cybernetic model and framework for defining life. For Grand "real, living systems are heterogeneous complexes of feedback loops made from nerves, chemical reactions, and genes" (1997a: 24). Cybernetic intelligence is formed at the second-order of emergence, where systems of feedback are able to react and adapt to the environment. The creatures that Grand designs qualify as life in cyberbiology, as they are informational systems of cybernetic feedback and control, that show emergent second-order behaviour that adapt and reproduce. Additionally, as with the computational universe that Hayles (1999) outlines, these digital life forms are reflected back onto their carbon cousins in the posthuman:

> When we look at future artificial life forms, we shall be holding up a mirror
> to ourselves. If these creatures consistently behave like us and appear to
> feel things the way we do, then presumably they *are* like us, in essence at
> least. (Grand 2000: 205-206)

From this, Grand offers a model of a computational regime, comparable to Hayles' computational universe. For Hayles (1999), artificial life is making a decisive move towards the posthuman by considering the relationship artificial life builds between humans and our silicon cousins, and the effect artificial life has on the definition of biological life. In the future Hayles envisages, distinguishing between natural and artificial life, between human and machine intelligence, will be difficult or impossible. In artificial life "the machine becomes the model for understanding the human. Thus the human is transfigured into the posthuman" (Hayles 1999: 239). This refashioning of the human to the posthuman amounts to a new worldview, one which Hayles terms a 'computational universe', where the essential function for intelligent machines, humans and the universe itself is processing information. Within such a computational regime the universe is a vast computer and we are the programs that it runs. In the computational universe the question is how higher-level computations can emerge spontaneously from the underlying structure of cellular automata. This correspondence, between the conditions under which life or computation are likely to emerge, is seen as a sign that computation and life are connected at a deep level. Within computational regimes everything is reducible, at some level, to information. If the name of the game is processing information, then Hayles considers that it is only a matter of time before intelligent machines replace us as our evolutionary heirs and the

problem of embodiment becomes trivial, an act of s(ed)uction of the digital over the material. She finds the problem of suppletion "when this mode of operation [simulation] is taken to be fully representative of a much more complex reality and when everything that is not in the simulation is declared to be trivial, unimportant, or not interesting" (1999: 245).

Grand offers a deterministic model that proposes, as a computational regime, a universe as a system of first-order structures producing second-order emergent behaviour. It is deterministic because, as with programs such as *Tierra*, once the parameters of the first-order structures are set and run (which Grand finds analogous to the start of the universe – the Big Bang as it were), the outcome of the program is already determined. The feedback loops follow the course set by the initial settings and rules of the program/universe. Grand proposes a 'responsible determinism' because, whilst in his model we all follow an emergent deterministic program making all of our actions inevitable, to recognise our lives as such would have drastic consequences. We must act as if our present were not inevitable; it is not forseeable due to the impossibility of knowing and computing all first-order structures of the universe. Even though Grand's universe is deterministic and inevitable, we cannot know how it is so.

Grand's responsible determinism is made possible through the fundamental likeness he extrapolates, from the digital cyberspaces created in the computer to the physical material world (the universe). For Grand the twin nature of physical and cyber- spaces underlies his theorising:

> One of the key assertions I'm making… is that everything is made from the same (non) stuff. At no point is there a clear break between hardware and software, between matter and form. Such a break is largely an illusion caused by the metalevel at which our own sensory organs exist. (1997b: 16)

It is because Grand is able to transpose the operations of the cyberspace artificial life instantiations that he (and others) design to the workings of 'hardware' (physical space) that the same logical determinism by which the computer operates is transferred to the physical world and to 'life as we know it.' "[A] metaphenomenon built from such simulated building blocks is fundamentally indistinguishable from the same metaphenomenon built from so-called 'real' building blocks – they occupy different universes, but are equivalent" (Grand 1997b: 17). The closed system of the computer (closed as it has finite memory

and CPU power) equates to the universe, which is also considered a closed system (of finite space and energy).

Edward Fredkin's Finite Nature

The idea of the universe as a computational regime is neither original nor confined within the study of artificial life. Digital physicist Edward Fredkin has, for some time, argued for a new vision for physics: one that views the universe as a cellular automata universal computing machine. His concepts of Finite Nature and Digital Mechanics, whilst yet to find mainstream appeal beyond the fringes of physics, have nonetheless opened physics to new conceptual directions and Fredkin himself has been referred to as 'Einstein-like' by notable researchers such as Marvin Minsky (Wright 1988: 5). His theory of Finite Nature meets the computational universe and the responsible deterministic model head on, finding the same model of computational regimes within the material molecular universe. His basic premise is to view the workings of the universe as a computer, "Finite Nature means that what underlies physics is essentially a computer... a cellular automata" (Fredkin 1992b: 7). This starts with a common assumption of the discreteness of both time and space. For Fredkin:

> Finite Nature is the assumption that, at some scale, space and time are
> discrete and that the number of possible states of every finite volume of
> space-time is finite. In other words Finite Nature assumes that there is no
> thing that is smooth or continuous and there are no infinitesimals. (Fredkin
> 1992a: 1)

Finite Nature, as with artificial life, has at its roots in automata theory; space is discretely divisible into cells that must be in one of a number of states. These cells change states through space-time (time, as we have come to understand in cellular automata theory is also discrete) through simple rules, or what Fredkin has termed 'the Rule' (Chandler 2003: 32) – the simple universal rule of the universe and the ultimate goal of his research. The Rule is applied at the grid's cell level, which Fredkin, as with our other computational models, stresses the importance of information as key. He proposes a new informational model for physics, one in which physics is described though the cellular automata – the universal computing machine found in Finite Nature. This informational model he terms Digital Mechanics (Fredkin 1992a: 3), and, as an example of cellular automata, has the same underlying base on which artificial life programming is made. Also, with our other digital models, Finite Nature has the same conclusions when taken through to its logical end. The most noticeable of these is its

deterministic nature, where the universe operates as a logical computer program when following the Rule. This recalls Noble's reminder of the analytical base of artificial life; artificial life programs, and cellular automata, and (now) the universe itself happen as they do because of how they have been programmed – their programming and initial state has pre-determined all futures states. All that remains is for the program to be run to realise its potential. Just as in Grand's responsible deterministic model, we cannot know how it is deterministic; "The deterministic nature of finite digital processes is different in that it is unknowable determinism" (Fredkin 1992). As we are situated within the program itself, there is no way for us to be able to view the universe's grid state in its entirety. We cannot see outside of the grid we are within.

Formulated within the physical sciences, Fredkin's Finite Nature model ultimately encompasses life within its theory as a computational regime. With Fredkin's overriding belief in the fundamental basis of all things in cellular automata, life is viewed in terms of informational computing machines, "life itself is a kind of computer. DNA works very much like a cellular automaton, and pretty much everything between DNA and the computer also runs on information" (Wright 1988: 79). As with Grand's cybernetic emergent second-order intelligence from first-order simple structures, Fredkin builds informational systems as cybernetic systems of feedback built upon one another:

> Now, the nervous system of an animal is another information-processing thing, just the nervous system that sends messages back and forth for simple kinds of sensations and so on. That's the second level. And then the intellectual level is yet another level. (Fredkin qtd. in Wright 1988: 79)

As with his universe-as-computer, Fredkin's model of life finds a compatriot in the responsible deterministic model as computational regimes. These are steeped in an underlying structure of informational processing, to a set of simple rules within the grid of cellular automata, and leading to emergent cybernetic processes of feedback and control. The universe is considered a closed system, pre-determined by its programmed rules (or for Fredkin – 'the Rule') and its initial state from which history unfolds, in sequential space-time steps. As a closed system, it is discrete; both space and time are packaged into set minimal units upon which all interaction is based. These informational interactions build upon each other in increasing complexity to produce, at higher levels, intelligence and reality as we know it. As discrete informational processing systems, all three models are digital, cybernetic and closed.

Making Statements About Life Itself

Within an informational formulation, and a cosmology of a universal computational regime, the conceptualisation of life itself makes specific statements about the ontological foundations of the real – what life itself is and how our natures operate. At the heart of computational regimes is the discrete packaging of both time and space, the reduction of all things to information: an inherent connectivity between all units within the system and the adherence to simple rules creating emergent complexity, all occurring within a closed and neatly defined system. Life itself involves the progressive movement to increased complexity by self-organising units within this system; either reduced to evolution on its own or by a combination of evolution and the workings of cybernetic feedback loops. Such conceptualisations and statements are neither innocent nor without politics. We are reminded that:

> The only propositions that can be verified – that is, proved true – are those
> concerning "closed" systems, based on pure mathematics and logic.
> Natural systems are open; our knowledge of them is always partial,
> approximate, at best. (Horgan, 1995)

Against this, emerging statements regarding computational regimes propose exactly the opposite. They suggest that natural systems are similarly closed as our digital universes, and the reason that our knowledge of our nature is incomplete is not due to its open character, but because of our inability to see all, due to our own implication within the universe's structure. The ability to make such statements about the world, life and the universe are realised through the equivalent foundational structure that the material molecular universe is perceived as having with the electronic digital universes we are creating in our computers. Fundamentally, both space and time within digital and material space are compartmentalised, as separate but discrete units. Within cyberspace, both space and time are both formulised as discrete and divisible units: space through pixelisation and time through CPU ticking. This recalls the structure of Conway's *Game of Life*, with its grid mapping and CPU tick timing. It is this basic framework on which all artificial life programming is based, regardless of its complexity. It is the application of rules upon first-order structures (discrete units) in each time slot (discrete tick) on which artificial life instantiations are based and run upon the application of rules on first order structures (discrete units) in each time slot

(discrete tick). It is the transference of this same space-time conceptualisation to the physical universe that Hayles' computational universe and Grand's responsible deterministic model make, in order to subscribe to the idea that our cyberspace artificial life instantiations reflect the very manner of our existence. It is this same transference that allows Fredkin's Finite Nature to make the identical claims that the physical universe is essentially a large computer program. In this mutuality of universal construction, where the physical universe is made up of discrete physical units and divided into discrete time slots, the universe mirrors the similar constitution of cyberspace. Without this fundamental underlying assumption of basic discrete units, neither computation nor determinism would operate or make sense.

Contradicting the abstraction of information that occurs within computational regimes, Hayles reminds us that for information must always be instantiated in a medium to exist. She highlights that not only is abstracting information from a material base an imaginary act, but more fundamentally that "conceiving of information as a thing separate from the medium that instantiates it is a prior imaginary act that constructs a holistic phenomena as a matter/ information duality" (1999: 75). Specifically, it is the abstraction of time and space into discrete units, independent of their material or digital substrate, which unifies computational regimes and allows the further abstraction of life itself as propagating informational and coded units. The division of space and time into discrete units is not originatory within computational regimes. We are reminded of Macgregor Wise's (1997) mapping of space, time and technology through the epistemes of the modern, amodern, and Deluezian. He describes the modern standpoint on space-time in such a discrete manner, finding that in the modern, technology transforms durée ('natural' human time) into abstract time. We see the disenchantment of time: the progression from durée to technology to abstract time. Technology is a result of the desire to master time, bringing it under control through systems of measurement and standardisation. From the disenchantment of time comes the disenchantment of space, and, therefore, the disenchantment of the external (noumena) and the disenchantment of nature. The world (our space-time) becomes, from Heidegger, *Bestand*: the standing reserve, objectified and commodified for our use. Computational regimes thus become the technologisation of nature, abstracting nature out of its own durée, in an attempt to objectify and control it.

Computational regimes offer a specific molar and unitary story on the nature of space-time, the structure of the universe, and the nature of life-as-we-know-it (and as-it-could-be). We must be wary of what such stories and statements tell us, and the 'god-trick' they provide of a "direct devouring, generative, and unrestricted vision, whose technological mediations are simultaneously celebrated as utterly transparent " (Haraway 1991: 189). These conceptualisations of life itself hold the promise of providing a window into the inner workings of life (as propagating informational forms – with or without the addition of cybernetic feedback loops) and reflecting these back to us in our cyberspace creations. Through the denial and mistaking of metaphors and assumptions within the technoscience of artificial life, the marriage of genetic fetishism and cybernetic informatics, and the extrapolation of a very modernist notion of discrete space-time, a unitary story of life itself, as abstract propagating informational units, is found repeatedly in the computational regimes of the computational universe, the responsible deterministic model and Finite Nature. It is these stories this thesis looks for in its travels through artificial life evolutionary computer games and cultures. Not only do these emplacements offer simulations and models of life, they reflect and come to define our own life, nature and cosmology, through acts of suppletion and s(ed)uction. Conceptually, the movement of artificial life, as a mere model life through to defining life itself as the exemplar of life, can be traced through artificial life and the stories it weaves in association with humans in an emerging sensibility of the posthuman.

Modelling Life as an Abstraction of the Real

When considered as an abstraction of the 'real,' artificial life is viewed as an always-incomplete model of life. In an abstract conceptualisation, artificial life becomes an extension of the rational philosopher's thought experiments as a reductive model, expected to uncover life's essential truths rather than provide its detail. As a simulatory model of the 'real,' there remains a separation between 'artificial' and 'real,' with artificial life as an imaginary 'other' place as extension of virtual mind thought experiments. Mark Bedau (1998) has partnered artificial life with contemporary philosophy, as a tool for what he considers an empirical turn, especially within biology and psychology. For Bedau, "artificial life shares philosophy's characteristic concern with broad essences rather than narrow contingencies" (Bedau 1998). Bedau's rationalist philosophy sidelines the body, offering instead a transcendence of the mind over the physicality and historicality of the body. Offering the essentialism and reductionism of artificial life as keys to

finding a philosophical universality, Bedau finds that, "In the attempt to capture the simple essence of vital processes, artificial life models abstract away most details of natural living systems without pretending to be accurate models of particular features of particular material systems" (1998).

Whilst Bedau follows a modernist Enlightenment model and turns to artificial life to fulfil a rationalist and transcendental universal philosophy, he also highlights the character of artificial life as simulation. For Bedau, simulation performs the role of extending the rational thought process, but for other writers simulation has been developed as being one of the key features forming the movement away from a modernist standpoint of Enlightenment progress. These writers highlight how artificial life, whilst retaining structures of transcendence and rationality, also destabilise other key features of the Enlightenment project. These are the binary dichotomy created between culture and nature, a centralised position of power, and a focus on realism. Such a destabilisation points the way for a movement and reterritorialisation to new definitions and essences for life itself, of which artificial life forms a major contributor.

Chapter 6

(re)Creating Nature, Worlds and Life: Considering Myth and Spirituality

The discovery of the New World induced an impatience with the Old. In vastly extending the range of the Renaissance imagination, it made Europe appear ever more despoiled, damned, and doomed, and prompted millenarian dreams of taking flight from this waning world in quest of new beginnings. In the New World, eschatological expectations of renewed perfection came into earthly focus. (Noble 1997: 38)

It only takes the replacement of 'Europe' with 'the material' or 'molecular' and a digital understanding of the New World to make David Noble's statement ring true for our digital heterotopian emplacements, striving to create perfected neo-Darwinian and cybernetic life itself. Artificial life and evolutionary computer games are creating new worlds and new natures hosting silicon life that, as has been discussed, are coming to supplant and define their carbon cousins, their world and universe. In this story, as code, it is the relationship between the silicon creatures and ourselves that we are creating that feeds our transcendental desires, in a grand narrative of informational evolutionism. This has become possible through reducing all things to information, which forms a double abstraction that first declares a distinction between information and the material it is formed within. It then moves to a second abstraction, determining that information can then be extracted from and independent of its material formation (Kay 1997: 27-29). In the discourse of artificial life, a 'virtual computer' thought of as a new world is created within the computer which is ready to host silicon life – neo-Darwinian and cybernetic life itself perfected, a pattern we see repeated in evolutionary computer games. This allotment of computer space and processing power is thought of as a digital ecosystem: a new nature (re)created in bits and bytes. As heterotopian emplacements of compensation, these digital worlds provide a flawless neo-Darwinian and cybernetic existence against our own complicated and muddled one. Structured within the programming of games and research projects, the story of the (re)created natural worlds, and the life they support, provide mythic possibilities that tie digital nature and life within greater scientific and spiritual mythic discourses of Western technoscientific culture.

This chapter aims to explore the spiritual, within a technoscientific discourse of artificial life. Computer games are a potent ground for myth, with "digital imaginary [that] is chock-full of images drawn from the depths of myth, cult, and popular religion" (Davis 1998: 205). Also, artificial life has a rich spiritual dimension. Kember (2003), Helmreich (1997, 1998) and Boden (1996) have all developed a spiritual element that permeates artificial life, highlighting spiritual discourses that connect both with Judeo-Christian and Eastern religious discourses. This chapter investigates this discourse in greater detail. Within the scientific discourse of artificial life, a connecting equivalent common informational structure has developed between the 'real world' and the digital universes we are constructing in our computers. This has generated an intimate union between physical and digital, and silicon and carbon life forms. The first step of this chapter is to explore the (re)creation of nature that is occurring within artificial life digital emplacements. Recognising the crucial role that humans have in the co-construction of these new culturally produced natures, the (re)creation of nature in a digital medium asks us to weed out the cultural narratives and rhetoric that come together in the creation of its meaning and purpose. As an exemplar of the posthuman, the computational regimes of artificial life emplacements are tied to discourses of cybernetic determinism, seen in both the computational universe and responsible deterministic model. The key signifiers of nature within a cybernetic standpoint, mapped throughout this chapter, are: the universe, the world and the individual. The chapter will highlight tropic ideals of the network, feedback loops, and code within and between these signifiers. These cybernetic and informational ideals associate themselves with cultural and spiritual discourses, finding mythic partners with new Western 'postmodern' spiritualities – combinations of Eastern and Western thought. These include Gaian, Buddhist, Gnostic, Taoist, and New Age beliefs, packaged within an overriding and overarching Western Judeo-Christian structure. From David Noble we are reminded "the present enchantment with things technological – the very measure of modern enlightenment – is rooted in religious myths and ancient imaginings" (1997: 3). With this in mind, the chapter highlights ties between digital artificial life emplacements and a formulation of the holistic universe, formed around the interconnectedness of all things.

The second section of the chapter moves forward from the (re)creation of nature and new worlds to the story of the life that populates them. Within the (techno)scientific discourse that contains artificial life, there is the central concept of life itself as propagating code following a neo-Darwinian evolutionary story of

ever increasing complexity enmeshed within informational structures of cybernetics, feedback and emergence. As with the (re)creation of nature, the story of life creates mythic possibilities within our emplacements that go beyond a strictly technoscientific discourse. Again, these tie in with a framework of 'postmodern' spiritualities, finding a grand narrative for life itself and tying it in the interconnectedness of all things. Birthed within a Genesis story, our silicon creatures live within structures of emergence and feedback that place them within discourses of a holistic living universe, the Cosmic Christ and Mother Earth. Examining the story of life itself also highlights the user or player's relationship with the artificial life emplacement and the life it holds. Readily acknowledged as a god-like position, the character of this role can be examined within our mythic discourses. 'New' notions of God, Goddess, and Godhead permeate the role of the player/user, highlighting the relations of power and structure within our digital emplacements. An emergent God figure is also considered, looking at assertions such as Bjørn Grinde's "God is in our genes" (1998: 20).

The (re)Creation of Nature and the Building of Worlds

The initial step when running any artificial life program is the allotment of a section of computer memory and processor time to the creation of a digital ecosystem or 'virtual universe,' within which artificial life creatures are inoculated. Within the discourse of artificial life and the posthuman, these emplacements become spaces and places that not only model and simulate carbon life, but supplant and come to define it. They become new digital natures and new worlds that inform us about our own – their creators and programmers are co-creating new natures and recreating our own. Mythically, the creation of new worlds highlights both Zen Buddhist notions of a subject's place and relationship within the world and new posthuman spiritualities centred on an unsurprising Judeo-Chritian genesis creation story. These mythic possibilities are given power through their designations as new worlds and new natures of an equivalent underlying structure as our own. Digital artificial life emplacements confuse and displace modernist boundaries between nature and culture; they are both cultural constructions and constructing nature. In her contemplation of the genome as cultural icon, Donna Haraway considers such conundrums as constitutive of a 'category crisis':

> ... a generic conundrum in which proliferating ambiguities and chimeras
> animate the action in science, entertainment, domestic life, fashion,
> religion, and business. Of course, the pollution works both ways; culture is

as much mouse-eaten as nature by the gnawings of the mixed and matched, edited and engineered, programmed and debugged genome. Borderlands are often especially heavily polluted and policed; they are also especially full of interesting traffic and powerful hopes. (1997: 149)

Writing against the postmodern notion that "global technology appears to *denature* everything" (1992: 297), she prefers to think of particular productions of nature, revealing a position reflecting her own materialist standpoint, "In its scientific embodiments as well as in other forms, nature is made, but not entirely by humans; it is a co-construction among humans and non-humans" (1992: 297). She continues:

... "nature" cannot pre-exist as such, but neither is it existence ideological. Nature is commonplace and powerful discursive construction, effected in the interactions among material-semiotic actors, human and not. (1992: 298)

Sarah Franklin, Celia Lury and Jackie Stacey take a similar view in their analysis of nature and culture:

Countering the view that nature has been displaced by culture, or simply the commodity, is the view explored here that nature is being put to work in new ways that signal not so much its disappearance as its transmogrification. Nature, in a sense, has been remade. (2000: 19)

Franklin, Lury and Stacey offer a processual model for understanding the cultural fluidity of the constitution of nature, comprising of threefold process of naturalisation, denaturalisation, and renaturalisation, similar to the Deleuzian concepts of deterritorialisation and reterritorialisation seen to be occurring within definitions of life itself, and aided by assemblages such as artificial life. Especially apparent when turning to our digital emplacements and the creatures they host, the writing and co-construction of the digital ecosystems and virtual universes, given the status of nature, occurs in "the implosion of the technical, textual, organic, mythic, and political in the gravity wells of science in action" (Haraway 1992: 300).

Recognising the co-construction of space and the real questions the duality between nature and culture and nature and stimulation, in both the physical co-construction of nature and digital co-construction of virtual universes within a materialist framework. Katherine Hayles finds that "the distinction between simulation and nature... is a crumbling dike, springing leaks everywhere we press

on it" (1996c: 411). What is of interest here is not the continual co-construction that is endeared to all spaces – physical or digital – but the manner in which they are constructed: the agents that come together in co-construction and the relationships of power and politics within these assemblies, how these connect to other assemblies and assemblages, and the stories, narratives and meanings that are produced through them. Simulations are just as real as the physical molecular systems and spaces they 'model,' but there is a different composition and make-up of agents with new relationships of power that distinguish our 'simulated' natures from our 'real' ones. Taking the assembly brought together in artificial life emplacements and evolutionary computer games as hegemonic orders, it is important to realise the unequal distribution of power amongst agents. Not all voices have the same strength, and not all intra-actions are on equal footing. Hayles reminds us that in the co-construction of space, nature and reality, even at the individual's point of view, all is not equal:

> ... the most we can say about what is "out there" prior to perception is that it is an unmediated, a stream of potential experiences that will happen differently for differently situated observers. As these actors, human and nonhuman, interact with the unmediated flux, their worlds come into being. (Hayles 1996c: 413)

Hayles terms this 'Maturana's world' after the work of Humberto Maturana, which provided radical ideas on how species and individuals *know* their world. Within Maturana's world there is no pre-given world to perceive as such; the idea of a world implies an entity that pre-exists its construction by an observer. Here, on an individual level and sympathetic to a materialist position, it is the intra-action between the individual and its environment (as the world out there, the unmediated flux), and the individual's full sensory perception and translation of this unmediated flux into a coherent reality, that is the manner in which each individual knows and realises the world. Against this, Hayles positions artificial life, with its claims of producing actual incidents of life. Within artificial life worlds, far from the inability to come to any conclusion about the 'out there,' (defined informational patterns form our underlying reality) we are given knowledge of the foundation of the world within discrete mappings of space and time adhering to simple rules. Finding equivalence between the emergent behaviours derived from first order simple rules involved in the construction of the paired physical world, and artificial life instantiations, artificial life researchers feel justified in the naming of artificial life phenomena and emplacements 'worlds.' Claiming a common ontological foundation of (abstracted) information in

both the physical and digital, artificial life researchers find a common structure to the world. In artificial life, the world of phenomenological experience is an illusion covering an underlying reality of simple forms and rules. It is here that the two standpoints – Manturana's world and artificial life – come together:

> Here Tierra [as a strong artificial life emplacement] eerily touches Maturana's world, for its interpreters believe they are justified in calling the simulation a world because they have already conceptualised the world as a simulation. (Hayles 1996c: 424)

Taking from *Tierra* and artificial life more generally, the simulational nature of the world comes because our perceived reality hides an actual deeper first order reality of simple rules and forms, rather than because we cannot *know* the out there. The underlying basic structures and rules are there, so it is up to us to find and illuminate them. It is this claimed common ontological construction between our own world and that of artificial life emplacements that artificial life practitioners look to in order to claim their identical structures. Both artificial life and a materialist standpoint, therefore, arrive at similar conclusions regarding a common realist construction of the physical and digital worlds, but the reasoning of each comes from opposing tangentials. From a materialist standpoint, the simulation becomes real due to the acknowledgement of a common co-construction between assemblies of agents in the creation of the real, regardless of its physical or digital embodiment. Within artificial life, on the other hand, the real gains the attributes of the simulation; it hides the true character of a deeper and theoretically knowable reality in higher order phenomena.

A common reference in visualising our digital emplacements is that they are forming new worlds within our computers: a conceptualisation that has more than fleeting Zen undertones. Within the practice of artificial life, there is a recognition that the world outside, and the worlds that programmers are creating within computers, are 'cut from the same cloth'; our world takes on the qualities of the digital universes they are programming and vice versa. Stefan Helmreich has traced how an understanding of Zen, transcending the dualisms between the knowing subject and knowing object, has informed artificial life researchers bringing "computer worlds and programs to life" (1997: 370). Zen meditation strives to dissolve distinctions between the subject and the world. It is this refusal to form distinctions between material and digital emplacements that caused many of Helmreich's informants to confront "their computational realities":

'Zen' was used by many Artificial Life scientists to refer to an experience of oneness achieved when the researcher had an immersed yet detached engagement with a simulation. The viewing, meditating researcher would recognize the simulation as well as the world outside the simulation were both perceived through the same sensory apparati, so that our experience of the world might be seen as a kind of virtual reality experience, a simulation, and simulations themselves might be themselves understood as potential worlds. (1997: 371)

In the version of Zen used within the artificial life circles that Helmreich has studied, the beholder and the world(s) that he or she surveys are considered as being made of emergent first order structures, giving rise to a phenomenological second order (simulational) reality. Steve Grand has also found a similar grounding in Buddhism in his own conceptualisations of space and matter (Grand 2000: 30). Derived from the same underlying ingredients, the 'reality' of the lived world and those within the computer find an equality of form. It is this congruence that artificial lifer Tom Ray picks up on in 'An Evolutionary Approach to Synthetic Biology: Zen and the Art of Creating Life' when he proposes that "The object of an AL instantiation is to introduce the natural form and process of life into an artificial medium" (1995: 180). For Ray, reality is found in form and process, and specifically life as the process of evolution by natural selection. Artificial life, or his preferred designation of synthetic biology, finds its accreditation as a thing to study in its 'own right' (1995: 180) from this understanding.

Constructed within computer programming, artificial life instantiations (re)create new natures and new worlds, inhabiting the borderlands of nature and culture (Kember 2003). Returning to Haraway's conjunction of nature as a co-construction of the technical, textual, organic, mythic, and political, this chapter turns to examining the spiritual constitution of the worlds of our digital emplacements. Close ties can be found between the emergent structure of artificial life instantiations and Gaian theory that considers the Earth as a living organism. Gaian philosophy finds a foothold in both the science and spirituality of artificial life, linking itself with environmental and cybernetic theory, while finding close connections and a place within a spirituality of the Mother Earth, Cosmic Christ and living universe. From such a foundation we find new points of reference for life itself. In their exploration of the icons of life in panhumanism, Franklin, Lury and Stacey (2000) offer the spherical images of the blue Earth, the foetus and the cell. In the movement from panhumanism to the posthuman, new tropic points of identification are found. Heralding an ontological shift from material structure to processual formations, in the posthuman it is not the material but

formations that form key imageries: those of emergent properties (the whole is greater than the parts), the system or network (the hive), and algorithmic codes (the book of life – either genetic or computer). These tropes permeate posthuman constructions of the universe, the earth and the individual.

Gaia and (Artificial) Life

The basic premise of Gaian theory is that the planet earth operates and should be considered as an organism; the planet (in its mutual organic and inorganic processes) is alive. It is a theory drawn from the concept of Mother Earth (termed Gaia by the ancient Greeks) and inspired by the images of the blue planet brought back from outer space:

> Journeys into space did more than present Earth in a new perspective. They also sent back information about its atmosphere and its surface which provided a new insight into the interactions between the living and the inorganic parts of the planet. From this has arisen the hypothesis, the model, in which the Earth's living matter, air oceans, and land surface form a *complex system* which can be seen as a single organism and which has the capacity to keep our planet a fit place for life. (Lovelock 1987: x, italics added)

The blue planet has been a potent icon of late twentieth century Western culture (Franklin, Lury and Stacey 2000; Haraway 1991) and even forms the cover image for J.E. Lovelock's introductory book on Gaian theory, *Gaia: A New Look at Life on Earth* (1987). This chapter moves away from the image(ry) of the blue planet to its conceptualisation and formulation as the 'whole earth.' This follows a posthuman disconnection with the material and allegiance instead with form. Conceptualisations of the whole earth and Gaia centre on a key concept of the interconnectedness of all things on earth (living and non-living, organic and non-organic) as a single complex informational system or network. It is through the interconnectedness of all things that life, and the conditions necessary for life, emerged on earth and are continually maintained. Within Gaia, life on earth is possible because the earth itself, as a complex interrelated and interconnected system is also considered a living being. For Lovelock (and his collaborator, biologist Lynn Margulis) Gaia is defined as "a complex entity involving the Earth's biosphere, atmosphere, oceans, and soil – the totality constituting a feedback or cybernetic system which seeks an optimal physical and chemical environment for life on this planet" (Lovelock 1987: 11). The interconnectedness of all things is theorised as occurring in Gaia through a cybernetic network of feedback loops

connecting all things as a cybernetic whole. These cybernetic underpinnings of Gaia are so strong that Lovelock devotes an entire chapter in *Gaia* to an explanation of cybernetic theory, including examples of where one can encounter feedback loops on a global scale on earth.

The links between the posthuman, Gaia, cybernetics, artificial life, and new senses of 'postmodern' Western spirituality are intimately connected. Artificial life, as the exemplar of the posthuman, encapsulates and ties together the discourses that permeate the posthuman. For Thomas Ray, the equal footing of carbon and silicon life is found in their common cybernetic formation and process, and is described in a manner in which Gaia resonates. The first description below could be read for carbon life and the second for silicon, but in the posthuman it is process and form which is paramount, demonstrated by the interchangeability of carbon and silicon life forms between the two statements. In such a posthuman framework, the two passages can be read on top of each other, the first passage as a description of living systems, the second illuminating the underlying structure of the system, organic or digital:

> Life is an auto-catalytic process that builds upon itself. Ecological communities are complex webs of species, each living off of others and being lived off of by others. The system is self-constructing, self-perpetuating, and feeds on itself. Living organisms interface with the non-living physical environment, exchanging materials with it, such as oxygen, carbon dioxide, nitrogen, and various minerals. (Ray 1995: 194)

> The new bottom-up approach creates a population of data structures, with each instance of the data structure corresponding to a single entity. These structures contain variables defining the state of an individual. Rules are defined as to how the individuals interact with one another and with the environment. As the simulation runs, populations of these data structures interact according to local rules, and the global behavior of the system emerges from those interactions. (Ray 1995: 180)

Although Ray does not extrapolate the entire ecosystem (as in earth or digital universe) as being alive as a single entity, the holistic philosophy of Gaia can be seen in the interconnectedness of all things in the processes of life – namely in the cybernetic processes of emergence and feedback. It is the view of life as a cybernetic system and process that begins to form statements regarding life itself, and its relationship with the rest of the world. In the posthuman, life has been intimately associated with discourses and rhetoric of holistic interconnectedness, process and form, forming statements of the interconnectedness of all things, cybernetic feedback and emergence. To this,

neo-Darwinists – such as are found in strong artificial life – tie emergence and feedback to evolution within the holistic system of life:

> Evolution is predominantly concerned with creating and maintaining adaptations to living organisms that are themselves evolving. This generates evolutionary races among groups of species that interact ecologically. These races can catalyze the evolution of upwardly spiralling complexity as each species evolves to overcome the adaptations of the others. (Ray 1995: 195)

Life throughout Gaia and the neo-Darwinian cybernetics of strong artificial life finds truth in statements of the interconnectedness of all things and cybernetic systems and processes. In the posthuman movement away from material embodiment, to an allegiance with form and process, discourses of the 'whole earth' take central stage and create bonds between the scientific discourse of artificial life and a spirituality of Gaian philosophy. Moving this a step further, within computational regimes in both their digital and physical guises, it is not only the planet seen as the 'whole earth' that is treated as a singular entity. Within computational regimes, the universe itself is regarded in a holistic manner. Returning to the scientific discourse of artificial life and computational regimes, this informational and cybernetic interconnectedness is tied to discourses of connectionism and emergence. Within the spiritual, Gaian philosophy finds universal compatriots in the Cosmic Christ and new postmodern formations of God and Goddess. It is through the interconnectedness of all things at a universal level that cybernetic processes form the deterministic discourses of the posthuman.

A 'Postmodern' Spirituality of a Living Cosmology

The scientific discourse of cybernetics, emergence, evolution and the interconnectedness of all things connects the technoscience of artificial life; the theory of Gaia and discourses of the posthuman. It forms statements about what life is and how spiritual philosophy of life itself is structured. These same discourses and statements tie both Gaia and artificial life (and the posthuman) to a set of spiritual discourses centred on the living universe, the Cosmic Christ, and, as we shall return to new images of God, the Goddess and the Godhead. These new 'postmodern' spiritualities bring together philosophies of the interconnectedness of all things and a holistic living system to a cosmology in the development of a 'living spirituality' (Fox 1990: 18) informed "by both modern science and by insights from the world's diverse spiritual traditions" (Elgin 2000:

17). They support a spirituality that considers emergence, connectionism and evolution as divine creative processes. Central to this new spirituality is the familiar conceptualisation, echoing the scientific philosophy of Gaia (on a new meta-level) that "our cosmos is not a fragmented and lifeless machine but is instead a unified and living organism" (Elgin 2000: 17). On a planetary scale, as with Gaia, the cosmos develops a discourse of singular holism that imbues it with the quality of life. This living cosmology forms the base of a new living spirituality that finds, in this life force, the Cosmic Christ; a figure born but not tied to (nor completely divorced from) Judeo-Christian discourses. For Matthew Fox, the Cosmic Christ is a figure of divine creativity that finds a role in both Christian and non-Christian traditions (1990: 20). True to the posthuman preference for form, the Cosmic Christ emerges as a divine pattern:

> The Cosmic Christ names the pattern that connects as justice, as loving, and as essentially friendly toward the universe and all things, humans included. The Cosmic Christ, then, being the Divine image in every atom and every galaxy, grounds a global morality in reverence for being... The tradition of the Cosmic Christ also represents the Goddess and Gaia tradition in the West. The Goddess is about Divinity's immanence in all things and in the celebration of creation. So, too, is the tradition of the Cosmic Christ. (Fox 1990: 24)

The Cosmic Christ within the living universe is described as the "pattern that connects" (Fox 1990: 24); the glue that bonds the interconnectedness of all things as the living universe; an "unbroken flow through of energy" that creates an image of a "vortex of a tornado or a whirlpool, as a completely dynamic structure" (Elgin 2000: 20) in the cosmos. In finding inspiration from both scientists and poets, including Norman Weiner, the founder of cybernetics, Duane Elgin's description of the living universe places it firmly within our developing discourse of the interconnectedness of all things, Gaia and cybernetics:

> No one part of the cosmos determines the functioning of the whole; rather, everything seems to be connected with everything else, weaving the cosmos into one vast interacting system. Everything that exists contributes to the cosmic web of life at each moment. (2000: 21)

Within the spiritual discourse of the living universe and the Cosmic Christ, it is this connecting life force or energy that is the source of divine inspiration. As a generative power, repeating the maternal connotations found in the Mother Earth of Gaia and the whole earth, the cybernetic energy system of the cosmos has also been termed the Mother Universe, "that is the creator, sustainer, and womb of all

cosmic systems" (Elgin 2000: 27). Elgin finds roots of the Mother Universe not only in theoretical physics, as a superspace that contains the building blocks of reality[10], but within the meditative traditions of various spiritual and religious doctrines, including Taoism, Christianity, Gnosticism, Greek philosophy, Buddhism, and Hinduism (2000: 25, 27-28). Within these, Elgin finds a repeated discourse of the interconnectedness of all things and the divinity of the power that connects them and gives them life. While the discourse of the Mother Universe and Cosmic Christ draws from a number of different spiritual, philosophical, and scientific doctrines, its narrative is decidedly millennial Judeo-Christian in order, as we find in the discourses surrounding the (re)creation of new digital worlds and, as this thesis will return to, in the investigation of the divinity of evolution.

New Digital Heavens: Digital Nature and the Spiritual

In the posthuman, within models of computational regimes exemplified by the computational universe and the responsible deterministic model, the world and the universe are not only reflected but supplanted by the digital natures we are (re)creating in our computers. The same appears to be occurring in the discourse of spirituality that considers the interconnectedness of all things and cybernetic energy flows as divine powers. In the same way that the Mother Universe and the Cosmic Christ imbue the cosmos with a divine connective life force, the cyberspaces of artificial life emplacements and evolutionary computer games find, in process philosophy, a recurrent discourse that finds "divine creativity" in the "vast, nonlinear reality wherein each node connects to every other node in an endless, recursive web" (Cobb 1998: 52). For Jennifer Cobb the parallel between 'reality' and 'cyberspace' is striking:

> When a set of algorithms that we call software runs in a computer, something remarkable begins to happen. The abstraction becomes a field of experience that we call cyberspace. It is this moment that the emergent quality of cyberspace makes itself known. The essential motor of this process, the spiritual center of cyberspace, is the fundamental sacred force that infuses *all reality*: divine creativity in action. The emergent dynamic found between the hardware and software in cyberspace is an aspect of divinity itself. In other words, *the cosmic force that drives the movement and unfolding of reality is the same force as that which drives the continual, moment-by-moment emergence of the world of cyberspace.* (1998: 51, italics added)

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[10] Here Elgin finds inspiration from the Princeton astrophysicist, John Wheeler, who describes space as the basic building blocks of reality. (2000: 25)

In emergence, Cobb finds a creativity that is divine in nature – a generative force that connects all things together in the creation of both reality and cyberspace. Here, the discourse of the new 'postmodern' spirituality of the living universe extends itself to both digital and physical natures. In the processes of emergence, connectionism and cybernetic feedback, the artificial life worlds that we are creating are spiritually connected with the physical living universe. As it is throughout the posthuman, it is not materiality that is of importance, but rather form and process – the digital and physical find equivalence of form within a spiritual discourse of the interconnectedness of all things irrelevant of their materiality (or lack of).

The digital worlds we are creating within our computers do more than connect the digital with the physical in a common spiritual discourse; they seem to fulfil the millennial Christian desire to create heaven on earth, in the building of a New Jerusalem that reflects the glory and divinity of creation. The quest for a New Jerusalem ties the pursuit of science and spirituality in a discourse of transcendence and salvation:

> With these utopian visions we witness the emergence of the idea that man, through his *own efforts*, can create a New Jerusalem here on earth. All these visions were profoundly Christian in intent, inspired, as one commentator has put it, by a "yearning to bring heaven down to earth." Rather than having to wait until the Last Judgement for the advent of a perfect community, Renaissance visionaries suggested that men could create heavenly cities themselves, by the application of science and technology. Technology would thus become a medium for *salvation*. Again and again in the age of science, technology has been viewed as a salvific force, a key to a better, brighter, more just world. (Wertheim 1999: 284)

Within the Christian tradition there is a millennial fervour that strives to regain a sense of immanence, lost in the fall from grace and expulsion from the Garden of Eden. In tracing the connected histories of Western Christian tradition and the development of the arts of science and technology, David Noble (1997) re-establishes the close bond between technological development and the struggle and pursuit of Christian spiritual salvation. Beginning in the Middle Ages, the West has looked to technology as a tool to fulfil the transcendental salvation narrative of renewed perfection on earth.

> In the early Middle Ages... the relationship between technology and transcendence began to change. Over time, technology came to be identified more closely with both lost perfection and the possibility of

With the advent of new cyberspaces created within our computers, technology
seems to have created this possibility of new spiritual perfection. Cyberspace has
held connotations of the spiritual and the mystic utopian spaces in which the
perfect is achievable, unhindered by the materiality of physical existence. It has
been perceived as a place of salvation, a more just and perfect place, and a new
heaven on earth. It is not a place of formal theology, but still retains a spiritual
appeal. For Wertheim, this creates a paradox in the spirituality of cyberspace: "It
is a repackaging of the old idea of Heaven but in a secular, technologically
sanctioned format. The *perfect* realm awaits us, we are told, not behind the pearly
gates, but beyond the network gates" (1999: 21). Cyberspace is spiritual space
perfected on earth.

As digital heterotropic emplacements of compensation, our artificial life
emplacements and evolutionary computer games are creating cyberspaces of
perfected neo-Darwinian and cybernetic life. Through the technoscience of
artificial life, practitioners claim to have (re)created new digital natures and life,
which operate precisely within neo-Darwinian informational structures of
propagating computer algorithms and cybernetic processes. From the neo-
Darwinian and cybernetic technoscientific perspectives, and the spiritual
discourse of the interconnectedness of all things, artificial life emplacements form
a new heaven on earth; life is perfected and materiality is transcended by
idealisations of form and process. As 'realised utopias,' digital computational
regimes of artificial life attain attributes of heterotopias, but as spiritual spaces
they retain aspects of 'other' spaces, apart and separate from the 'real.' It is this
spiritual disconnection between the 'real' space of the physical world and spiritual
space of cyberspace that takes them beyond being 'just as real' to a hyperreality
of suppletion, or 'new heavens on earth'. The cyberspaces of artificial life become
sacred spaces, set apart and distinguishable from the 'real' through their
perfection. It would appear that the creators of artificial life emplacements have
realised millennial goals of not only knowing creation, but of actual involvement
its making. They have realised dreams in existence since Boyle and Newton, and
retained in the goals of modern technoscience:

Henceforth nature was to be understood by the way it was made, which
required of the scientist a God-like posture and perspective. But divine

knowledge of creation was not all. Some aimed even higher, seeking not merely to know creation as it was made but also to make it themselves, actually to participate in creation and hence know it firsthand. (Noble 1997: 67)

Within the mythic discourse of the interconnectedness of all things, digital artificial life emplacements become constructed spaces of new earthly perfection – a New Jerusalem of neo-Darwinian and cybernetic life. They are spaces in which the cybernetic ideals of feedback, connection and emergence and informational evolutionism wholly structure and define the life within them. They are new mythic living universes co-created by humans by and within our own technologies. In the posthuman's ontological levelling of the material and the digital as informational structures, artificial life emplacements resonate with the discourse of the living universe and the spiritual imagery of the Cosmic Christ and Mother Universe. Within the discourses of the posthuman, we not only know that creation is processual, following the informational processes of cybernetic feedback, emergence and the interconnectedness of all things; but in artificial life, we have made it for ourselves, creation (post)humanly perfected.

Gods of Evolution or God as Evolution: The Story of (Artificial) Life and Our Place in It

Yet, at the end of [Francis Bacon's] life, in his *New Atlantis*, he predicted that men would one day create new species and become as gods – "the undeclared ultimate goal" of modern science, as Lewis Mumford put it. (Noble 1997: 65)

The digital artificial life emplacements that are being created as virtual worlds within computer systems have, within the scientific and spiritual discourse of the posthuman, achieved this 'undeclared ultimate goal' of modern science – the creation of new species and the attainment of god-like status for the programmers and users of the programs. The new digital ecosystems we are creating as virtual worlds and universes realise the mythic discourse of the interconnectedness of all things as informational systems and networks of cybernetic feedback loops and emergence. Once a digital ecosystem has been created, the defining step of any artificial life emplacement is the inoculation of the virtual world with digital life – the first creatures of our new perfected worlds. This necessary step takes place every time a new artificial life program is initiated. In a Christian genesis birth narrative, users – in a godly position – bring life to the digital ecosystem of the

virtual world through the introduction of the first silicon creatures. Digital life is humanly created, and made in our own neo-Darwinian cybernetic image, as propagating informational structures enmeshed within a cybernetic system of connectivity, feedback, emergence and evolution. As the drama of life unfolds, the key neo-Darwinian definition of life, as evolving informational structures finds, ties to the mythic and spiritual cosmos:

> Life as a sacred, cosmic force is a rich and complex notion, filled with far-reaching implications. First and fundamental is the understanding that the very essence of life is process. When life ceases its becoming, its never-ending evolution, it is no longer life. Life can be identified with the moment-by-moment unfolding of creativity. (Cobb 1998: 55)

Within informational evolutionism, it is the replication and evolution of informational structures that form the core definition of life, either in its organic or silicon context; life is the process of evolution. Within the spiritual configuration of the posthuman, the process of evolution becomes the mythic grand narrative of life: a divinely creative force that both moves life forward and is its essential quality. The story of life is the story of evolution.

In the struggle for immanence, evolution gains direction and purpose within the mythic discourse of the posthuman. It is evolution that ultimately fulfils millennial Christian transcendental salvation narratives, as the dead weight of bodies and flesh give way to new digital stages of evolution within the digital emplacements that have come to supplant and define us. In a posthuman spiritual discourse, evolution is divine and will delivery our own immanence. Drawing from the work of Pierre Teilhard de Chardin, a Jesuit priest and popular spiritual figure within digital circles, evolution finds its holy place:

> The concept of evolution allowed Teilhard to frame his mystical vision of matter imbued with a divine force in the fundamental truth that all things are in process. For Teilhard, this meant that matter was not antithetical to the divine, but essentially vitalized by it. He saw that the "All" was in fact ultraliving. This was a radical turning point that led Teilhard to formulate a vision of evolution as led, ultimately, by divinity. For him, evolution was both a scientific and holy process. (Cobb 1998: 81)

Within a mythic discourse of cybernetics and emergence, evolution becomes a forward driving force, continually striving towards the ultimate Christian millennial goal of perfected earthly immanence. As a scientific and holy process, we are reminded "the machines we create, our technologies, are leading factors in the

evolutionary process" (Cobb 1998: 88). The technoscience of artificial life takes centre stage in such a grand narrative of life and evolution. It provides not only the definition of life itself in the posthuman, but also becomes the next stage of life in the evolutionary process. According to a set of artificial life practitioners, the grand narrative of evolution includes artificial life as its next stage (Helmreich 1997: 376), a masculine birth of salvation and transcendence:

> In providing this grand story of evolution as unfolding toward a more
> perfect future, a future in which the flesh of humanity falls away to birth the
> butterfly of Artificial Life, Artificial Life practitioners repeat a very millennial,
> very Christian kind of salvation story – and one underwritten by a very
> masculine faith in technology. (Helmreich 1997:378)

In such a story we are the creator gods of the worlds we give birth to and find salvation in. Within the discourse of 'postmodern' spirituality, however, the position and nature of God is being questioned and challenged. The patriarchal omnipotent God is being usurped by a figuration of God found within the system, and as a bottom-up phenomenon. In the spiritual narrative of life itself, God is found as emergence and evolution itself, rather than outside of these. Artificial life emplacements and evolutionary computer games reflect this duality of a God as top-down (patriarch) and bottom-up (emergence). The dual nature of God becomes entwined within the mythic drama of the story of life as evolution, contrasting the position and power of the player or user and that of the process of emergence and the system. In our digital emplacements, we take on the role of an omniscient patriarchal God, positioned outside and above the digital world, looking back into it, and able to see the workings of the world we have created and manipulate (Hayles 1999: 233; Kember 2003: 75; Helmreich 1998; Adam 1998). In contrast, the bottom-up God of emergence is found within the system itself, as emergent behaviour and evolution. These both contribute to the development of myth and grand narrative surrounding artificial life, and within posthuman spirituality both are necessary.

Seeing the God-Trick: Humans as God

The most obvious role that humans take on in artificial life emplacements and evolutionary computer games is that of a patriarchal God, overseeing the creatures they have created. In the discourse of the posthuman, where we have gained the knowledge of nature and life itself as propagating informational structures, we have attained the privileged position of the god-trick, "seeing

everything from nowhere" (Haraway 1991:189, Kember 2003: 75). Positioned outside of the worlds created, the player or user looks in from above, overseeing the world and the life it holds, a panoptical view that allows vision into both the ongoing occurences of the world and a privileged view of its inner most workings.

Describing the play of the game *SimLife*, artificial life guru Christopher Langton takes us through the mythic story of life and our role within it. He uncovers the mythic possibilities of *SimLife* within a discourse of a creator God and the interconnectedness of all things, starting with the player's role in the creation of the planet:

> On entering the game, the user, à la "Genesis," must first define a physical world by creating mountains, lakes, and river; establishing a climate, complete with regional and seasonal variation in temperature and moisture... As the world is created, the user is able to view his "creation" developing in a "Map" window, which provides a synoptic view of the dynamics of the world throughout the simulation. (Langton 1991: 4-5)

It is this association with a Genesis narrative and the player's obvious patriarchal God placement within the play of this mythic possibility of construction that forms the initial and most apparent god position, within evolutionary computer games. It is also this player positioning that gives simulation games their genre definition of 'god-sims.' Kember considers this placement of player as God as one ultimately of power:

> Power, as it currently configured is monolithic. It passes from the creator to the creations of ALife worlds but is neither shared nor contested. The power of the creator is embodied in the creation through narratives which closely model those of monotheistic Judeo-Christian religion. It is clear that ALife represents [Haraway's] 'god-trick' par excellence. (2003: 75)

Taking evolutionary computer games out of a strictly Judeo-Christian Genesis narrative and placing them instead within a structure of postmodern spiritualities, a patriarchal god becomes a necessary, if shared, divine position, and is therefore both shared and contested. Also finding a divinity in emergent processes, the god position is shared with the system within postmodern spiritual narratives. A patriarchal god figure remains necessary, because without this external influence computational regimes would not be able to run, nor would they even exist. It takes an external entity to fulfil both the construction of the universe and the creation of life within it, as well as conceptualising the makings of the universe (the grid of computational automata) and the rules by which it abides. It is this

'author-ly' aspect of the patriarchal God position that the producers of the game take and fulfil; it is the development and programming of the game that places the game producers in a divine role, complimenting the player in the patriarchal God position. Computational regimes cannot develop or initiate themselves; they require an exterior force or entity to do so. Within evolutionary computer games this role is discharged through a combined effort from the game producers and player. In their author-ly role, the game producers also realise their dominant position within the hegemonic order of the assembly, brought together in gameplay. It is the developmental and programming aspects of the game that structure the narrative scaffolding of gameplay, delineating the character of play and becoming a dominant force in the shaping of narratives and meanings produced through play.

God is in Our Genes: Evolution as God

In the discourse of the interconnectedness of all things, the power of the patriarch God – the God who governs from above – is being usurped by the system. A new figuration of God as emergence has come to vie for the power of the world and universe. In the discourse of neo-Darwinism and the spirituality of the Cosmic Christ and Mother Universe, where all things are connected in process, the system and process find divine power in evolution. Evolution, as both the director of the process life and the process itself, is the God from within the system, the ghost in the machine. When Bjørn Grinde states "God is in our genes" (1998: 20) his purpose is to suggest that humans are genetically programmed to search out a religious existence. This chapter takes his declaration out of context and offers instead that within the posthuman, God is in our genes in a more apparent sense. It is our genes, as informational propagating structures, that are the purpose and force of evolution. It is within our genes, and the corresponding computer algorithms of our silicon cousins, that the emergent power of evolution comes forth – here God is quite literally in our genes. In the mythic discourse of the interconnectedness of all things, artificial life displays and defines the creative power of evolution:

> Creativity as a divine force that animates and drives evolution forward is the theological Trojan horse hiding deep inside the scientific disciplines of artificial life and artificial evolution. If one accepts the theological premise that life is sacred, then A-life and artificial evolution serve as potent examples of how the divine is coming to inhabit cyberspace. (Cobb 1998: 159)

The emergence of evolution is the divine creativity that guides life forward. It is a God that draws itself from the process of the system – from within nature as the interconnectedness of all things – connecting to images of the living Godhead and the Goddess. Matthew Fox asserts that in a 'postmodern' spirituality of the living universe, God is re-imagined as below and not above: "To relocate Divinity in the depths of nature and of the self is again to reencourage an entire civilization to listen to its creative powers and to allow those powers to emerge once again" (1990: 22). As we have been continually reminded of throughout, the most divine creative process is the emergence of evolution itself. Within artificial life, emergence and evolution garnish a level of respect and awe, appropriate for their divine status. In investigating the God-like status of artificial life practitioners, Stefan Helmreich finds that while artificial lifers might play at being Gods, evolution holds the title properly:

> While Artificial Life researchers speak playfully of being gods, their tones become much more serious when they speak of evolution, the force they see as responsible for organic life and for the rise of the practice of Artificial Life... In many ways, of course, evolution has become for these scientists a simple replacement for God, and so it's not surprizing that 'evolution' and 'god' are often treated as synonyms in their everyday speech, this easy interchangability allows researchers to rotate in and out of being evolved products of evolution and being evolution itself. (Helmreich 1997: 379-380)

In the spiritual discourse of the living universe, where the posthuman looks to the processes of digital cyberspace emplacements for the definition of the 'real,' the processes of artificial life form the common sense of the divinity of life and the living universe, in mutual processes of connectivity, emergence and evolution. As we have seen throughout the posthuman, form and process are given privileged standing, with the key emergent process of evolution taking the divine position of the God of the system, guiding life forward in a process of divine creativity (see also Kember 2005: 153). Jennifer Cobb encapsulates the partnering of science, technology and spirituality, and the conflation of the physical and the digital in the posthuman, in her description of the emergence of nonlinear systems in cyberspace. For Cobb, similar processes also seen occurring in the physical living universe match what is seen to be occurring in cyberspace:

> With computational emergence and self-organization, we find divinity present in the digital. In this medium, it makes sense that the divine expresses itself in the form of digital strings. What is remarkable, and truly awesome, is that when numbers of these small, simple digital strings are thrown together and left to run, lifelike properties emerge entirely

independently. Nonlinear systems are born – networks, populations, swarms, and colonies. It can be no accident that these baby systems reflect the same processes that we see in the organic world. There is a through-line between carbon and silicon, between the digital and the analog. Both realms are born of the same confluence of physics, chemistry, and divine creativity. (Cobb 1998: 172)

Treating an emergent God-figure as a replacement for a patriarchal God, however, is unattainable. Within posthuman spirituality, a patriarchal God and emergent God are intimately entwined and co-dependent. Despite the desire to have done with a God that is outside and removed from the system to allow an emergent God figure the sole propriety over process and system, such a removed figure is a necessary part of the equation. Without this overseeing force separated and above, the system's critical questions remain unanswered: Who wrote the rules and program of the computational regime? Who constructed the universe? Who initiated the regime (started time)? Finding an inner connective force that guides and creates in emergence does not escape the requirement of an outside force that at least creates and initiates the computational regime in the first place. In the same manner, a patriarchal God figure is dependent on emergence for the continued development of the system within a computational regime. Without connectivity and emergence within a system of process philosophy, things would not run, nothing would happen, and the system would remain static. Therefore, despite the apparent power struggle between positioning a figuration of god either above or within the system, spiritually computational regimes realise a dual and co-dependent patriarchal and emergent god figurations.

From Myth to Mythic Possibilities:

Posthuman spirituality, implicated within computational regimes, tells a story of ineterconnectivity, emergence and holism through the declared divinely creative forces of emergent process, overseen by a second overseeing force outside and removed from the system. Intimately connected with the science and scientific discourse of artificial life, the spiritual within artificial life finds a divine process within the emergent qualities of connectionism and first order rules that show emergent higher order behaviour. Through interpreting the local dependency within cellular automaton on neighbouring cells, in determining cell state at each time interval or generation as a global or universal holism, the postmodern and posthuman spirituality, partnered with the spiritual discourse of artificial life, finds a universal connective force that treats the universe as a singular spiritual living entity. Reflected more locally at the planetary level as Gaia and Mother

Earth, this living universe of the cosmic Christ finds a spiritual path, through the creative evolution of emergence, which guides life forward. A more traditional patriarchal Godhead is also implicated within this spiritual discourse, without whom the system cannot be programmed or initiated. This dual mythic story of patriarchal and emergent gods creating systems of creative evolution is consistently played through within evolutionary artificial life computer games.

Evolutionary artificial life computer games and projects (re)tell this mythic journey through the narratives created in gameplay, structured by the mythic possibilities presented within the game. Namely, through the mythic possibilities of construction, creation and change that structure and guide the player through gameplay, the scientific and spiritual discourses of artificial life are realised as they are played through. These three ever present configurations of gameplay structure and position the player and play, creating narrative possibilities aligning with the scientific discourse of computational regimes and the spiritual discourses of interconnectivity, holism and the dual nature of patriarchal and emergent god figures. The virtual world is made through construction, initiating a Judeo-Christian genesis narrative of a patriarchal god-player, forming a new world and universe ready to host life. Each time a new game is initiated the first task at hand is the construction of a virtual space, through the allotment of an amount of computer memory, in which to host the silicon life about to be created. Scientifically, the construction of space creates a virtual computer within the computer where the robust environment needed for the programming of cellular automata and genetic algorithms can occur. The construction of this 'virtual computer' and 'virtual universe' constructs space and defines the rules of the world. Spiritually, this translates to a very Judeo-Christian creation narrative, on the birth of the universe through divine intervention. In doing so, the patriarchal godhead sets the parameters, rules and structure for the emergent god within, and as, the system. With a digital ecosystem now constructed and ready to host new silicon life, the second mythic possibility that evolutionary artificial life computer games (and programs) structure play through is creation. This is the inoculation of digital environments with new life, the creation of life on these new worlds occurs by divine intervention, rather than through emergent intra-actions. The creation of life continues a Judeo-Christian genesis narrative structure and continues to reinforce the patriarchal god positioning of the player. While the construction of space usually signals the opening or loading of a game, the creation of life commences gameplay properly.

Spiritually, construction and creation focus on the intra-actions between the player as patriarchal god and the game, and set the stage for the possibility of the third spiritual and scientific mythic possibility of such games: change. Change incorporates emergent processes and evolution into narrative possibilities and the interconnectedness of all things, within a grand narrative of creative evolution. This has the goal of leading towards ever increasing complexity, and therefore intelligence. Scientifically, the narratives of change within artificial life systems are intimately entwined with biological formulations that have found common ground in informatics, connectionism, emergence and cybernetics. Spiritually, these have been translated into paired stories that find a figuration of the cosmic Christ within connectionism and emergence, a figure representing a living universe of interconnectedness. Within evolutionary artificial life computer games and programs, the possibility of change is the main thrust of gameplay. It is the intra-action between the player and the system, with the player learning how to manipulate the system in order to produce meaningful and desired results, from the emergent processes of the system. Spiritually, this translates to the struggle and co-operation between the player as patriarchal god and the system as emergent god. Change within these computer games is the realisation of something better through the emergent processes of cybernetic systems and evolution. Change is progressive, non-predictable and negotiated.

Tracing a genealogy of evolutionary artificial life computer games forms a history and development of the scientific and spiritual discourses of artificial life and the posthuman. Finding an ancestor in the *Game of Life*, evolutionary artificial life computer games have developed mythic possibilities that structure gameplay and position the player to realise narratives that produce meanings about life itself, that tie the spiritual and scientific discourses surrounding life itself, nature and the cosmos within the computational regimes of the posthuman. The development of the spiritual and scientific narratives that tie silicon and carbon together continues through popular scientific projects and evolutionary computer games. Similar to Sarah Kember's historic overview (2003), the next chapter traces this development through the *Game of Life* and on through the *Blind Watchmaker*, *Tierra*, *SimEarth*, and *SimLife*. These build a narrativity that comes to fruition within the mythic discourse in play within *Creatures*.

Chapter 7

A Genealogy: The Evolution of Evolutionary

Computer Games

The scientific and spiritual mythic discourses that pervade evolutionary artificial life computer games tie these games into a specific set of grand narratives that are associated with computational regimes, and a new ontological structure found in informational formations and process. A genealogy of the games and research projects that have found popularity as scientific projects, as well as with a general audience, traces the development of both the scientific and spiritual discourses that come together in the grand narratives of artificial life and computational regimes. Through increasingly complex games and popular scientific projects, the assumptions and narrative rhetoric that characterises evolutionary computer games, and artificial life more generally, develops in its scientific and spiritual depth. The genealogical journey presented in this chapter covers a set of games identified in my Masters dissertation (Mackie 1998) and follows a similar course set by Sarah Kember (2003), who traces the development of evolutionary computer games and popular programs through *Tierra*, *SimEarth*, *SimLife* and *SimCity* (85-91), finally examining *Creatures* (91-115)[11]. For this thesis, following participant engagement to investigate the genealogy of games, each has been played over the course of study. From this analysis of gameplay and further engagement with the various additional media surrounding the games available, this chapter looks to identify key statements and concepts taken from gameplay. It has been purposely written in the third person to emphasise the non-specificity of the results; what has been brought into discussion are general statements able to be made about each game. I begin with the *Game of Life*, a program not properly classified as artificial life, but laying the foundations for all computational regimes. Early artificial life demonstrations like Richard Dawkins' *Blind Watchmaker* or *Biomorphs* introduce narratives that develop tight links between digital and material, through highly anthropomorphised language and conceptualisations. The artificial life research project *Tierra* exemplifies programs of its type, and enjoyed a high degree of popularity amongst an interested lay

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[11] Elsewhere Kember highlights the importance of the *Game of Life* in the development of artificial self-reproduction and evolution (2003: 70), as well as an overview and critique of Richard Dawkins and *Biomorphs* (2003: 54-56).

audience. *SimEarth* and *SimLife* go further and introduce artificial life to the general gaming audience. Connections between silicon and carbon life are actively made in these games, with objectives of maintaining viable ecosystems reflecting those found on earth. The spiritual aspect of evolutionary computer games is highlighted within these two examples, developing the interconnectedness of all things through a Gaian thematic that is central to gameplay.

Kember builds her genealogy as examples where "simulations are seen to offer mirror rather than alternative worlds, reproducing hegemonic discourses of origin and evolution" (2003: 84). The genealogy offered here aligns to, and augments, Kember's overview, offering greater detail to Kember's "brief analysis" (2003: 84). This thesis sets itelf apart by tracing the development of gameplay and the position of the player within the assembly and system. The genealogy of games builds an increasingly complex set of scientific and spritual statements available. The chapter also further implicates the player, and how his or her position develops, especially in relations of power to each game system. It is a player-centric analysis of games, and aims to show how progressive games have built a repertoire of play within a 'sim' genre that has supported digital entities to be considered as living. Two areas are developed in the preparation for a fuller analysis of *Creatures* as the most advanced evolutionary computer game this thesis covers. The first is the development of narrative associated with artificial life emplacements, which is increasingly connected and involved with the cultures evolutionary computer games and projects. The spiritual and scientific narrative structure played through the mythic possibilities of construction, creation and change has been developed as an integral aspect of gameplay. The games and programs presented actively promote their spiritual and scientific features and make these a core element of gameplay. This is exemplified in *SimEarth*'s unapologetic Gaian overtones and *SimLife*'s scientific character, including experiment notebooks for the player to make use of. The scientific and spiritual narratives that these games and programs associate with are actively promoted within gameplay and through other structures and connect silicon and carbon, digital and material. The second connected area is the placement and positioning of the player within these games and programs. As with the development of narrative structure through the genealogy, the player's position within these digital emplacements finds a common and developing role. A player's ability to influence events and the occurrences of the gamespace increases through the genealogy, moving from a primarily observatory to participatory role. As the player's involvement becomes more active, the tension of power and control between the player and the system also becomes more apparent. This

relationship becomes a part of the narrative structure of the game, played through narrative scaffolding and mythic possibilities. Even in the earliest program analysed, the *Game of Life*, the dual balance of power between player and system is present.

Game of Life (1940s -): The rules of self-organisation

Within computational regimes, Conway's *Game of Life* (*Life*) is more than aptly named. Although rarely classified as artificial life in its own right, the cellular automata of grids, rules and states that make up *Life* nonetheless form the conceptual backbone and core of all artificial life programs, as well as forming the prototypical model for computational regimes. As such, its importance within artificial life cannot be over emphasised. It is a game with a central focus on emergence; the application of simple rules across discrete time units on a simple two-dimensional grid can form regular and/or stable patterns that display such lifelike behaviours as predictable movement, coherence of form, stability over time and/or predictable disintegration. For those who follow a computational regime, this type of emergence is the foundation of life itself, displaying the rudiments of self-organised behaviour. The *Game of Life*, therefore, plays with the essential core of reality and what it means to be alive.

As has been previously detailed in chapter four, the *Game of Life* operates on a two-dimensional geometric grid where each grid space can either be open (unoccupied/empty) or closed (occupied/black). Originally played on an Oriental 'Go' board with flat counters, predating modern electronic computational analysis, *Life* and other similar GA programs are still a major contemporary focus of computer research and interest. In *Life* the player arranges a pattern over the grid to initialise the game and then applies a set of simple rules to the game set. The rule set consists of:

> 1. Survivals. Every counter with two or three neighbouring counters survives for the next generation.
> 2. Deaths. Each counter with four or more neighbours dies (is removed) from overpopulation. Every counter with one neighbour or none dies from isolation.
> 3. Births. Each empty cell adjacent to exactly three neighbours – no more, no fewer – is a birth cell. A counter is placed on it at the next move.
> (Gardner 1970)

These rules are the foundational programming of *Life* as a computational regime, through the manipulation of discrete informational bits over discrete time units, through the application of a set of simple rules. The application of the rules to the game set changes the pattern of the grid and qualifies as the progression of one unit of time, also classified as a generation. Playing *Life* over a number of time sequences or generations produces emergent patterns across the grid that appear remarkably lifelike. As Kember comments, "[t]he idea, of course, was that the process would continue and that the cellular automata would model not only self reproduction but also evolution, and indeed emergence" (2003: 70). The predictable behaviour of sets or clusters of closed spaces (shapes or objects), that through generations produce apparently coherent and almost purposeful movement (or absolute stability), has lead to a naming and classification system for *Life* objects. Typically objects are classified by their behaviour, size, movement speed, and direction. These are normally divided into three phyla – *Stable Objects*, *Oscillating Objects*, and *Moving Objects* – and then subdivided within each phyla. *Stable Objects*, for example, are objects that maintain shape, size and position and are subdivided into the classes of *Inductors* (objects with no death cells but containing one birth cell) and *Eaters* (objects that absorb or 'eat' other objects that collide with them, while maintaining their shape). Objects are further divided into orders, typically assigned by object size and genera, which in the case of *Moving Objects* are organised by the speed in which the object moves. The classification of *Life* objects generally reflect the Linnaean system used in the biological sciences to describe and categorise all living things. While the names given to *Life* objects are generally not highly biological (spaceships, gliders, and pumps are popular inspirations for names), the classification system in which they are hierarchically positioned reflects contemporary biology.

From the progressive nature of individual cells 'dying' or coming 'alive' as the rules are sequentially applied to the grid, comes the emergence of recognisable patterns of cell activity that have been classified in the same manner as biological phenomena, creating narrative possibilities for *Life* that places it within the biological, computer and life sciences. While it is forgotten that 'movement' in *Life* is not the transfer of an occupied cell to a neighbouring empty cell, but the 'death' of one cell and the 'birth' of a new (so no actual 'movement' takes place), the pattern of *Life* as it plays out on a computer screen looks remarkably lifelike. The inference that *Life* suggests, as a computational regime, is that to some degree our own existence mirrors the rule based emergent patterns found in discrete space and discrete time. Far from just a game, researchers interested in

Life take the emerging patterns within its two-dimensional grid very seriously, and postulate the rudimentary foundations of our own reality within *Life*.

Interest in *Life* as a research tool has centred on the discovery of different objects, and the analysis of their behavioural patterns. This has led some researchers to make parallel inferences with the essence of carbon life and reality itself, found at the core of the computational regime argument. Mavericks of this standpoint, such as Fredkin, have taken the concept of *Life* and have wholeheartedly applied it to a conceptualisation of reality as a universal computational regime. The challenge for Fredkin and his peers is to ascertain how many dimensions that the grid of reality contains (*Life* is a simplistic two dimensional space – reality is considered to be far more complex) and what the underlying rules, or singular Rule as Fredkin is eager to postulate, are at its base. Others have seen the challenge in *Life* as the production of increasingly complex machines, with the ultimate goal of creating a Universal Turing Machine within the grid of *Life*. To this end, Paul Rendell presented plans in 2000 for a simple Turing Machine that could be theoretically expanded to fit the definition of a Universal Machine (see rendell.server.org.uk/gol/tm.htm).

Life is rule based, discrete, emergent and deterministic. Given a certain grid sequence at time 0, the appearance of the grid at any following time interval is set. Given the rules, grid size and original sequence, no other pattern is available at a given time slot and the system progresses in a logical defined manner. While it is deterministic, with each generation holey determined by the last, it is also unpredictable. The only way to realise what patterns will emerge is through the actual running of the program. *Life* is the common ancestor of this type of 'unknowable' determinism, found repeatedly in the computational regimes of the universal computer, responsible determinism and Finite Nature and the inspiration for later games such as *SimLife*, *SimEarth* and *Creatures*. All these share the common factor of the reducibility of all things to discrete units of information, changing over discrete time lapses. As a computer program, *Life* behaves in a logical manner just as any other program would. Extrapolating the operations of *Life* to the physical molecular world and universe, however, through the overlay of biological narratives and placing it within a theoretical framework of computational regimes, very modernist notions of space and time are recuperated and repackaged as the ontological underpinnings of reality. Here, space and time are postulated as discrete grid spaces and generational progressions, then re-associated as definition and model of how the world is, as the informational basis

of reality. Although the patterns and shapes that *Life* produce are too primitive to be classified as (artificial) life or to count as a true model or simulation of the physical world and universe, it is within *Life's* programming that the foundational structure has been formed, of the complexity deemed necessary for intelligent behaviour to emerge.

As the playing of *Life* is the logical emergence of grid patterns that appear through generations of game play, the skill for a player is not necessarily in the manipulation of emerging patterns, but in the setting of initial parameters that will provide interesting patterns once the game has started. The player is definitely externally placed to the *Life* environment, looking down and onto the world-grid in a patriarchal god positioning. The player, in this role of patriarchal god, decides the originating grid sequence, and through initiating the game brings 'life' and 'time' to the world-grid. On most contemporary computer based *Life* systems the player regulates time by controlling its speed, even to a generation on generation level (i.e. manually progressing each time slot on the computer), allowing for different 'times' in the *Life* grid-world. The other most noticeable area of patriarchal godly control the user engages in is the determination of the grid at time 0. The user is able to set the initial parameters of the game through the placing of the originating pattern of the grid. Even in the relatively simple grid-world of *Life*, it is the patriarchal god-player who plants the seed of life in the world; a genesis mythology is played through, even in this 'proto' artificial life program. It is the player's responsibility to arrange the grid in such a manner that the unfolding generations provide a display of lifelike behaviour and emerging *Life* things of predictability and regularity. As soon as the player activates time within the system, however, control is relinquished from the patriarchal player-god to the system as emergent god, aligning to the new postmodern spiritualities. Once time has begun, the player is in a purely observatory role; his or her obligation to the system has been fulfilled and *Life* will run according to its rules along its deterministic emerging generations of patterns. Being a patriarchal god in *Life* is largely a passive role. It is the system that continues the good work in the role of an emergent god once the program is initiated. The player can 'interfere' with the emerging generations and alter the gamespace at any time interval, manipulating the patterns in the grid. Technically, this action, in a computational regime, is establishing a new regime. New parameters have been set with an associated new history. Time is reset to 0 and a new regime would be initiated, leaving the program to redefine its emerging patterns.

In the mythic possibilities played through in *Life*, the true power does not reside with the patriarchal player-god, but rather within the system itself as an emergent god, in the application of the rules that define the emergence of the changing grid-world. It is this application, across continuing discrete time frames, in which the emergence of lifelike behaviour takes place. The player's role is more removed, deciding on the originary grid-world state, triggering the passage of time and analysing the resulting patterns that emerge, dictated by the rules of the game. Spiritually, played through in the mythic possibilities it presents, *Life* foreshadows and lays the foundation for a belief in a central dogma, focused around the godly process of emergence itself, and the connected holism of the universe through informational ties of connectivity. The central dictate of simple rules forming the core of the emerging behaviour of the entire grid-world positions the player outside the true source of power within the system; the continuing action of the system determines the pattern of the grid-world in the adherence to the rule set over the course of time, while locating power within the system itself. It is impossible to locate control in any one aspect of *Life*, as would be expected within a scientific and spiritual discourse of interconnectivity. It is only though the intra-action between a player and the game that the system works, as well as between the different components of the game with the demarcation of a given grid set of a defined size in evolution over generations in time of continually applied rules.

The *Game of Life* contains all the ingredients for the development of computational regimes and increasingly complex artificial life emplacements: discrete informational units conforming to simple rules, an interconnected network of interdependence, and the emergence of recognisable and classifiable behaviour patterns that display lifelike behaviours. All that is missing in the progression to artificial life is the addition of self-organisation, evolution and cybernetic feedback loops to make the movement from lifelike to life itself. Within the scientific and spiritual discourses that surround artificial life and computational regimes, the *Game of Life* sets assumptions that are carried forward through future programs and games. Scientifically, and critical to the deterministic theoretical underpinnings of computational regimes, *Life* assumes the discrete nature of both time and space. It from this assumption that the concept of emergence develops and is defined as a deterministic force; it is only from the initial structuring element of the possibility to define each grid point at a time reference that future generations are knowable. Time and space have been made discrete, and the state of each is defined by the rules of the system; by knowing the rules and the

state of the system at any point in time, the state of the system at any *other* point in time can be calculated. Transferring notions of discrete space and time and deterministic emergence from logical computer programming to the material molecular world and universe has ontological and political effects. Spiritually, as the application of the rules of the system to one grid point depends on the states of the grid points that surround it, there gains the assumption of the interconnectedness of all things. Every grid point within *Life* is dependent on its neighbours for defining its state, supporting a developing spiritual discourse of interconnectivity, holism and the cosmic Christ. Additionally, *Life* establishes the position of the player within evolutionary artificial life computer games, exterior to the system looking in; a typical patriarchal god placement. Adhering to a postmodern spiritual discourse, play involves the release of power to the system, positioned as an emergent god. These competing and co-dependent god positions are present within *Life*. Within the *Game of Life*, the mythic possibilities of construction, creation and change are all present and accounted for, giving a narrative structure upon which subsequent projects and games have developed.

Blind Watchmaker (Biomorphs) (1986 -): Evolution itself

If the *Game of Life* preconfigures computational regimes and forms the prototype upon which artificial life emplacements have been conceived, the *Blind Watchmaker* introduces the concept of digital neo-Darwinian evolution. Accompanying the book of the same name, the *Blind Watchmaker* game (more commonly known as *Biomorphs* – named after artist Desmond Morris' surreal animal like shapes) is an early artificial life tool, developed by iconic neo-Darwinian biologist Richard Dawkins, as a means of demonstrating his theory of evolutionary process and evolutionary space in action. *Biomorphs* diverges from most games and programs that make up this genealogy. It does not conform to the same programming structure introduced in the *Game of Life*. Similar spiritual and scientific discourses, however, are played through in the mythic possibilities offered by the game.

In *Biomorphs*, the user is presented with a three-by-three grid of nine line figures, or biomorphs, each varying slightly from one another. It is the player's responsibility to choose the biomorph that will continue to successfully breed the next set of figures. Upon confirming his or her chosen individual, that figure is taken through to the next generation and is used as the parent for the next set of biomorphs, consisting of variations by one genetic movement each from the

parent. As a tool to demonstrate the concepts that Dawkins' elaborates on in the *Blind Watchmaker*, *Biomorphs* is steeped in anthropomorphised language and strong metaphoric overtones, the project produces a heavily biologised meaning for progressions of computer illustrated stick drawings, preparing and aligning the user within a framework in which Dawkins can make his evolutionary argument. The power of *Biomorphs* as an evolutionary descriptor is not in the program itself, but in (Dawkins') translation and mythologising of events. The program cannot be understood without the accompanying evolutionary biological narratives it associates with, and produces. It is only through the assembly of the intra-action of the player, the program and the biomorphs in the digital genetic space, and within the language used to make meaning from the game, in which *Biomorphs* comes to make sense as a biological tool. This seems to run contrary to Dawkins' own intent with the program, as he does not want to "prejudge the issue by building-in specific animal pictures to start with. We want them to emerge solely as a result of cumulative selection of random mutation" (1986: 62). Even here, however, Dawkins has already structured the biological into the production of meaning in the game – he builds 'random mutation' into the game, an event associated with biological phenomena. We are encouraged to expect 'animal pictures' to emerge at some point through play, from figures that have been specifically designed to display anthropological similarities. Kember takes this further:

> In other words, [Dawkins] is selecting 'evidence' of evolution or creating an evolutionary pattern which he then uses as evidence of evolution. With this sleight of hand, Dawkins captures the paradox of creation which is at the heart of the ALife project: the God-like act of creating life is 'stolen' or appropriated by man and then credited to the computer. (2003: 55)

The result is the production of narratives of computer evolution producing remarkably pseudo carbon-biological results (in at least their two-dimensional visual aesthetics). Through progressive generations, the complexity of the stick figures increases as the player selects for shapes of interest. Forgetting that the biomorphs visual appearance is not random, and instead already humanly created or formulated through the artistry of Desmond Morris; for Dawkins, the search for the biological within the computational brought startling results, with the finding and breeding of insect type shapes. At each generation, choosing the most insect-like while his "incredulity grew in parallel with the evolving resemblance" (Dawkins 1986: 72), Dawkins determined the arthropod direction *Biomorphs* took. With excitement, Dawkins sourced a collection of animal shapes including a

'swallowtail', 'scorpion', 'jumping spider', and 'man in hat' amongst other familiar animals and shapes (1986: 75). It is through these anthropological visual associations between three-dimensional biological forms, and two-dimensional computer generated line drawings, that Dawkins structures a feeling for evolutionary processes within a computer program. By closely entwining the biological with(in) the computational, Dawkins creates an exploratory computer genetic space of human guided evolution. It incorporates human and computer intra-action, in the production and exploration of a collection of computer aided stick figures of related complex shapes. Nothing new is produced in *Biomorphs*; all of the possible shapes already theoretically exist in what Dawkins has termed the 'genetic space' or 'Biomorph Land' (1986:81-82). By having a set number of genes with a set number of genetic permutations, there are a finite number of possible genotypic outcomes within the game. With no environmental pressures present to muddy the phenotypic expression of the biomorphs genetic make-up (and therefore creating a direct translation from genotype to phenotype), each genotypic expression holds one potential realisation, equal to one place on the map of genetic space. The genetic space of the program is the entire potentiality for the set of genes and variants that make up the biomorph genome. It is deterministic, as it pre-determines and maps all possible genotypic/phenotypic outcomes within the game. Every genotype has a singular, mapped phenotypic potential in genetic space. The way that *Biomorphs* operates to move the player through the genetic space by the mutation of chosen biomorphs, however, differs from the other artificial life programs examined.

Unlike games based in the genetic algorithms first developed in the *Game of Life*, *Biomorphs*' rules do not determine the state of the space in the progression of each time frame within the system. Instead, they guide the mutation from generation to generation of the player-selected figures. It is the intra-action here, between human, game and game elements that generates time, plots history, chooses direction, and decides on the route of evolution. The results of evolution are deterministic, as they are pre-expressed within the biomorphic genetic space and routed through the mutational rules of the game. The path of evolution, however, is not. Directing the path of evolution is the human player's contribution to *Biomorphs*; through continual choices they guide the development of generations of biomorphs. Dawkins gives this the term 'artificial selection,' as the selection process is determined by exterior criteria that are not related to the inherent fitness of the individual biomorph. With no environmental pressures to define fitness, no biomorph is inherently more or less 'fit' than any other. As

players, we are mythically placed in the role of patriarchal god, to choose the biomorph that takes our fancy for each generation, from outside and above the gamespace. Forgetting that even pedigree dogs have been bred to suit particular jobs and environments, Dawkins likens the purely subjective nature of selection within *Biomorphs* to human selection within animal husbandry:

> The human eye has an active role to play in the story. It is the selecting agent. It surveys the litter of progeny and chooses one for breeding. The chosen one then becomes the parent of the next generation, and a litter of *its* mutant children are displayed simultaneously on the screen. The human eye is doing exactly what it does in the breeding of pedigree dogs or prize roses. Our model, in other words, is strictly a model of artificial selection, not natural selection. (1986: 69-70)

As the selecting agent within *Biomorphs*, humans gain a patriarchal god-role, similarly positioned as in the *Game of Life*, above and outside of the game's digital environment. It is through this positioning and role within the game that humans gain a degree of power. Selecting each generation's successful biomorph gives the player the godly power of choice, deciding the criteria for selection and executing this choice and effectively exercising the power of life and death, extinction or reproduction. It is this execution of choice that drives the system forward, providing an engine and measurement of time, determining the navigation of the genetic space. In *Biomorphs*, time is reduced to the progression of generations; the creatures are static, only the potential ability to reproduce associates them with any lifelike attribute. This is life itself stripped back to its bare essential neo-Darwinistic bones (or perhaps more aptly, genes) – there is no *living* in *Biomorphs*, only the act of mutation, reproduction, birth and death; all aspects that are not performed by the player or game rather than biomorphs themselves. There is no biomorphic intra-action and no real form of reproduction that occurs by the biomorphs, it is forgotten that these actions are operated computer programming outside of each individual's coding. The biomorphs do not intra-act between themselves and do not actively contribute to their intra-action with human users; they are frozen static entities. The only movement and measure of time is the extermination of a set of biomorphs with their replacement by a new set – mutated adaptations of an individual from the prior generation. As befits *Biomorphs*' neo-Darwinian definition, life within the game is the evolution and progression of generations of code through each additional time unit, triggered through human-game intra-action.

With the dependence on the player for the progression of time and artificial selection in the evolution of the biomorph set through time, it appears that humans have a strong position of power in their patriarchal god standing within the game. Here it is only through human intra-action that the game progresses, unlike in *Life*, where the game progresses on its own once initiated and humans are largely relegated to the role of spectator. Fulfilling the role of a patriarchal god in *Biomorphs* is definitely participatory. In this sense, the human player holds the power of time progression and history creation. The player chooses when time occurs (moving forward on each choice of a biomorph) and the direction of history (the choice of each biomorph, leading to the story of biomorphic evolution through time). It is up to the player to decide that insect biomorphs will be developed rather than swallowtails, and it is their choices that decide the most insect-like shapes. At first glance, it appears that the mythic possibilities of the game structure the player, as a participatory patriarchal god that holds and retains the power to guide the system forward. Within this structure, the system does its best to understand, and provide the player with favourable biomorphs. Considering *Biomorphs* within such a scenario, it is the player that controls the system; the system is but a servant in the player's sovereignty. As with *Life*, however, this appearance of power is illusionary. Again the association between player and game finds a shared decentralised control that builds a relationship between the player as a patriarchal god, and the system as an emergent god. It is not the player who controls the physical attributes of the biomorphs. This is computed by the system adhering to the rules of mutation programmed into the game. Players choose what they believe to be the biomorph of the present generation that most closely resembles the desired biomorph in the next. The rules of mutation programmed in to the system's programming determine the aesthetics of the next generation, and it is the assembly brought together within the program as an integrated whole that shapes the outcome of biomorphic evolution. Spiritually, *Biomorphs* displays the same duality between patriarchal and emergent god found in *Life* and throughout artificial life emplacements and computational regimes. Scientifically, the player is incorporated within the assembly of agents, in a distributed network of control and power, that plays through the evolutionary story of digital life absolutely reduced to information.

Dawkins' own adventures with *Biomorphs* highlights this struggle and co-dependency between player and system. Dawkins reports that his initial play with the game resulted in following an evolutionary path to an insect-like outcome. He was so excited that making a record of the final insect biomorph escaped him,

and he was forced to retrace his steps in a second attempt to achieve the same shape (1986:78). During this second time, Dawkins was unable to find the same path through the biomorphic genetic space, and spent extra time attempting to find his way back to similar shapes he found during his first go. While highlighting the enormity of the genetic space within *Biomorphs* with many close relatives giving diverging evolutionary results, it also exemplifies the player's lack of direct control over the system. In his search for his elusive insect biomorph, Dawkins must conform to the system and do his best to guide evolution in the direction that he hopes will bring him to the placeholder within the genetic space, which displays the biomorphic phenotypic attributes that we recognise as insect-like. He becomes a part of a system of intra-actions that together determine the results of gameplay. His actions neither directly control the course of events, nor are impotent without effect. They integrate within the larger system that, as a whole, moves the game forward.

A second example of Dawkins demonstrating an at least partial relegation of control to the system can be found in the inability to evolve a true insect shape. In his search for an anthropoid biomorph, Dawkins is actually thwarted in his attempts; he is only able to produce a figure with eight legs rather than six legs normally associated with the insect shape (1986: 73). His inability to find a biomorph with the correct number of 'limbs' in its shape highlights the limitations of the system; no such shape exists within biomorphic genetic space. Given the genetic variability of the biomorph genome, there is no combination of genes that, when brought together as a biomorph genome, exhibit a phenotype with six legs. Dawkins' search will ultimately go unfulfilled, as is (pre-)determined by the system, and he will have to settle on a biomorph displaying an additional two limbs. For Dawkins to be able to have the potential of a true anthropoid, the core genetic make-up of the biomorphs and how their genes are expressed would need to be altered, an action outside of the remit of the player of the game. Such an alteration would need to occur within the programming of the game and would effectively change the game itself; *Biomorphs* with a potentiality of a six-legged figure within its genetic space would be a different game. Dawkins is left with only the ability to intra-act as part of the system, moving evolution towards an eight-legged figure. He lacks the power to move outside the genetic space of the game as it is.

In presenting the concept of evolution with our historic travels, *Biomorphs* also highlights the importance of the anthropomorphised stories that are overlaid on

the digital activities of the program in order to make sense of the game. The scientific and mythic discourses played through in *Biomorphs* do not gain attention from what they demonstrate as computer programming, because there is little of interest in the navigation of the object set on its own. Within solely computing terms, *Biomorphs* is simply a manner of computer aided user movement through a predetermined code set. Meaning is created within a highly biologised narrative structure in which the game is immersed. Here, the game is understood through illuminating the fundamentals of life itself within a neo-Darwinian framework. Taking biomorph appearance for 'fitness,' player choice for 'artificial selection,' programmed code redistribution for 'mutation,' and the movement of one selection set to the next as 'reproduction,' a grand narrative of neo-Darwiwian life and evolution is produced. It is only through the importation of these specific narratives of life itself, structured around the game and in play, that *Biomorphs* has interest. Dawkins uses *Biomorphs* as a tool to demonstrate, structure and align his audience to the conceptual arguments made in the *Blind Watchmaker*. Playing *Biomorphs* is largely an exercise in structures of feeling, introduced to the culture of neo-Darwinian evolutionism where life itself has effectively been reduced to reproducing strings of code. Dependence on a surrounding biological narrative structure continues through artificial life emplacements and games.

Tierra (1989 -): The primordial soup

As previously highlighted (Hayles 1996b, Kember 2003, Helmreich 1998), *Tierra* is also highly dependent on the narratives that surround the program in order to make sense of play and to be able to produce meaning. *Tierra* brings the concepts of self-organisation (*Life*) and evolution (*Biomorphs*) together in a digital universe of competing, reproducing and evolving strings of computer programming code. In doing so, *Tierra* is the first computer program to make the claim that its inhabitants are truly alive; creator, biologist and leading American artificial life researcher Thomas Ray views Tierrans as actual instances of life. From the introductory declaration "information wants to be alive", *Tierra* goes forth to attempt to demonstrate not only this desire for life, but that information is the fundamental building block of life itself, silicon or carbon. Created as a research tool to explore life and evolution, *Tierra* has become popularised through the ease of use as a program for 'hobby' artificial lifers, and the prototype model for similar research based artificial life programs.

As with *Life*, *Tierra* operates as a computational regime: a self-contained digital universe of both discrete space and time that runs logically according to its rule-based programming. Its underlying conceptualisation and narrative is rather simple: to create a robust digital universe that can support computer algorithmic 'creatures' that reproduce; add mechanisms of mutation, sex (to stimulate evolution) and death (so that the world does not just fill up); and see what emerges. In other words, *Tierra* is the construction of a digital emplacement that caters for the necessary conditions for the creation of neo-Darwinian life that changes through evolution over time. *Tierra* follows the mythic journey of construction, creation and change that characterises evolutionary computer games and programs. As with *Biomorphs* before it, making sense and understanding the operations of the computer code within this mythic structure that shapes *Tierra* is only possible when attached to the heavily biologised and anthropomorphised narratives that accompany it. Ray's own preliminary computational description of the system is one of his only largely non-biological descriptions of *Tierra* (but even here, as we can see, evolution, mutation and natural selection still slips in):

> The C code creates a virtual computer and its operating system, whose architecture has been designed in such a way that the executable machine codes are evolvable. This means that the machine code can be mutated (by flipping bits at random) or recombined (by swapping segments of code between algorithms), and the resulting code remains functional enough of the time for natural (or presumably artificial) selection to be able to improve the code over time. (Ray & Virtual Life 1995)

Ray quickly biologises the explanation of *Tierra* programming, where machine code becomes 'creatures,' the digital space within the virtual computer becomes the 'soup' and the talk includes evolution, mutation, births, deaths, genebanks, genomes and ecological analysis. Whilst Ray's use of biological terms and metaphors highlights his lack of distinction between natural and artificial organisms (Kember 2003: 85), it is difficult if not impossible to make sense of the programming of *Tierra* without its biological metaphoric overlay. It is only within the scientific and spiritual grand narratives of artificial life, and of a specific neo-Darwinian evolutionary definition of life, that meaning is produced within *Tierra*, because a narrative structure of species lines developing and competing for the scarce resources of CPU time and space in a digital microcosm of life itself is built. Tierrans are static creatures and, as with biomorphs, they have no activities of living associated with them, no active metabolism, no movement, and no true sociability with other Tierrans or with the user of the program. They are inert

creatures that are replicated by the system's programming as each allotted CPU time is divided; they are technically not even active for their own replication. The programming of the virtual computer's operating system reads and copies the code of the creatures; this is not an operation of the creatures themselves. Against this, Ray associates a degree of interaction and sociability to species of Tierrans within the narratives he produces from running the program, with species that steal other creatures CPU time allotments or make use of parts of code from other creatures, in order to successfully reproduce and regularly develop within the Tierran soup. This displays interesting developments within the evolution of the machine code that, if Tierrans were actually knowingly competing, show ingenious methods of gaining reproductive advantage over other Tierran creatures. There is no actual intra-action, however, between creatures occurring at this level. Any intra-action at this level is between each machine code 'creature' and the virtual computer's operating system. Tierrans do not replicate themselves or knowingly or unknowingly aid in their evolutionary paths, or have sociability with other Tierrans. It is only through the overlay of an associated story of life and evolution, paired with the continuing events of *Tierra*, that any of these meanings that Ray projects onto Tierrans are produced, forgetting the role of the virtual computer's operating system in reproduction. The story of Tierran life is the production of and running through the mythic possibilities of construction, creation and change within a neo-Darwinian framework. The associated grand narrative of informational evolutionism becomes a necessary part of the production of meaning in the running of *Tierra*. It is the intra-actions between *Tierra*, the user, and the mythology supporting *Tierra* that together produce meaning of digital Tierran life. Here, the evolutionary narrative that Ray associates with *Tierra* produces structures of feeling that align the user with the game, and an understanding of this associated narrative becomes critical in the production of meaning through play.

As a research tool, *Tierra* is concerned with the observational measurements of the evolutionary narratives taking place. Although there is no visual display of creatures, because they are left within the digital universe with the user's imagination to give them physical attributes, the user is presented with numerous methods of gaining and interpreting data on all aspects of the ongoing developments within the Tierran digital universe. This panoptic system details all aspects of Tierran life, from the number of creatures present in the soup, an analysis of the genetic make-up of the different species present, locating dominant species, to tracking individual creatures and giving analysis over time

periods. The user is also able to adjust many of the variables within the program, giving a robust system in which to experiment. The user can determine the parameters under which the computational regime operates, deciding how the rules will work. Although the user can control the degree to which the rules are applied, they do not have the ability to fundamentally change the rules themselves. These are tightly determined by the programming, and the user can only adjust the extent to which the rules operate along a sliding scale for each parameter of a set minimum to maximum. While the degree to which mutation rates and haploid sex rate in developing evolution are within the user's control, the user has only these two variables in which to effect genetic change. They are unable to add new methods of genetic change to the program or to construct a system with no genetic change variable. The user can determine how the rules work, but not what they are. Therefore, while there are innumerable histories that can be created in the running of *Tierra*, the programming and system structure all of these along similar paths.

As with the other examined programs, the user, with a degree of control on the system, initially realises a position of power within the assembly brought together in *Tierra*. Positioned outside the soup, the user retains the traditional patriarchal god positioning we are finding common within the genealogy of artificial life research programs and games. Scientifically within *Tierra*, this position takes the role of scientific researcher, observing and measuring the experimental ecology of the Tierran system. But the distinction between scientist and patriarchal god is unclear in *Tierra*; both share the same attributes of position and power. Despite the position the user takes, the monopoly over control and power, which the user actually achieves, is again limited by the system, reflecting the shared power between patriarchal and emergent gods. Although the user has access to all variables within *Tierra* and can adjust the degree to which these variables are actioned upon within the program, the user cannot change what the variables are or the basic rules by which they operate. This guarantees the technical operation of the computational regime; it is by protecting the fundamental programming that provides a shield against the creation of a system that would not work. More importantly, it limits the power of the user and the meanings that can be produced through use. Applying this in a spiritual sense, the realisation of the power of the system has not been lost on researchers in the field, and users balance their traditional god positioning with the power the system holds.

In the production of meaning, the similar paths along which narrative scaffolding and mythic possibilities shape the narratives that are produced in the running of *Tierra* structure specific meanings of life itself. Kember finds that *Tierra* highlights the apparent tension between the scientific and religious discourses at play:

> In fact it might even be said that Ray embodies the competing strains of religious and scientific (including science fictional) discourse, with genesis in one corner and natural selection in the other... Ray not only creates life, but also creates the environment within which life evolves. (2003: 60)

There is a tightly knit collection of familiar statements about life that can be produced through the playing of *Tierra*, structured around a neo-Darwinian evolutionary definition of life and the creation and determination of computational regimes. Independent of the direction or path that the system follows, the narratives that are formed, and the history that is created, the story produced through running *Tierra* remains consistent. Life itself is reduced to its bare neo-Darwinian essentials, as propagating strings of information that are tied into a larger narrative of connection, competition and progression. Through running the program, *Tierra* actively recuperates a story of capitalist enlightenment played out in an evolutionary story of life itself, where the overriding objective is gaining reproductive advantage against a succession of species with increasing complexity. Developing onwards from the narratives of life that have been produced in the games investigated so far, the narrative that emerges from *Tierra* equates information with life itself. It also equates reproduction and evolution as the purpose and defining characteristic of life, and equates competition for scarce resources as the driver for progression. It equates speciation, increased complexity and the development of reproductive advantages as the objective of competition. It places this equation for informational evolutionism within a computational regime, where the connectivity of the system and its decentralised nature of control and power are matched by a cosmology of universal interconnectedness.

Scientifically, the user of *Tierra* typically approaches the program as a researcher interested in patterns of evolution impossible to map, monitor or produce in carbon biology, but where the results can be mapped back to the carbon biology it simulates and supplants. The Tierran ecosystem becomes a Petri dish – a microcosm of the world – with numerous measuring tools available for the user to realise a panoptic view of the ecosystem. Spiritually, this ecosystem becomes another world where there is a tension between the player as patriarchal god,

looking above and on to the Tierran world holding the power to control the parameters of the virtual universe, and the system as emergent god powering the process of change. The grand narrative of life itself that develops our story from the *Game of Life*, where the objective of emergence was continued emergence. In *Tierra*, emergence is associated with continued and forward moving progression: the increasing complexity of reproductive tactics and genetic composition over time. *Tierra* introduces a game of life itself on a grand narrative scale. It is this plot of ever increasing and progressive complexity, driven by the competition for scarce resources, that continues through commercially developed evolutionary artificial life computer games like *SimEarth* and *SimLife*.

SimEarth (1990 -): The Gaian scientific spirituality

SimEarth is amongst the first generation of 'sim' computer games produced by games company Maxis specifically targeting the home computer games market. Sim games, or 'god-sims' as the genre has also been referred to, share a common simulation element with the player in a position that is recognisable to the more research orientated programs so far examined, outside and above the gamespace with a panoptic vantage of the events of the game and leading to the games' godly nomenclature. The challenge of *SimEarth* is to develop and manage a sustainable world ecosystem, maintaining the Earth as a holistic living system, balancing organic living systems with non-organic regulatory systems such as the atmosphere and geosphere. *SimEarth* boldly associates itself with the scientific and spiritual philosophy of Gaia, including an introductory section in the instruction book by James Lovelock, which further explains the scientific and spiritual claims of Gaia and acts to structure feeling into the game's culture. As with other artificial life programs surveyed, *SimEarth*, steeped in Gaian theory, is about the interconnectedness of all things:

> [Gaia] sees the evolution of the species of organisms by natural selection and the evolution of the rocks, air and oceans as a single tightly coupled process. In Gaia the organisms and their material environment together constitute a system which is able to self-regulate climate and atmospheric composition. (Lovelock 1990: 3)

Within *SimEarth*, Lovelock not only connects the organic and non-organic within a holistic system, he also structures the regulation of self-organisation as a strong aspect of play within the game. For Lovelock, not only do the individual components that make up the worldly system evolve, but the Earth as a living system in itself also evolves. As a living system the Earth is self-regulating and

self-organised. Within this concept of self-regulation, *SimEarth* progresses our developing grand narrative of life itself, through the addition of self-organisation and regulation, through cybernetic feedback loops as fundamental aspects of living systems, and through the intra-action between living and non-living in the conflation of the interconnectedness of the system as a holistic entity. Unlike in *Tierra* where self-organisation was largely an imposed concept attributed to static strings of code, within *SimEarth* the different components of the worldly system are connected and regulated through interdependent cybernetic systems, which create a self-regulating and self-organised unit of Earth or living world on a global scale. The challenge for the player is to adjust the parameters of this system, in order to progress the complexity and evolution of the creatures that inhabit the planet and the success of the planet itself.

Structured within this holistic approach and the interconnectedness of all things, gameplay in *SimEarth* focuses on the player being able to "develop, manage, and preserve his/her planet within allotted energy budgets" (Bremer 1990: 2). Moving on from *Tierra*, where the 'space' of the virtual universe or soup was considered only as a limiter to the number of creatures that could be present in the soup to drive competition, space in *SimEarth* is a component of gameplay. In *SimEarth* the management of the environment is as critical as the management of populations of beings (referred to as SimEarthlings). The player must effectively maintain the parameters of the sum of the planetary system within optimal equilibrium conditions, ripe for the maintenance of life and the emotional wellbeing of the planet. By introducing this focus, *SimEarth* takes the definition of life itself out of the strictly neo-Darwinian definition found in *Biomorphs* and *Tierra*, and introduces a cybernetic elements to the genealogy. In its Gaian pretence, *SimEarth* is a game about the management of cybernetic systems of feedback, control and equilibrium, treating a planetary system as a regulatory and cybernetic whole. It is by the adjustment of feedback mechanisms that the player maintains a system equilibrium that keeps the anthropomorphised and personified figure of the Earth, as displayed in the Gaia game window on the monitor, in 'bliss.' It is here, again, that the move to a cybernetic definition of life itself is fore fronted. Where *Tierra* and *Biomorphs*, within a neo-Darwinian framework, have been concerned with the evolution of static strings of code that otherwise have no meaningful intra-action with their reality, the concern with *SimEarth* is the intra-action between all aspects of the system. It introduces a system of interdependent feedback loops amongst the different elements of the game, developing the interconnectedness of the system to an increased complexity. The entities that make up the planetary

systems of *SimEarth* move beyond simple interconnections between code, programming and player, and form complex relationships between all the various agents and components of the system that come together as an assembly in gameplay. But even as the system increases in its complexity, a central theme recurs – an evolutionary grand narrative of ever increasing complexity through informational evolutionism and an underlying fundamental determinism of computational regimes.

Whilst the challenge in *SimEarth* is the maintenance of cybernetic equilibrium balances, keeping the Earth 'happy' and life flourishing, this does not remove the game from following a directed evolutionary path that mirrors *Tierra*'s decidedly modernist enlightenment narrative of increasing complexity and progressive evolution. Although acknowledged as both a limitation and bias of the game (Bremer 1990: 6), evolution in *SimEarth* closely resembles the historicity of Earth, and continues with an extrapolated trajectory that sees civilisation reach a technological end point of escaping in an exodus of the sentient SimEarthlings in city sized space ships. This common transcendence theme, also seen in *SimEarth*'s gaming cousin *SimCity*, reflects modernist desires of transcendence and escape, a game end that sits in a strange irony considering the Gaian philosophy in play. Although intelligent mammals (humans) are not the sole form of intelligent SimEarthlings that can evolve sentience in *SimEarth*, it is assumed that "intelligence is an evolutionary advantage" (Bremer 1990: 6). Structured and plotted in game play through designated evolutionary jumps, the course of evolution is structured so that it always leads to an intelligent form of life, and a similar pattern of technological development that has been found in Earth's Western civilisations. There is an assumed directional nature to evolution, a progression of ever increasing complexity to a purposeful goal (of escape). The stories produced through *SimEarth* tie this progression of the evolution of the games four basic systems: the geosphere, atmosphere, biosphere and civilisation, within an interconnected cybernetic structure in which the path of development and transcendental end objective remain constant. When played successfully, gameplay in *SimEarth* always evolves intelligence of a certain kind (if not a certain life class), a certain developmental path of civilisation, and a common end scenario. The gameplay that can be produced, the narratives that can be produced through gameplay, and the meanings about the nature of life and evolution that can be produced are highly structured through the underlying assumptions and programming of the game. In the unfolding of history and the development of civilisation, the mythic possibilities of change within *SimEarth* are

highly structured, developing narratives structured around a singular narrative of life.

As a key agent within the assembly brought together in the playing of *SimEarth*, the player affects the historical developments, and, as with *Biomorphs*, guides gameplay's direction. The player is responsible for determining the parameters of a host of features within the four planetary (sub-)systems of the worldly system that determine the cybernetic systems of feedback and control, as well as physical shaping the planet, populating SimEarthlings, creating technological advances, and triggering major events ('acts of God'). To achieve the (unacknowledged but implicit) ultimate evolutionary goal of exodus – "the closest thing in SimEarth to a 'win condition'" (Bremer 1990: 126) – it is necessary for the player to pay careful attention to the different measurement tools available to their disposal, effecting tweaks and changes to feedback parameters, pushing evolution and technology towards intelligence and advancement, and triggering events to change the course of history, all while keeping the Earth happy and healthy. Without player intra-action as an integral part of the game system, history in *SimEarth* stalls, the cybernetic systems that make up Gaia degrade and the Earth becomes 'unhappy' and 'unwell.' Unlike the *Game of Life*, where the player's role was primarily as observer, here the player maintains a participatory role in the continued success of the evolution of the planet and game. That is not to say, however, that *SimEarth* departs from computational regimes in a seeming lack of determination; *SimEarth* remains deterministic and retains its composition as a computational regime. *SimEarth* camouflages its deterministic nature, and creates interesting gameplay. If the game receives little or no player intervention it is unlikely that evolution will occur to such a degree to advance gameplay forward. It is the player's intra-action with the game that creates the conditions (if the player is skilful) that lead evolution along a path of increasing complexity. It is a measure of success within the game to how much the player's adjustments to the parameters of the rules determine successful historic paths. If the player does nothing within the game while it runs, *SimEarth* maintains the deterministic framework of computational regimes, but the paths followed by the system will not promote the conditions necessary for the evolutionary advancement of the system.

Spiritually, the player is placed in the role of a participatory patriarchal god as a divine figure in the game, immersed intimately in the day-to-day occurrences and happenings of his or her charges, ensuring the forward advancement of the game

and of evolutionary progress. Within the mythic possibility of change, the player's power within a participatory patriarchal god role arises from the ability to alter the state of the computational regime, either through changing the parameters of the system (adjusting variable rates) or by effecting a direct change to the state of the system (adding SimEarthlings, initiating an event, pushing evolutionary or technological advancement). It is such alterations that drives gameplay and challenges the player. The player's involvement with the game masks, but does not forfeit, the underlying deterministic nature and power of the system as a computational regime. *SimEarth* remains fundamentally deterministic, finding simple rules that produce emergent higher-level behaviour within a system of discrete time and space. As with *Tierra*, the player can only influence the scale and parameters of the elements that make up the programming, but not the underlying programming itself. As computer code, the game programming is inherently rule based and logical; as a cyberspace emplacement, it forms a computational regime. The joy of playing *SimEarth* comes from the challenge of re-adjusting the parameters of the mechanics of the game's programming to create working cybernetic systems of feedback and control, which allow for the evolution of the worldly system and its living and non-living components. It is the challenge of becoming part of the game's culture, learning the system, making the system intuitive and being able to integrate actions that will adjust the system in which desired futures can emerge. The player must conform to the programming and logic of the game. Attempting to create game actions that deviate from the evolutionary assumptions of the game gain no advantage to the player; injecting higher life forms into the world before evolution is ready for them will result in the population quickly dying out. Jump to an advanced civilisation and the player could jeopardise the population altogether. The development of the mythic possibilities of change must be adhered to in order to produce meaningful gameplay.

SimEarth's challenge largely derives from the ability of players to adjust to the program and to understand how the multitude of tools work and being able to make predictive judgements about what courses of action will produce desired outcomes. For Kember:

> Each planet [within *SimEarth*] is a system, and it quickly becomes clear that where the tools are for playing with, the rules are to be learnt. Te challenge is to understand how the rules work and then apply them by using the tools. (2003: 86)

Gameplay can be seen as investigative, both in the player's testing of tools to gain an appreciation of how things work in the production of intuition, and in the player's ability to test different hypotheses through creating different scenarios in experimentation through gameplay. *SimEarth* boasts a number of different experimental modes and situations that the player can use precisely for this purpose. In 'Aquarium' the player is presented with a world without any land mass. As land is needed for the progression of technology, the player is given the challenge to "create continents on this planet so that civilisation can evolve" (Bremer 1990: 110). Other scenarios present the Earth at various stages of development (Cambrian, modern day) or even a Mars to 'terraform' and make "fit for human occupation, and colonise the planet" (Bremer 1990: 115). The game's culture is structured through experimenting with the game, and through forming intuition on how to manipulate scenarios through the use of game tools. This leads to a common sense understanding of how life and the (sim)Earth are considered as regulatory systems. *SimEarth* creates close ties between the game, its use as a simulation and its relationship with the physical world around us, especially with additional scenarios rooted in our own planetary history. The stated purpose of the game manual, to "teach you how to use SimEarth and to introduce you to the basics of Earth Science" (Bremer 1990: 8), is illustrative of the connections that the producers of *SimEarth* are attempting to create. In this manner *SimEarth* refuses to remain as just a game, and makes active connections in the production of new meanings of life itself, the nature of reality as computational, and the living status of Earth itself.

SimLife (1992 -): The genetic playground

Where *SimEarth* concerns itself with the macro-management of worldly systems, *SimLife* immerses itself in the micro-management of an ecosystem and the creatures that inhabit it. It continues the development of the scientific and spiritual mythic grand narratives of artificial life and life itself, both in the complexity of the programming and the levels of adjustments available to the player, and in the connections the game makes with its carbon kin, all within a cybernetic definition and rhetoric of life itself. *SimLife* presents a digital ecology and ecosystem in which the player can manipulate a vast range of variables, to experiment, play with and support the growth of life on both an individual and population level. A complex simulation tool, and as with *SimEarth*, promoted and used as an educational aid, *SimLife* disrupts boundaries between entertainment and education. Such games present worlds that "are by no means alternative.

They are mirror worlds which reproduce – through simulation – hegemonic discourses of origin and of natural/socio-economic evolution" (Kember 2003: 91). As a game, *SimLife* challenges players to create and manage successful digital ecosystems. As an educational tool, *SimLife* forges ties with ecology, population studies and evolutionary biology. As an artificial life emplacement, *SimLife* presents new relationships between carbon and silicon life-as-we-know-it and tempts the user to see new visions of life-as-it-could-be. In other words, the creatures of *SimLife* forge close ties of kinship with their carbon cousins, but also move away from the known, to new unusual combinations with no direct correlation in the carbon world. Actively acknowledging its artificial life credentials, *SimLife* forges links between its digital cyberspace emplacements and the physical world:

> What can be considered the ultimate goal of SimLife is to look beyond the game, to understand the real world with its millions of species with their combined billions of genes are all interrelated and carefully balances in the food chain and the web of life, and this balance can be upset. (Bremer 1992: 3)

The primary objective of *SimLife* is the creation and maintenance of populations of creatures, attempting to create balanced ecosystems of various plant and animal species suitable to the varied environmental conditions within the gamespace. While relatively simple, *SimLife* creatures display a genetic structure that when expressed translates to individual behaviour and intra-action with other creatures and the environment. Unlike *Biomorphs* and *Tierra* where individual creatures had no true intra-action with each other, the creatures in *SimLife* intra-act with each other and their environment on an individual basis, moving forward from *SimEarth* where intra-action was primarily concerned at the population level. Each creature's actions are determined by its rules of engagement with its environment; the specifics of these rules are determined by the genetic make-up, or programming, of the creature. This creates a gamespace system of individual intra-acting creatures (both 'plant' and 'animal') whose actions are determined by a 'genetic code' expressing simple cybernetic relationships relating to such things as proximity to others (either positive for members of the same species or negative for prey and predators), proximity, and the need for food and/or water, and the desire for sex. These determine behaviours such as speed and direction of movement, the seeking or avoidance of other creatures, eating, drinking and engaging in sexual intercourse. The result is a collection of creatures and an environment whose intra-actions establish a rich ecosystem of cybernetic

feedback and dependences that encapsulate a rudimentary cybernetic definition of life. Within this cybernetic composition, the experience of bodily engagement remains largely forgotten as behaviours remain a direct translation of 'genetic' programming instruction. The intricacies of a full metabolism are missing within *SimLife*; there remains a focus on gene action rather than gene activation.

The player in *SimLife* assumes the now ubiquitous position as patriarchal god-head looking onto and into the digital ecosystem, above and outside the emplacement of cybernetic intra-actions. Recognising the varied identities the player can make within the game and forging connections between the digital and physical, *SimLife* attempts to show the breadth of the user experience in the number of 'hats' the player is able to wear:

> • A planetary game warden trying to protect and improve various ecosystems;
> • A behavioral ecologist exploring the different ways plants and animals interact in their ecosystems;
> • An evolutionary biologist trying to prove theories;
> • Charles Darwin (only in his dreams);
> • A being with amazing powers who creates worlds, populates them with plants and animals, and balances ecosystems for fun;
> • An Artificial Life experimenter; and
> • A normal human trying to play and win a pretty complex computer game.
> (Bremmer 1992: 12)

The range of player roles both highlights the complexity of the game and structures the types of experiences playing *SimLife* produces, highlighting and acknowledging the variety of narratives that can be created from gameplay. In doing so, *SimLife* bonds itself with strong connections with ecology, biology and artificial life, as well as being a game played for enjoyment. All of these functions exist concurrently within the gameplay of *SimLife*; the player can co-inhabit and move between these roles (and others not so formally defined) throughout gameplay. They all overlap and co-exist, the player likely adopting and moving between a number of roles in the same game. The player is given a full range of the trappings that a patriarchal overseeing position heralds, from the Zeus-like 'smite' button, complete with lightning bolt crisping the unlucky to charred remains, to the ability to manipulate the parameters of all the workings of the gamespace and the creatures that inhabit it, with the ability to create new species through genetic engineering. As has been the case throughout the games and programs covered by this genealogy, the player removed from the gamespace, is a necessary, if excluded, element of gameplay. Following the mythic journey of

construction, creation and change, the player's input is both necessary and exterior, reflecting the game's positioning as a heterotopian emplacement of compensation. Mythically paired with the system as emergent god, the player as patriarchal god is a necessary element of the production of successful gameplay and the development of a grand narrative of life itself that encapsulates the game. On a similar level to *SimEarth*, players participate in the day-to-day intra-actions of the gamespace, ensuring the continued success of their duties. Despite players' intimate intra-action within the assembly of creatures and enviro-spatial elements of *SimLife*, they are excluded as part of the system; they neither reside within the gamespace nor are determined by its rules. Unlike the ludic element of *SimEarth* with its escapist end goal, the structured direction of gameplay within *SimLife* is left much more open, with no established end state or completion of the game present. In its structuring of the element of change, *SimLife* offers an open paidean style of gameplay, with ludic scenarios available as additional play options. On the whole, *SimEarth*'s open style gives much more freedom to the assembly brought together in the direction of play, reflected in the many player roles that the game suggests are available.

Both *SimLife* and *SimEarth* display the necessary tension between a patriarchal god-as-player and an emergent god-as-system. The player as patriarchal god, positioned exterior to the gamespace but complicated within the system, is as necessary for productive play and the success of the system as is the emergent god within the system itself. Displayed throughout this genealogy, the two seemingly opposed positions find an uneasy relationship and co-dependence within these games. Players cannot achieve the omnipotent power promised from their privileged position and level of panoptic access to the system; it is the process of emergence of the computational regime that shares the power. The system, similarly, cannot function without input from outside itself, and lacks the ability to initiate its own being, or manipulate its cybernetic functions to optimum or desired states. It cannot construct its own 'universe' or create life. The player and system must co-exist for the game and world to operate, the system relies on the player for its very existence, and the player relies on the system for the emergence that produces meaningful gameplay. It is this intra-action between player and system that produces interesting and enjoyable game play. The system challenges the player to reach the objective of obtaining stable populations, and the player is challenged to make the system intuitive and second nature.

The dual nature of god-as-player and god-as-system is highlighted in the mythic possibilities the game plays through. The mythic narratives produced and enacted through play combine a post-modern genesis narrative within the sensibility of a spiritual and scientific philosophy of Gaian interconnectedness, producing a spiritual grand narrative about life itself and a matching cosmology. It is a story of the construction of worlds and ecosystems, the seeding and creation of life, and the development of this life into viable living ecosystems that change and evolve over time. It is also the story of the cosmology of a computational regime, the emergence of cybernetic life patterns and behaviours, and the challenge of maintaining equilibrium balances. Chris Langton, in his review of *SimLife*, follows the genesis mythology of construction, creation and change that is enacted through play. For Langton, the player "à la 'Genesis,' must first define a physical world... create the plants and animals who will 'live their lives' in this newly created world... populate the world with them" and "start the simulation going" (Langton 1991; 4-6). It is this (re)enactment and genesis myth creation that firmly positions the player as an external patriarchal god, given the task of overseeing and caretaking the digital emplacement and the creatures that inhabit it. But on the seventh day, the player does not get to rest. Langton also highlights the challenge and goal of the game of "setting the world on an open-ended course" (Langton 1991; 6); reaching a level of equilibrium within the gameworld whereby the ecosystem can develop with minimal intervention. Langton finds that:

> This goal is not easy to achieve. Establishing a viable ecosystem is not at all straightforward, and many worlds become barren of 'life' before one achieves a few long-lived populations. (Langton 1991; 6)

The complexity and challenge of *SimLife* is found in the learning, understanding and making use of the system. It is through developing an intuition of how the cybernetic systems of feedback and control are interlinked, and how one as the player can influence and manipulate the controls of the game successfully, that meaningful play is produced. The power of the player as patriarchal god is balanced by the emergent god-as-system, as with other games from this genealogy. The mythic narratives produced from gameplay intermingle the necessity of a patriarchal god that gives life to the system, the interconnectedness of all things and the power of emergence, and the interplay between these two vantage points.

The Development of Heterotopian Emplacements of Compensation

The genealogy of evolutionary artificial life games and programs, popular with a general audience, traces the development of these as heterotopian emplacements of compensation for life, nature and cosmos. Fermented in the *Game of Life*, these games and programs develop the ingredients to take forward in an investigation of *Creatures* and the meanings of life itself that are produced through gameplay. Developed with close connections and relationships of kinship with carbon life and the material molecular world in mind, a cosmology of computational regimes and neo-Darwinian and cybernetic definitions of life itself have been progressed and elaborated. From the backbone of the *Game of Life*'s deterministic grid gamespace of discrete space and time through to the equally deterministic *SimLife*, the games and programs of the genealogy produce a set of statements about life, nature and the cosmos that remain consistent throughout. They produce a scientific and spiritual discourse of construction, creation and change through gameplay.

The first of these statements is the reduction of all things to information. From the binary on/off, open/closed grid of *Life* through to the increasingly complex simulations of planetary subsystems in *SimEarth* and rules of engagement in *SimLife*, the construction of space, the creatures that inhabit it and the manner in which they intra-act are all defined and instructed as information, code and rules. Within the computational regimes of artificial life, all things can be reduced to information. The second foundational statement that is produced is interconnectedness of this information. Recalling the rules of *Life*, where the state of any cell is governed by the states of its neighbours, in the course of generations through the cybernetic systems of feedback and control in later games, the application of change to the system is regulated by the state of neighbouring and connected bits of information. In order to know the progression of the system at any point, knowledge of all points of the system and the rules is essential; everything within the system is connected. This also means that there is a limit to the system. Any system must be closed and self-organised on a global scale. Taking the discrete nature of all things within the system and their interconnectedness in the progression and application of rules brings the statement that the system is deterministic. Given a defined initial state and a given set of rules, the system will follow a single path of history without external influence. This gives the basic definition of computational regimes – closed systems of discrete information units that obey simple rules that are dependent on the state of neighbours through the progression of generations.

From this foundational definition, statements about the nature of life itself have also been developed. As with all things, life is fundamentally based on information and is codified as genetic algorithms. The basic life-like behaviour these strings of code are attributed with is evolution, as demonstrated in *Tierra*, giving a statement about life that is based within evolutionary discourses. As the intra-actions between artificial life creatures and between creatures and their surrounding environment develops, the neo-Darwinian definition of life based in evolution has grown to a cybernetic definition that places living things within cybernetic systems of feedback and control. The cybernetic definition of life also reflects the interconnectedness of all things. It is these statements that lay the ontological foundations about the nature of reality, life and cosmos within conceptualisations of computational regimes. Spiritually and scientifically, the narratives that are produced in gameplay, and the associated meanings that are taken away from play, are structured around these statements regarding the ontology of the real, nature and life that bind the digital and physical together. Within such a framework, the digital emplacements of evolutionary artificial life games and programs become heterotropic emplacements of compensation as perfected examples of computational regimes. As such, the meanings that are taken away from these games and programs come to define our own world, nature and cosmos, as exemplified with Fredkin's conceptualisation of Finite Nature. The simulational model has supplanted and come to define what it models. The *Creatures* series is the most developed instance of this and takes us beyond life-as-we-know-it to new formations of life-as-it-could be. The next chapter investigates *Creatures* and the game's culture in developing bonds on kinship and common narratives and histories between silicon and carbon life.

Chapter 8

Creatures: Playing with Life, Nature and Cosmos

Playing *Creatures* develops relationships with new digital forms of life. Progressing from the genealogy of games and programs before it, *Creatures* produces bonds of kinship (Kember 2003: 97) and connections between silicon entities and carbon life, and between digital and material worlds. The creation of a game's culture focuses on the care and nurturing of these silicon creatures as alive, and the common ties these entities claim with their carbon cousins, and produces meanings and narratives developed within gameplay and taken away from play about the possibilities of artificial life. As with evolutionary games and programs before it, *Creatures* develops a narrative structure through narrative scaffolding and mythic possibilities that produce narratives of construction, creation and change. Recalling the introductory section of the first chapter, gameplay focuses on the relationship between the player and his or her digital charges, a species of digital life called Norns. Norns live on the planet Albia and it is the player's task to establish and maintain a population of Norns, protecting them from the dangers Albia presents. With various levels and styles to which *Creatures* can be played, players can intra-act with Norns as virtual pets, through to performing complex genetic and evolutionary experiments. All gameplay styles are presented within an overlying structure that considers close ties of affinity between carbon and silicon.

Creatures becomes "a case study which illustrates a dynamic relationship between the games' producers and consumers, between science and engineering and between science and culture" (Kember 2003: 83). While Kember utilises *Creatures* in the initiation and continuation of dialougue with Steve Grand, the game's designer and leading British artificial life researcher, this chapter focuses on a detailed analysis of how *Creatures* has been able to treat silicon entities as being alive. As with the investigation of the genealogy of games in chapter seven, this chapter focuses on gameplay and an analysis of the creation of a game's culture that considers Norns as forms of life forging close bonds of kinship with their human players. This kinship is more than skin-deep, uniting Norn and human within a cybernetic definition of life. It introduces Albia as not only the gamespace

of *Creatures*, but also as a cybernetic artificial life emplacement that makes connections with the material universe as computational regimes. It outlines the manner into which players are aligned with this culture of the game, through structures of feeling that promote *Creatures* as a game about the technoscience of life and the nurturing and care of this life. Moving into an examination of gameplay, the chapter introduces players and the roles and placement they are offered in the game. It ties these positions to mythic narratives of construction, creation and change that are structured through play. Realising the negotiated hegemonic order that develops through immediate and extended play, the chapter looks to how players have adapted gameplay styles within *Creatures* and how these new styles of play relate to the original game's culture. Finally, it presents the gameplay style of the player Anti-Norn as an example of a possible alternative mode of play and resistance within *Creatures* and its game culture[12].

Welcome to Albia

The simplest way to describe Albia is as a digital planetary ecosystem, the gamespace of the *Creatures* series (except in *Creatures 3*, where we are taken on a spacecraft built by the ancient race of Shee, but the terrain remains Albian-like), and the cyberspace that Norns, Grendels, Grettins and other digital life forms inhabit and live out their lives under the watchful eye of the player. An examination of Albia as the gamespace of *Creatures* covers a number of conceptual layers and initiates a fuller examination of the game and the *Creatures* game's culture. Albia is both the gamespace in which *Creatures* is played and which activity is structured, and a cybernetic artificial life emplacement designed as a cyberspace in which intelligent behaviour can emerge within a cybernetic definition of life. It illuminates *Creatures* as a cybernetic artificial life emplacement within the structure of the Albian ecosystem and gives a first level spatial semiotic analysis of the game, while serving as a precursor to a fuller examination of the game's culture. As a structured and structuring space, the landscape of Albia directs gameplay within *Creatures*, structures the narratives formed during and taken away from gameplay, and the production of meaning.

Scientifically, *Creatures* is a working artificial life emplacement, and can be examined to how the Albian ecosystem has been designed, how it operates, how

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[12] Kember (2003: 102-105) investigates Steve Grand's and the *Creatures* community's opinions and discussion surrounding Anti-Norn's torture of Norns. This is focused on the questions of Norn 'aliveness' that were raised within player news groups and discussions in reference to Norn torture and Anti-Norn specifically and includes her interview with Grand on the topic.

this supports new cybernetic definitions of life, and how these intra-act in gameplay in the production of artificial life entities. In the cybernetic definition of life postulated by Steve Grand, we are reminded that a key requirement for life, and especially the emergence of intelligence, is the interaction between a living entity and its environment. For Norns to exhibit cybernetic intelligent life-like behaviour, they need to be embedded within an informational environment consisting of cybernetic systems of communication and control. Within this model, from these environmental first level interactions, intelligence and life can emerge. The Albian ecosystem not only becomes a semiotic space that structures gameplay, but also is key in the formation of an artificial life emplacement within a cybernetic definition of life. Albia is constitutive and an integral part of the artificial life system.

The Albian Ecosystem: Setting the Scene

Albia is a lush digital environment and space that seamlessly combines frontier naturalism with high technology. It is a small world that the player learns was once inhabited by creatures called the Shee, an intelligent race fond of science. The Shee have since evacuated the planet, leaving behind a range of technologies, including a hatchery containing the six remaining Norn eggs for the player to hatch. Albia is technically a disc world (not spherical as is the Earth) and operates on its outer edge in a two-and-a-half dimensional space. That is, there is right, left, up and down, but depth is limited to layering in front or behind other objects, everything effectively occurs on the same two-dimensional plane. North and south do not make sense on Albia; all of Albian life operates on the edge of the disc that forms the planet. The player can only travel east (right) or west (left). Travelling far enough either left or right takes one right around the world, eventually returning to the starting point. Albia has a number of microenvironments. The game begins in the deserted Shee city, a Robinson Crusoe set of buildings with their underground cellars and structures, and then traverses the Eastern and Western Oceans, with a tropical desert island separating the two; vegetable gardens, a jungle, and even a Grendal's liar where the Norns' nemesis enjoys to spend time lurking and awaiting hapless Norns. Albia presents a very lush 'natural' ecosystem. Dotted around the planet are a number of technological items that compliment their surroundings. In fact we find out that:

> From the deserted Shee city in the east, to the oceans and jungles of the
> west, Albia is positively covered in structures, of all kinds. The ancient Shee
> civilization left behind some incredible machinery when they departed for

another home, including the Learning Machine that allows you to reach your Norns to speak and the mysterious *infinite carrot dispenser*, which can be found on the Desert Island that separates the Eastern and Western Oceans. (Simpson 1997: 8)

The emplacement of Albia is presented as a seamless partnership between the natural and the technological. Complimenting the tropical environs are a number of technological items, including computers, incubators, food production machines, and transporters (from more traditional submarines and gondolas to high-tech Star Trek style instant transporters). Keeping within a posthuman imaginary, the technological and natural become inseparably entwined in Albia. There are technologies producing the natural elements on the planet (such as carrot producing machines). There are technologies to be used to birth a new Norn (incubators which are essential when an egg has been touched by the player, as touched eggs will not hatch on their own), and there are technologies that have protected the Norn species from the Grendels so that the player can repopulate the species. *Creatures 3* further develops this; the player is taken aboard the Shee Spacecraft, which has been split into "five separate environments, each with their own ecology" (*Creatures 3* game packaging 1999). Here the fluidity between technology and nature is at its most intimate. The most advanced technology of the Shee race is a series of protected natural environmental ecosystems travelling through space. Nature also becomes technological in *Creatures* with much of the natural vegetation having medicinal properties, with the ability to rejuvenate (or poison) Norns or even tomatoes that increase Norn sex drives. The player must be able to harness these natural technologies in order to successfully play *Creatures*. Kember finds that:

In keeping with traditional Western techno-scientific perspectives, nature is constructed as a resource for exploration, observation, experimentation and exploitation. The presence of both danger and biological potential is seen to justify and reward technological intervention. (2003: 95)

Creatures is definitely playing in a new technological nature (re)created; there is an inability to distinguish within the game between the technological, the cultural and the natural. The things brought together in the assembly that makes up *Creatures* cannot be defined as either 'up there' as cultural, or 'out there' as natural. They are things 'down there' actively engaged in the production of both. This is further developed as the new digital 'natures' *Creatures* creates reflect and inform about our own. They are (nature)cultural artefacts that themselves create and produce new nature(culture)s. The narratives and statements these new

(re)created natures produce reflect, reinforce and supplant our own with specific discourses of what nature is.

Although Albia is a disk world and therefore operates in two (and a half) dimensions, it is presented to the player with a great amount of depth, as if a three-dimensional sphere with recognisable Cartesian horizons including distant mountains, oceans and islands. With a little investigation, however, one can discover that this illusion of depth is not natural to Albia, but has been "added for the enjoyment of Albia's human visitors from here on Earth" (Simpson 1997: 4). This is an added effect to aid human players in feeling at home in the unusual dimensions of Albia. This landscape sets the stage for the game, structuring the feeling of the game and semiotically positioning the player with additional reference points to the spiritual and scientific discourses that the game presents. In the first two editions of *Creatures*, oriental style vistas are found, with *Creatures 1* referencing the Far East, with rocky islands and ranges reminiscent of exotic Thai locales, and *Creatures 2* presenting a distinctly Japanese flavour, with Albia's own (simulacrum) Mt. Fuji visible in the distance. This exotic mystic landscape is further reinforced with oriental style buildings complementing this background. This humanising feature becomes a structuring feature of the game, put in place to make players comfortable in a new nature of strange dimensions, but also placing players firmly within the spiritual heritage of both artificial life and the posthuman. We are reminded of both artificial life's and postmodern spirituality's inclusive nod to Eastern religions and especially Zen Buddhism. Our 'artificial' backdrop continues this theme, the Eastern flavour of the spatial presentation of Albia is kept on the sidelines, not fully engaged with, but a background to structure and frame the game. As becomes apparent in gameplay, the mythic possibilities of *Creatures* structure and produce a much more post-modern Judeo-Christian tradition in its spiritual mythology, reflecting the narratives developed in chapters six and seven and developed throughout the genealogy.

Moving to the foreground gamespace where gameplay occurs, players and Norns are presented again with two differing outlooks to Albia and its landscape. As with the humanised backdrops, players are presented with an Albian aesthetic that structures meaning development and gameplay. Norn Albia is simpler than human Albia; where humans see a number of different types of food, Norns see one type; where humans see a number of different types of toys to interact with, Norns again see only one. To this end, the player is recommended to name objects carefully, realising that "Norns are only able to distinguish between

categories of object, rather on specific types" (Simpson 1997:59). Carrots and cheese are both seen as food by the Norns, there is no difference in Norn Albia between the two; the distinction is a human benefit. Norns are able to distinguish twenty different categories (in *Creatures 1*). The richer, human Albian landscape encompasses at least forty-two items within these categories. This presents human players with a diverse environment in which to interact with the Norns and other Albian life. Aesthetically, a player is presented with a lush frontier style world with a wide range of items to interact with and make use of – from food and toys to transport vehicles and teaching machines. All are familiar to a human of Western origin: carrots, cheese and honey food, coffee drinks, spinning top and ball toys, fish and bees. It is a complete ecosystem, a more than adequate nature to raise life in. It is an environment reminiscent of the player's own, where items are easily recognisable and connections between the ecosystems of Albia and Earth can be made.

This frontier landscape of Albia becomes an exploratory space of intra-action with these new artificial life entities. Even while the player finds him or herself as part of an archaeological adventure, rediscovering the technologies of the ancient race of Shee, *Creatures* does not look backwards, but forwards. The player definitely inhabits new techno-spatial frontiers in *Creatures*. As cybernetic systems of life itself where the world as system operates by 'the rules' in a bottom up system of emergence and feedback, the *Creatures* series forms heterotopian emplacements of compensation. Exemplifying a cybernetic definition of life itself, Albia operates as a complete cybernetic ecosystem, with a wide range a variety of plants, animals and natural forces that connect with each other in cybernetic systems of feedback and control:

> The sun is shining in Albia. Bees buzz around looking for flowers, caterpillars munch their way through beelancanth plants, and little fluffy clouds drift overhead. Earlier it was raining, but the water has long since dried out in the midday sun. Ants march across the ground looking for rotting fruit to carry back to their nests. If they find enough, queen ants will explore the world trying to find new homes... (Simpson 1998: xi)

Each of these things operates in the same manner within Albia, through a system of cybernetic intra-actions in which Norns and the other 'higher' life forms of the planet form an integral part. Even the player, digitally represented as a floating hand, is (at least superficially) included within this system. The gamespace of *Creatures* is a full cybernetic emplacement; weather patterns and the intra-actions of lower and higher life forms all emerge as the result of first level interactions,

and are cybernetic connected through systems of feedback and control. This interconnectedness of things with the ecosystem of Albia contributes to the richness of the game and makes further connections between digital and material worlds. In *Creatures 2* we find the insects and animals of Albia are connected, where bees "pollinate the flowers of Albia", molluscs live "off the detritus built up from dead and decaying matter", spiders "feed off on unwary insects foolish enough to get trapped in [their] web", and bats "live off fruit" (Simpson 1998: 89). Not only do these creatures add interest to the Albian landscape, they build and create the cybernetic richness deemed necessary for the production of intelligent life. As part of the assembly of the gamespace they form part of the robust cybernetic systems that allow seemingly novel responses to emerge and complex lifeforms, such as Norns, to exist. The things that make up the cybernetic components of Albia take on aesthetic and semiotic value in their structuring and shaping into things we humans can understand relating worlds together; but at a fundamental level, Albia operates as it does because of the intra-actions formed by its inhabitants (and how these have been programmed to operate; the rules they follow). At the most basic, this is as genetic algorithms of propagating informational units operating in a holistic cybernetic system of feedback, control and communication leading to emerging systems of increasing complexity displaying lifelike behaviours and intelligence. It is a deterministic informational system; a realised utopian emplacement of Grand's responsible deterministic definition of life itself.

The one item within *Creatures* that is not determined by the programming of the game is the actions of the hand: the player's representative and presence in the gamespace. The hand is a floating entity, disembodied from the rest of its body and the player's digital extension of self, able to interact with the Albian environment, including picking up other objects and intra-acting with the Norns and other creatures. While it forms part of the Albian ecosystem, it is not holey determined by its programming, as control of its actions are held by the player. The hand forms the player's extended presence into the cyberspace of Albia, all the actions that the player can perform in *Creatures* are controlled and affected through the hand. As is typical with 'god-sims', the hand presents a player positioning that is outside and above the Albian terrain, included within the system, yet overseeing it. As found throughout the genealogy of games and programs, the player is positioned within a patriarchal god vantage point. It is reminiscent of a classical Western Christian representation, white and male, as if created by Michelangelo. The hand positions the player, aids in the definition of his or her role within the game, provides a perspective into the Albian ecosystem

and extends the player into the gamespace allowing intra-action with the other creatures and objects of the game.

Developing the Culture of *Creatures*

Creatures is a game about the technoscience of life itself. And more than (just) (playing with) an experimental laboratory world, it is an exploration of an emerging relationship with a specific new type of life in a new digital medium. Through play and intra-action with *Creatures*, the player finds and develops a game culture, forms an introduction to how *Creatures* is to be played, and begins to guide the production of meanings that can be produced through immediate and extended gameplay. An investigation into the structures in place to align the (potential) player to the kind of game *Creatures* is highlights initial elements that produce feeling for the game, and go on to provide initial structure to the production of meaning that gameplay creates. Elements that structure feeling found in the game packaging, instructions and pre-game video vignettes on the CD-ROM align the player to what kind of game *Creatures* is. They introduce their positioning and open the players to the game's culture as an integral participant. Involvement with and playing of *Creatures* is a productive practice; the foundations for this active culture are laid in structures of feeling that introduce and coordinate new members of the culture, realising the development of a common sense within it.

In *Creatures*, we find a number of structures in place to introduce, structure and reinforce human intra-action and relationships with new life. They develop a common sensibility about life, as defined in cybernetic terms, which not only positions Norns as alive in their own right, but also creates bonds of kinship with human and carbon life. They align the player with the nurturing and techno-scientific aspects of the game and build the expectations of finding 'real life' on their PC, within the game. The *Creatures 1* game box prominently warns of 'Digital DNA Enclosed'. This is a game that experiments with the very essence of life itself in the cybernetic definition of gene fetishism and already equates silicon and carbon lifeforms. Associating with both the game's techno-scientific computer and biological science underpinnings, we are encouraged to 'Get A-Life' in the form of these new life forms – Norns – to actually "create life on your PC", with recommendations by leading biologist and iconic neo-Darwinist figure Richard Dawkins. The game's scientific stature continues to be structured through terminology, where the players find that Norns come "complete with their own biochemistry, brains, and digital DNA." The game's developers, Cyberlife, appear

more as a scientific brand than an entertainment product developer, complete with a ubiquitous double helix logo. This further forges the ties between silicon and carbon, and definitions of life emphasising a focus on genetics as code. The status of *Creatures* as a game at all is questioned by Dawkins who finds it instead "the most impressive example of artificial life [he has] ever seen," further structuring feeling for the serious techno-science at play. By *Creatures 3*, the bold claims of Norns' aliveness have been downplayed, instead quoted as "behav[ing] as though they are really alive" rather than as actual instances of life. The integration of technoscience within a (re)created nature, however, is most evident with 'advanced machines' that, when connected, form 'huge automated devices' to aid the player in controlling Norns and the Shee spacecraft environment or ecosystem.

Balancing the techno-science of *Creatures* are initial structures that highlight and build a feeling for the nurturing aspect of the game. *Creatures* may be about the cutting edge of techo(life)science, but it is also about building relationships of kinship between silicon and carbon – between Norns and humans. As with all new life, Norns need to be cared for and raised carefully. On the game box of *Creatures 1* players are prompted to 'play,' 'teach,' 'protect,' 'laugh,' 'exchange,' and 'encourage' in their intra-actions with the species of *Creatures*. Norns are presented as "friendly, curious, social, and eager to learn." They are categorised as 'small children' who require the player's help in order to survive. The packaging states, "their life is in your hands." The *Creatures 3* game box describes Norns as "Cute, loveable and endearing, [...] often victims of Grendel violence and Ettin impish behaviour." Norns are structured as helpless children that need the player's care and nurturing to survive and thrive. To this end, the player is presented with a section of the Shee spacecraft as a "Norn Terranium – Specially designed for Norn care, this world contains everything you'll need to hatch, teach and care for your Norns." Feeling within *Creatures* is structured here, as a game about caring and protecting new life. The relationship of nurturing is one of kinship; the player raises Norns as small children. The player takes on the roles of parent, guardian and god. The relationship of kinship not only reinforces the techno-scientific claims of the synthesis of actual life in the game (as it is difficult to form bonds of kinship to non-living things), but also informs the player of how this new life should be positioned and thought of, and how this new life relates to our own. The bond of kinship between Norns and humans translates beyond an emotional level to a common ontological heritage. Norns are anthropomorphised as children, because they act just like us and *are* just like us (or, more to the

point, we must be just like them). A common essence between Norn and human life finds structuring in the foundations of digital creatures that share family values with their human caretakers, on more than a mere social relationship. The ties are already structured much more deeply, as human's immaculately machinic produced children, with their own DNA tying bonds of neo-Darwinian and cybernetic kinship with their carbon guardians.

Continuing with the induction of players into the culture of *Creatures*, the pre-game video vignettes structure and build common sense within the game. The vignettes form part of the game CD-ROM that needs to be loaded in the computer in order for the game to be played. In *Creatures 2* we open with a spider crawling over a cave wall, painted with prehistoric cave paintings of a mythic past. As the spider makes its way across the stone, the history of Albian uncovers itself through the paintings, from the birth of the Norns (complete with divine electric bursts), natural disasters (volcanoes erupting), the threat of Grendels, the industrious Ettins constructing the built environment, and the departure into deep space of the Shee. The spider moves us away from our historic journey by stepping off the cave wall and onto the metallic piping of Shee technology. We are then accelerated into a scene of active technoscience, as our lowly spider trips the machines into action, mistaking an arachnid shape for egg and triggering the production of a Norn egg. This machinic birth is accompanied by a dazzling display of laser light power, and the release of binary code illuminating its way up the machinery. The action collimates in the machine opening and depositing a fresh Norn egg in anticipation of the initiation of the game.

While the vignette provides a mythic history lesson of Albia and the creatures that populate it, its archaeological value is offset by the triggering of machinery that dramatically produce the promise of new life, being an egg to realise new relationships between carbon and silicon life. *Creatures* is not a game that looks to the past, but instead to brave new futures. The relationship between technoscience and life is structured clearly within the *Creatures 2* vignette. The ancient technological machinery of the Shee is tripped into operation and produces the potential for new life as a machinic technoscience conception. To ensure the connection between life, information and technology is made, binary life code streams up the machines, amalgamated and realised as the Norn egg. As binary 0s and 1s, it is code that becomes the common denominator in the production of new life. The vignette structures a perfected study of life in the cybernetic definition: the gleaming new egg standing as the proud progeny of its

machine parent, ready for the player to take forth and multiply. It continues to structure the game as concerning new life that is tightly entwined with technology in new allegiances of code.

In *Creatures 3* the vignette takes us away from the Albian landscape into outer space. Swirling galaxies fade in and out of view, and as the camera pans out we realise that the space-scape is actually being reflected in the eye of a Norn looking into space with awe and wonder. As the camera continues panning, the lush natural environment surrounding the Norn becomes visible before a blue force field hums into existence, revealing that the scene is an external window of a giant Shee spacecraft. As we continue to pan out, the Shee spacecraft arcs into the horizon. The setting of *Creatures 3* departs from the two previous instantiations of the game because it does not occur on Albia, but on the ancient Shee spacecraft that had departed Albia in historic times past (as discovered in the cave paintings shown in *Creatures 2*). While the vignette for *Creatures 3* highlights this change of perspective, it also reinforces the partnership of technoscience and nature in the game, and importantly structures a post-human cosmology. The lone inquisitive Norn looks out into the depths of space, fractally reflected in his eyes; the bond between Norn and universe is set in place. The universe is both within the Norn and beyond him, and both are intimately tied together. The vignette for *Creatures 3* provides an initial structuring of the mythic possibilities of the game and of the series as a whole, especially as a continuation of the vignette found in *Creatures 2*, where binary code is implicated and harnessed in the production of life. *Creatures 3* progresses this fusion of life and informational code out to the stuff of the universe itself. The Norn is the cosmic Norn connected to everything at once in a fractal web of swirling galaxy patterns. Just as within post-modern spirituality, the cosmic Christ is connected through a cybernetic web of information patterns in the holistic universe. The solitary Norn realises the interconnectedness of all things in his outward gaze, and in doing so structures feelings towards a cosmological common sense of the holistic universe.

In a similar manner, press coverage of *Creatures* similarly structures a feeling of the game in its techno-scientific status and claimed production of life. Leading computer game magazine *Edge* focuses its review of *Creatures*, and Cyberlife Technology, on Artificial Life as a leading technoscience and its possibilities. Following "the creatures' progress," *Edge* confirms the life status of Norns as "actual living creatures" with "simulated blood systems, instinctive drives and rudimentary brains employing neural network technology" and who mate,

"donating their coded DNA to the resulting progeny" (*Edge* 75 1999: 41),
structuring Norns' techno-scientific interest as coded proliferating life forms. The
serious science of *Creatures* is structured further, and reinforced through the
article's introduction of Cyberlife as part of Cambridge's great history of
"scientific glory," sided with Newton, Darwin and Hawkins (*Edge* 75 1999: 40).
Further aligning Dawkin's endorsement found on the *Creatures 1* game box, this
places the game firmly within a (techno)scientific framework and the belies the
significance of the 'play' at work. The Shee spacecraft is described as "essentially
a gigantic breeding experiment" and the game's producer Toby Simpson boasts
of the improved biological systems incorporated in the game. As with material
published by Cyberlife as the game producers, the connections between silicon
and carbon are pronounced, further establishing the game's developing culture of
new life and the player's connection with this life as kin and caretaker. From both
primary and secondary sources, (potential) players coming to *Creatures* find a
common culture based around a story of life itself, the technoscience that has
created this culture and our ontological relationship to this life. It prepares
players to what playing *Creatures* will be like, and hints at a feeling for the life they
are to find within their computers and the nurturing and experimental role of the
player's position. It aligns the player to the spiritual and scientific grand narrative
of construction, creation and change played through in gameplay.

Creatures is structured along a number of related directions that bring players
towards an understanding of what the game is about, and the development of a
common sense for the game's emerging culture. Key in the structuring of
Creatures is the sense that the game is about a specific variety of life itself, and
our relationship with that life in both a techno-scientific and nurturing role.
Included in this relationship, common bonds between carbon and silicon are
structured through familial bonds of kinship between human and Norn and a
more encompassing common cosmology of the living holistic universe. Whilst
structures of feeling are most commonplace at entry points to a culture, they are
present and continually produced throughout the game's culture. In the case of
Creatures, these are the things that players first come across to the entry point of
the game This is not only in the immediate game play but also broadens in
extended game play and in other points of contact with the culture. Importantly,
through the productive intra-action of gameplay, the structures of feeling are often
developed by players and other members of the culture.

Playing God

The player's presence is extended within the gamespace of Albia, represented digitally as a floating hand positioned above (or in front of) and involved in the activity of Albian life. This typical player positioning within the 'god-sim' genre, and common throughout the genealogy of games covered in chapter seven, places the player spiritually in a participatory patriarchal god vantage point, and scientifically as researcher or scientist. The hand, as the player's extension into the cyberspace emplacement of Albia, realises an important heterotopian feature found throughout the genre. By the very act of entering Albia as a heterotopia, the player is at once excluded by his or her presence. As an extension of the embodied player, the hand allows the player an entry point into the gamespace. Floating over and in front of the Albian terrain, however, it also highlights that while the player may be present, he or she is not included in the emplacement itself and remains as an outsider looking into the space. This element of the gamespace of *Creatures* as a digital space and as a heterotopian cybernetic space excludes the player; they are not digitally constituted or fully conforming to the underlying programming rules of Albia as a computational regime. This excluded position within the Albian emplacement is reflected in the spiritual role of patriarchal god that the player is able to hold. In order to fulfil the scientific and spiritual grand narratives the game presents, the player must be outside of the system, technically. They rely on the player (and game producers) to hold a position exterior to the system.

When examining issues of power and control within the game specifically, the excluded nature of the player's position within the gamespace and role as a patriarchal god figure highlights the player's limited power within the game. Found throughout evolutionary computer games, the player must negotiate positions of power with the system. Even accounting for the highly participatory role that the player finds within *Creatures*, there is a negotiation between player and system (spiritual positioned as an emergent god) that takes place within gameplay, as there is with other evolutionary artificial life games. The negotiation of power between player and system is structured within *Creatures* as mythic possibilities that the player is pointed towards and guided through in gameplay.

Mythic Possibilities

Conforming to the mythic possibilities of construction, creation and change, play in *Creatures* develops through three stages of spiritual and scientific mythic

possibilities: the construction of a world or universe, the creation of life within this universe, and change or the evolution of life over time. Construction, creation and change are technically necessary for the scientific development and running of artificial life computer systems. Equalling this technical aspect of gameplay to a post-modern spirituality, tied closely with a Judeo-Christian Genesis story, connects *Creatures* with greater cultural grand narratives.

The spiritual and mythic possibilities of a technological Judeo-Christian Genesis story structures the parameters of construction, creation and change within *Creatures*. The player enacts and realises these through the intra-action of gameplay. The player realises his or her god positioning, and a specific mythic story of life within *Creatures* is established, through the (re)enactment and playing through of a unique mythic genesis narrative. It is unique as players in each instance of *Creatures* realises their mythic possibilities individually each time the game is played. As part of a structured and structuring emplacement, gameplay throughout all instantiations of *Creatures* structures itself around the mythic possibilities programmed into the game, and the player must conform to this direction of gameplay to make play a success. *Creatures* continually produces new relationships between carbon and silicon life and new meanings of life itself through the productive practice of gameplay. Far from recreating a distinctly Judeo-Christian relationship of external and divinely powerful god, players of *Creatures* soon realise that different relationships of power are present in Albia: ones that move towards a posthuman spirituality in the interconnectedness of all things.

God as System

Retaining a post-modern spiritual duality between a patriarchal and emergent god figure, *Creatures* challenges the player's position as a unitary god, finding an emergent spirituality of process and the interconnectedness of all things in the mythic possibility of change. After the initial mythic challenges of construction and creation, the player's challenge is to guide new Norns throughout their day-to-day life, taking a role of leader and nurturer. This is a simple task when Albia contains only a few Norns to track, maintain and keep in order, but proves increasingly difficult as the Norn population increases. These difficulties arise not only because of the increased logistics involved in managing growing numbers of Norns, but with the increased amount of stimuli available from other Norns it

becomes more difficult to engage and maintain a Norn's attention. Norns are attracted to movement and they become easily distracted, preferring each other's company to that of the player. When they do pay attention to the player, even then ensuring Norn obedience is difficult. Norns come across as wilful little creatures, and players quickly realise that the challenge is not to teach and adapt Norns to their style of play, but the opposite; players must adapt to the workings of the game in order to build and maintain relationships with the Norns. Maintaining a level of control in the game means understanding and playing by 'the rules.' Successful play is achieved by working with the structures and programming of the game, adjusting play style to the game's operations. Within the mythic structure of change, power is shared between the player and the system, and the player guides and manages within the confines of emergent processes.

The mythic possibility of change encourages a gameplay style that structures itself around a spiritual mythology of the interconnectedness of all things, within day-to-day life and existence in Albia. Players are brought into this system, but in keeping with *Creatures* as a heterotopian emplacement, they are also excluded because the emergent programming of the game does not constitute them. The challenge that the players face becomes the integration with the system, learning the structure of the underlying programming in its emerging systems and processes in order to exert influence over the creation of history in the game. The player's god positioning does not challenge the power of the underlying system, but instead influences and offsets the deterministic nature of the system as a whole. As with *SimLife* and *SimEarth*, the player has influence over how the game progresses but cannot alter or change the fundamental rules of the system.

The player therefore shares the status of god with the game, the player as a participatory patriarchal god shaping intra-action within Albia, and the system as an emergent god, tending towards deterministic cybernetic process of communication and control. Players challenge the determinism of the system, creating gameplay and the production of history through their involvement with the entities of Albia. If left on its own (as is done with a Wolfing Run), the system sustains itself through its interconnectedness and self-organisation and emergence. It is within these properties of the system that the rules and the offset of power are kept.

Construction, Creation and Change – the Story of Life in Creatures

Life in *Creatures* is structured within the ideals of the cybernetic definition of life itself. Norn life is grounded in genetic and cybernetic determinism, and the maintenance of homeostatic equilibrium, through negative feedback loops within their own digital metabolism and between themselves and the environment that they are embedded within and form part of. Norns are phenotypically defined and realised by their (digital) DNA; they operate on a system of gene action where code contains both the instructions for representation and the means for its actualisation. Albian life, at this elementary level, is codified. Departing from a neo-Darwinian evolutionary framework, having an embedded body within the cybernetic environment of Albia is key in the schematics of life within *Creatures* (although, in keeping with a cybernetic framework it is embedded information that is important). It is Norn DNA codes for Norn systems, the phenotypic realisation of the genotype, that through establishing systems of feedback and control with the surrounding environment and within the Norn maintain their aliveness and create the conditions for the emergence of life-like behaviours (intelligence). The player's intra-action with this life is two-fold: establishing and maintaining conditions of homeostasis to ensure Norn health (nurturing); and breeding or enginerring Norns to enhance the genetic value of the population.

The story of this Norn aliveness is structured within the mythic scientific and spiritual grand narratives of construction, creation and change, which have been developed throughout the genealogy of evolutionary artificial life games and programs. The birth of a new computational regime requires the allocation of computer memory space necessary to construct a virtual computer-within-computer to contain and constitute the artificial life programming. The allotment of this space and the construction of Albia are aligned with the mythic telling of the construction of new universes and worlds, created to host and become home to new life. In the act of pressing play and starting the game, receiving the proclamation 'loading world', the player initiates the play through of the mythic possibilities of the game in the construction of Albia, scientifically constructing the conditions for 'intelligent' cybernetic life to emerge whilst spiritually constructing the world and universe as patriarchal god. The act of construction partitions an area of computer disk space as a new digital Albian universe, planet and ecosystem, and heralds the mythic journey at hand. Genesis stories begin with the construction of the universe and world; *Creatures*, following the tradition of artificial life programs, is no different. The player's next task is one of creation. It is the player's hand extension into Albia whose god-like touch will bring life to the screen and properly initiate the game, with the birth of the first Norn. The

creation of life is the second step in the running of Artificial Life programs: once a virtual computer has been partitioned (the construction of a new universe) this memory space must be seeded with computer algorithms that have the potential to self-replicate within the conditions of the virtual computer. Selecting a Norn egg from the hatchery, the player hatches the first Norn and seeds the world with intelligent life, with the aid of the technology of the incubator. In *Creatures*, creation is the combination of godly intervention and technoscience in action. Whilst the construction of Albia and its ecosystem brings the rudiments of life, it is only through the touch of god and workings of technoscience that life with the potential for 'intelligence' is introduced to Albia and *Creatures*. The choosing and birth of the first Norn proclaims the start of gameplay and the start of the player's relationship with his or her new charges and new life. Unlike Genesis, on the seventh day god does not rest; the god-players must now give their full attention to the nurturing and successful raising of the new life at their disposal.

Continuing the mythic journey, the bulk of gameplay relates to change in the development of individual Norns and the related evolutionary development of the Norn species. Here, "the breeding of successive generations of norns... leads of course to evolution which is – given the underlying ALife philosophy – the true agent of the game and more powerful than the god-like Shee and their player-programmer descendents" (Kember 2003: 97). The player continues as a participatory patriarchal god, mythically positioning throughout the game and able to keep a panoptic vantage of Albia. Through the hand, the player influences and controls Albian activities, including the ability to remove or inject Norns and/or other objects into the gamespace (in *Creature*-speak referred to as 'cobs') as Albian history is created. Within *Creatures*, individual Norns 'physically' develop throughout their lives as well as the Norn species progressively evolving through breeding of generations. Birthed within a scientific discourse of the cybernetic definition of life, Norns develop through a system of learning based in bottom-up emergent patterns and cybernetic relationships within itself, and the environment that surrounds it. Through player-Norn intra-action and with the aid of the 'learning computers', Norns learn rudimentary speech patterns and simple actions, directions and objects. With return visits to the hatchery and through 'natural' births, a Norn population is formed. It is the player's objective to maintain and develop this population through a combination of breeding, raising and nurturing, playing through the possibility of change over time, and the development of Norn and Albian history. The third criterion for the successful production of an Artificial Life emplacement is fulfilled in the creation of change

through the production of history. Change in Albia consists of the everyday developments of the Albian ecosystem, in unfolding cybernetic processes and systems that within the computational regime of a responsible deterministic model emerge as the day-to-day reality of Albia. Gameplay becomes history making. Change is also evolutionary, in the continued development of the relationship between the player and Norns, and the development of the Norn lineage through natural mating, breeding programs, and other genetic manipulation and engineering techniques. The player influences the process of change through his or her manipulation and control of Albian occurrences, especially in the continued intra-action with Norns. To support this goal the player has been supplied with a number of 'Kits' offering a range of tools in each of six specialisms – an Owner's Kit, Health Kit, Breeder's Kit, Science Kit, Neuroscience Kit, and Observation Kit. Accessing each Kit makes advanced tools available for the monitoring of Norn biochemistry, the supply of and means to inject medical and other substances to each Norn, the investigation of the genetic make-up of each Norn, and tools for the tracking and recording of Norn life.

Following gameplay through the mythic possibility of change in *Creatures*, life plays as both a scientific challenge and as a continuing soap opera in the development of history. Players must keep their Norns alive, healthy, propagating and evolving, as well as take part in the production of daily history through participating in Norn life stories that mimic our own. Bonds of kinship, created through the production of common histories and life-recording tools, tighten claims of Norn aliveness as well as forge bonds between human and Norn that are more than skin deep. "Norns are like children: a new generation" (Kember 2003: 97). The Kits and tools available in gameplay allow the player to accomplish his or her goals, forming narrative structures that shape gameplay and the production of meaning within the game.

The Production of History – the Recording of Norn Life through Change

The bulk of gameplay in *Creatures* is taking part in change: the unfolding of day-to-day events of Norn existence. Following a paidea style of play, there is a start point to the game but no objective end point; there is no set of goals that result in the end of the game (unless the player fails to successfully establish a Norn lineage and exhausts the egg supply in the hatchery). The creation of history through official and unofficial recording of events, therefore, becomes a central

focus in the development of play and forms narrative structures that shape and guide gameplay in the production of bonds between human and Norn life stories, through common life histories. Within *Creatures* the recording device automatically records all events of merit, a running time-stamped log of occurrences such as births and deaths. Whilst this creates a list of events in the ecosystem, much like a anthropologist's or zoologist's field notebook or similar logs in previous programs such as *Tierra*, the player has been given a number of tools to both officially document and socially celebrate Norns' lives in the 'Owner's Kit.' The Owner's Kit contains the tools and official documentation necessary to register and validate Norn life as a citizen of Albia, and recognition as an intelligent individual entity. Registering a birth details the Norn's name, gender and age, and lists the owner (player). Upon verification, a Birth Certificate for the Norn is supplied. This step is vital within gameplay, as it is through registering the Norn that he or she learns his or her name, fulfilling the creation of self-identity for the Norn. It is also a prerequisite to be able to gain an official Birth Certificate for the Norn, to create ancestral traces through pedigrees, and the ability for the Norn's life to be celebrated with photographs and a tombstone when they are deceased. The player is so warned: "If you don't register your Norn's birth, you won't get a birth certificate, and you will not be able to select a picture or leave any final words when your Norn dies!" (Simpson 1997: 90). All of these structure the production and recording of history in a manner familiar with parallel human lives. Birth registration regulates Nornian society, documenting official births, creating recorded citizens, and pairing Norn life with similar regulatory processes within Western contemporary cultures.

Registering a Norn birth officiates the new life with a Birth Certificate and, with the logging of the event in the recording device, initiates a recorded life history for the Norn, structuring an anthropomorphised official and regulated Albian 'citizenship.' The recording of life history is continued through the social tools of photography and captioned diaries. With the registration of birth, the player becomes able to access the other tool of the Owner's Kit: the Photo Album. Here the player as parent is able to take photographs of the selected Norn, edit the album, and write additional entries with each photograph in a system not dissimilar to scrap booking. By implementing techniques that we are familiar with as humans in the creation of our own continued production of self, bonds of kinship between human and Norn are further entrenched.

Photography gains importance in the game practice of Norn 'adoption.' Adoption continues in the production of kinship between player and Norn. The trading of Norns between players over the Internet has been integral to *Creatures* from the first instantiation of the game, opening the game from the immediate play of players and intra-actions within their iteration of Albia to an extended play, connecting players and multiple iterations of the game. Players have developed this aspect of trading into a more developed culture of adoption, where players have created websites (or areas of websites) devoted to the display and description of various Norns available for players to download and import to their own Albian terrain. The movement from 'trading' to 'adoption' is traceable to a *Creatures* player using the online tag 'Anti-Norn.' 'Anti-Norn' caused a sensation in the *Creatures* community through the creation of a website devoted to tortured Norns that he had systematically punished, and who displayed diminished 'behavioural traits.' Downloading and including these Norns in a player's own Albia became known as adoption, with players challenging themselves to rehabilitate these 'damaged' Norns. Adoption has since branched out to include all forms of trading Norns over the Internet, and typically includes Norns that a player is particularly proud of. This might be through breeding, strange occurrences creating unusual prodigy, or by manipulation and recoding of the Norn's computer code/digital DNA. Photography is an important tool in adoption, with photos of hopeful Norns posted onto websites with descriptions for new prospective owners to browse. These often include anthropomorphised biographies of the Norns available for download, complete with photo snaps of grinning Norns vying for new parents. Adoption practices structure the techno-scientific status of the game, with most Norns included for adoption being the proud parent or player's best efforts in the genetic manipulation of the Nornian gene pool, achieving new colours and interesting traits. These are often described in technical terms, specifying the genotypic structure and or the phenotypic attribute in a manner akin to a biological specialist.

The creation of history through photographic documentation, either commemorating events or tracking Norns through adoption, can continue throughout each Norn's life. Photography is a social tool, enabling and structuring both the development of gameplay and relationship between player and Norn. When a Norn dies, this relationship is formalised again in the placement of a tombstone, allowing the player the opportunity to pay their last respects to honour the deceased Norn. Death is both a social practise and official event; the player chooses a photo and writes a caption to place on the tombstone and the

death is officially recorded in the recording device. Even in death, connections and links are made between human and Norn, as official and social ties are structured in gameplay tying Norn and human social practice.

Raising Life the Technoscience Way

Nurturing life in *Creatures* goes beyond mere guardianship and social ties to a more encompassing techno-scientific challenge, ensuring Norn life and wellbeing through the management of individual Norn bodies and the continued Norn lineage. Players must develop skills to keep their Norns healthy as well as maintaining and improving the Norn 'gene pool' through breeding and genetic engineering techniques. In aid of these challenges, the player is supplied with advanced tools in a number of player Kits, which allow both a number of monitoring and observation tools as well as to directly intervene with specified Norns. These tools structure a narrative supporting a cybernetic definition of life, signalling the player in the maintenance and manipulation of a number of Nornian 'biochemical' feedback systems in the production of health and wellbeing. The Health Kit tracks a Norn's fitness through the monitoring and regulation of drives and needs. Attempting to maintain homeostatic equilibrium, Norns will self regulate and will "learn to perform actions that will reduce the levels of these meters" (Simpson 1997: 92). These include the maintenance of pain, hunger, exhaustion, sleepiness and boredom – the player is given specific additional advice about how to encourage the Norn to self-regulate each of these areas. The levels of each drive indicate which are at homeostasis and which would benefit from intervention. Each drive and need is generated from a combination of 'chemical' levels and interactions that the player can monitor in the Science Kit. With such knowledge, the player can choose to 'prescribe' a medicine available from the 'Doctor's Page' of the Health Kit or can take more direct action and move to the 'Injections' page of the Science Kit where certain chemicals can be hypodermically syringed into the Norn. Gameplay is structured around the ability to monitor and intervene in the cybernetic processes of feedback between the Norn and its environment. Health and wellbeing in *Creatures* is structured as the maintenance of drives and needs, produced through the regulation and balance of biochemical feedback loops.

Sex and reproduction follow similar narrative structures, with both male and female sex drives and female fertility generated through biochemical levels and

balances, which the player can monitor and influence in the Breeder's Kit. As with other drives and needs, sex for Norns is directed by the attempt to maintain homeostatic balance. Narrative scaffolding produces a connection between silicon and carbon within the game. The player is informed that "Animals need to breed in order to survive, and in Norns sex is a primary drive. Norns start to develop a sex drive during adolescence, and a high level indicates a need for them to mate" (Simpson 1997: 96). Kinship bonds between animals and Norns are enforced in claimed parallel cybernetic reproductive strategies. Norn sex, the 'kiss-pop' of a heterosexual male and female sexual meeting, alleviates unbalanced drive levels and achieves Norn homeostasis. To aid in Norn reproduction, as is available with other drives and needs, the player is given the opportunity to influence biochemical levels. In encouraging sexual mating, the player has access to chemical substances to increase sex drive through the 'Aphrodisiacs Page,' where "mating-related herbs" are available to supply to the Norns to raise or lower their sex drive. In this way, the player is able to influence biochemical levels relating to the balance or imbalance of sex drive chemical levels.

Having the ability to influence sex drive is important in *Creatures*, in developing Norn breeding programs, and ensuring that the Norns that the player wishes to mate are encouraged to do so, while others are discouraged from doing so. With the purpose of the evolution of the Norn species, Norn breeding is a central concern within *Creatures* and the player has been given three standards techniques in which to influence Nornian evolution, both in artificial selection and genetic engineering. The first is using standard breeding programs through which certain traits are artificially selected for, similar to the breeding of pedigree dogs. It is through this type of manipulation that the Breeder's Kit is useful, in the monitoring and control of Norn sexuality. *Creatures 2* furthered the interest in genetic experimentation with the addition of a gene-splicing machine, providing technoscience equipment so that players could experiment with the mixing of genes without the reliance on sex, pregnancy and birth. The gene-splicing machine operates by combining the genomes of two creatures into something new and unexpected by the random amalgamation of the donor codes. It opens *Creatures* to transgenic engineering; Norns can be spliced with the higher creatures of Albia, creating unusual combinations of Norn-Grendel, Norn-Ettin or Grendel-Ettin. The third and most involved manipulation is the genetic engineering of new species through the writing of new genetic code through the Genetics' Kit (an official addition to the game that can be purchased separately) or by using a variety of third party programs developed by players for the task.

Genetic engineering of new species can be the addition of new sprites or altering the manner in which the creatures appear on screen, to the more involved recoding of behavioural and biochemical genotypes, developing species that exhibit new ways of living.

Players have taken the genetic engineering of the Norn DNA to fantastic and unusual ends, creating new strains and breeds not envisaged by the game producers. Enthusiast 'Nornlove' has attempted to compile a (non-exhaustive) breed register for *Creatures* with 96 different breeds archived, of which only 16 are original or developed by Cyberlife[13]. The remaining 80 breeds are the result of player development and include breeds with unusual colourings (such as Star Trek Norns in Federation uniform and Borg Norns with bionic enhancements, or Valentine Norns with hearts on their chests) to unusual traits such as Calvin Norns who can make some of their own food through 'photosynthesis.' Another example of a player developed breed, MerNorns have been extremely popular amongst players. Developed by players Lis Morris and Wafuru (J. Vara), MerNorns begin life on land, spend adolescence as amphibians, and adulthood as ocean dwellers, living and breathing underwater[14]. MerNorns deviate in Norn appearance (by adulthood, MerNorns' legs are replaced by a fish tail) and chemistry (by moving from air breathing to water breathing) in ways that Norns were not originally intended. This example of player inventiveness remains within the culture of the investigation and nurturing of digital cybernetic life found within *Creatures*. Players produce these radical movements in Norn evolution as part of programs of genetic engineering and experimentation, in ways that adhere to underlying structures of the game and further the development of narrative structures that focus on gene action as the code and basis of life. Through extended play and the labour of players, *Creatures* has widened narrative structures that continue a common sense of life itself as a cybernetic system of alliances of code, communication, feedback and control.

From Carbon to Silicon and Back Again

Creatures produces links and connections between silicon and carbon life that structure the underlying ontological similarity between the two in both immediate and extended play. *Creatures* has been structured as a game about life in both its

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[13] www.nornlove.tripod/breeds.html
[14] www.helephant.com/wafuru/e/mer.html

techno-scientific and nurturing parameters. It creates familial bonds of kinship between silicon and carbon that are cemented in a common foundation of code, emergence and cybernetics. Finding a common foundation of code and information within the techno(life)science's allegiance with informatics, Norns not only mimic and simulate carbon life, they ask to be considered as actual instances of cybernetic life. As Kember highlights:

> Kinship is represented on the level of narrative and interactivity and is underlined by a deeper level or principal of connection. The game is based on the principle that norns, as artificial life-forms, are alive or possess the same essential life criteria as humans, including autonomy, self-organisation and evolution. (2003: 97)

As part of a realised utopian cybernetic emplacement, Norns move beyond a reflection of carbon life to supplant it. As a perfected informational universe, Albia compensates our own muddled universe and informs us of our own informational composition. As with other Artificial Life heterotropic emplacements, Albia exemplifies a definition of life and cosmos that our own universe is defined against. It is through this suppletion that computational regimes are understood. The universe comes to be considered as the same as the models created to simulate it; we look to the 'simulations' to define our own.

These links between the scientific and ontological status of carbon and silicon life are made concrete on the official *Creatures* website[15]. Here, the connection of the biological within computation is paramount, and users find various articles of support and advice, with subject matter including understanding Norn biochemistry, ecosystem studies, extended evolutionary experiments of the 'most healthy' Norns, the technologies of Cyberlife and Artificial Life, and an assessment of how a carbon living being can be reproduced inside a computer. For players who wish to further their understanding of the technoscience and links that *Creatures* makes, an online bookshop guides users in the subject areas of *Creatures*, Biology, Genetics and Artificial Life with a large selection of titles including prominent biologists such as Richard Dawkins and Steve Grand. The *Creatures* website disturbs the boundaries between gameplay and scientific practice, between game and educational content, and between carbon and silicon life. Links and ties are both formally and informally forged between gameplay, and more 'properly' scientific areas of biology, artificial life research and the philosophy of the meaning of life itself. Through the website, players are given the

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[15] www.creatures.co.uk

opportunity to explore possible lines of gameplay that they could take with
Creatures and how this can tie back to a greater enjoyment of the game, a greater
understanding of the technoscience behind it and the connections made between
silicon and carbon life.

'Anti-Norn': Is sadomasochism resistance?

Creatures is a game that develops a culture and common sense assumptions built
around ideals of life itself, defined as self-organising code embedded within a
deterministic cybernetic system and post-modern spiritual underpinnings.
Through structures of feeling, players and others associated with the game's
culture are introduced and aligned along the techno-scientific and spiritual
meanings of life itself that are structured for, and produced in, gameplay. To be
able to play the game in any meaningful sense, players must align themselves
with *Creatures* as a game about the raising and nurturing of digital life. Players are
responsible for the protection of this life; they hold a privileged patriarchal
position within the game, and success is based on the ability to create a thriving
population of creatures that progressively advance through generations. Without
this basic understanding of the common sense of *Creatures*, gameplay can only be
unsuccessful; the game will not make sense and the player will not be able to
progress in the play of the game or make any meaningful connections between
action and gameplay. Players become involved in the production of the game's
culture through play and intra-action, both within the game in immediate play and
through more elaborate connections in extended play. As well as developing new
types and species of Norns, Grendels and Ettins, players have introduced new
objects to Albia[16] such as toys, food, machines, and other creatures such as fish
and penguins. They have developed new landscapes and worlds for Norns to
inhabit, and have influenced, through player feedback, new iterations and add-ons
to the game from the developers. This player-developer intra-action has become
instrumental to the development of *Creatures* and its culture. To this end,
Creatures Labs created the 'Creatures Developer Network,' a membership
affiliation of *Creatures* players who voluntarily register to beta test and further
develop aspects of the game. There is an immense amount of free labour involved
in the production and maintenance of a *Creatures'* game culture. There are Albias
to be attended to, Norns to breed and engineer, websites to build and maintain,
web forums and newsgroups to populate, and development to continue. This
creates a collection of immediate and extended gameplay intra-actions that come

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[16] In *Creatures* these are commonly referred to as 'cob's' – Creatures OBject.

together to continually produce a game's culture and common sense, developing meanings through gameplay about the nature of life itself.

The case of the player 'Anti-Norn' initially challenges the production of culture surrounding *Creatures* as concerned with the raising, nurturing and development of digital lifeforms. 'Anti-Norn' achieved infamous status throughout the *Creatures* community in the production of a website devoted to the act of torturing Norns, exhibiting images of Norns within *Creatures* games displaying submissive poses and verbalising equally helpless language. 'Anti-Norn' is a male American ex-marine who achieved such atypical Norn outcomes through the continued 'slap-punishing' of his Norn population and by teaching Norns submissive language. These 'abused' Norns became a calling point for outraged players who began the practice of adoption, downloading 'Anti-Norn's' Norns to rehabilitate and develop them, in a manner not dissimilar to intervention by fostering and adoption from unsuitable and abusive parents, or owners of abused children or pets. 'Anti-Norn' himself became vilified within the *Creatures* community, sparking a debate within *Creatures* newsgroups on the moral and ethical implications of torturing and abusing digital life forms (Kember 2003), and whether Norns counted as being alive, and therefore had any rights. The furore 'Anti-Norn' created was so intense that he even received a death threat from another *Creatures* player and many debated whether sanctions should be taken against him within the community.

Much of the reaction from other players focused on the completely contrary style of gameplay 'Anti-Norn' formed in *Creatures*, and the implications this had in attempts to define the life status of Norns. Far from the nurturing and guiding hand that most players bring to their Norns,' Anti-Norn' dismissed this style of play for another more apparently sinister and oppositional approach. As an alternative to creating 'happy' Norns who were well balanced, outgoing and social, 'Anti-Norn's' population became, through adverse treatment, withdrawn, cowardly and confused. For the majority of the *Creatures* community, this violated the game's accepted culture that had been cultivated within the greater assembly of players, eliciting a highly negative response from other players including the aforementioned death threat. Commenting on player reaction to 'Anti-Norn', Steve Grand finds that the community "showed a greater regard for the creatures than it did for the life of this one human being" (creatures.wikia.com/wiki/AntiNorn). 'Anti-Norn's' gameplay embodies an alternative and oppositional gameplay style within the *Creatures*' player population and the game's acceptable culture. 'Anti-Norn's' torturing of Norns can be framed as a form of resistance against the

hegemony of the existing game culture. Through torturing and abusing Norns, 'Anti-Norn's' gameplay attempts to question and (re)establish boundaries of life itself, between digital and carbon. By effectively denying Norns anything resembling 'human' or 'animal' rights, Anti-Norn challenges the ontological unity between digital and carbon and the equivalent life status each is allowed to achieve.

While 'Anti-Norn' displays an alternative and challenging style of play, examining his oppositional gameplay style within the framework of Raymond William's proposition that "the dominant culture... at once produces and limits its own forms of counter-culture" (1977: 114) Norn torture becomes a case of 'counter-culture' that ultimately remains within the constraints of the dominant game's culture. The question of whether it is possible to torture and abuse a non-living thing is raised – can Norns be abused if they are not living, or at least acceptably life-like? In other words, a gameplay style focused on the torture and abuse of Norns remains concerned with life and our intra-action with that life, as humans. In a hegemonic game culture centralised and focused on the production of 'positive' life intra-actions, its resistance comes not in the form of anti-life, but in the production of 'negative' intra-actions. Whilst highly original, 'Anti-Norn's' style of gameplay nonetheless ultimately remains within the dominant culture's remit of the production of digital life. 'Anti-Norn's' subversive style of gameplay remains within the remit of intra-acting with life. Torturing an entity, found outside of the gamut of things allowed to be alive or considered to be lifelike, would not make sense. *Creatures* is a game structured around the production and proliferation of life, to attempt to play *Creatures* without this central core structure would not produce meaningful gameplay. 'Anti-Norn's' resistance is produced and subsumed within the greater culture of the game. He remains within the parameters of the culture of *Creatures*, but exposes the game's production of meaning through subverting the player's role from nurturer to sadomasochist. By dramatically torturing and displaying abused Norns, 'Anti-Norn' visibly fractures the aura surrounding the life status of Norns and makes the game's culture of life itself evident and debateable. Kember's analysis of *Creatures*' newsgroups during the height of the Anti-Norn torture debate shows how the focus of discussion of Norn torture was linked to debate on their status as alive (2003: 102). Allowing humans to torture Norns alarmingly calls into question their status as living creatures in an interesting duality – on one side Norns can only really be tortured if indeed they are living, and on the other if Norns are living should they not qualify to rights that would protect them from abuse? This debate is played

through within the greater game's culture that, even in its counter-culture, is firmly entrenched in narrative structures and grand narratives of life itself.

Creating Narratives, Producing Meaning

Playing *Creatures* produces an Albian game history through the intra-action of the assembly, brought together within gameplay. The player is a key agent within this assembly in the production of history through the maintenance of Norn lives and evolutionary lineage – intra-acting with the creatures and objects within the game to influence the daily activity of gameplay, as well as further intra-action with other players in extended play, trading, informing, debating and showing off with each other. This gameplay produces the official recording of life on Albia and develops the narratives that players produce and take away from gameplay. The production of narratives that produce meaning from play are intimately tied with the creation of history. Failing to remain within the confines of gameplay initially structured within the game, the assembly of *Creatures* players have developed goal-setting situations in the playing of *Creatures* that challenge players with additional ludic style scenarios within the continued development of history, which the paedia setting of the game takes. These games-within-games highlight the challenge of life at play within *Creatures*.

Breeding experiments such as 'Wolfing Runs,' where the game is left running on its own at increased speed to encourage the natural evolution of Norns through generations, or the trading and one-upmanship that comes with the 'genetic engineering' or breeding of new Norn traits, are based around a gameplay style of scientific experimentation with the creatures within the game and as additional features introduced through player development. Even the rehabilitation of 'Anti-Norn's' abused Norns, through adoption and download, produce narratives around the story of life and lives, with narratives of abuse, rescue, vulnerable and at risk populations, adoption and protection. The 'Norn Genome Project' initiated by the player community to crack Norn 'genetic code,' and analogous to its human counterpart, as well as numerous player produced 'gene splicing' and engineering tools available for *Creatures 1*, not only produce advanced narratives about (Norn) cyber-biological life sciences, but have also prompted Cyberlife to include more advanced techno(life)scientific features in later iterations of the game. One of the joys of playing *Creatures*, and key to its success, is how gameplay can take many levels, from keeping Norns as digital pets to advanced 'genetic engineering' and computer programming. A serious style of gameplay is

adopted by a large number of players, treating *Creatures* as an experimental emplacement for the exploration of the life processes that Norns and the other creatures of Albia display, connecting with each other through websites and newsgroups. This highlights how the discourse of life itself, which the game introduces, has been readily adopted and further enhanced within the game's culture by the greater assembly brought together in extended gameplay. Throughout gameplay and the associated work involved in extended play, connections between human and Norn are made, from the 'Norn Genome Project,' to adoption agencies and 'Creatures Wiki', an online user-populated encyclopaedia site devoted to *Creatures*. These mirror and extend the similar connections between silicon and carbon that the official *Creatures* website makes.

Players consider *Creatures* a serious game for playing with life. When combined with the ties bonding silicon with carbon life that the *Creatures* website forges, and especially with Steve Grand's own model of computational regime in responsible determinism that crosses both Albian and Earthly life, nature and universes; a specific and unitary story of life itself emerges, told repeatedly through the narratives taken from gameplay and surrounding activities, and intimately tied with other similar discourses produced within the sphere of the contemporary life sciences. Prior to a critique of what life is deemed of value within artificial life emplacements (Adam 1998), there needs to be a close examination of the ontological foundation of computational regimes at play within *Creatures* and other evolutionary artificial life computer games and programs, their bundling of discrete space and time, the deterministic cosmological model that emerges, the reliance on genetic action in the construction of life itself and the grand spiritual and scientific narratives that are all repeatedly played through and (re)produced in the mythic possibilities and narrative structures of these games.

Creatures offers statements on the nature of life itself, digital life, and the nature of reality as a cosmology; structured gameplay produces meaning and player narratives. That is, structuring gameplay around a life ecosystem of a deterministic cybernetic model, of feedback and control, gives a statement that life is defined as such a model and produces meaning through play that supports such a statement. It offers statements that effectively complex life-like behaviour can be produced in a computer that counts as life. It offers statements on the interconnected and deterministic nature of the cosmos as a computational regime. *Creatures* is a productive thing; meaning is produced through gameplay that is structured around statements about life itself. Playing *Creatures* continually

produces new games and new narratives that are each unique, but each produces and builds upon a game's culture focused on a cybernetic definition of life and a cosmology of computational regimes based within responsible determinism.

Chapter 9

'Does it Work': A Conclusion

Information is alive. (Brouwer and Mulder 2003)

The change in accent made by Brouwer and Mulder in 2003 to Ray's 1988 proclamation "information wants to be alive" demonstrates the entrenchment of informatics within the life sciences in the fifteen years between these two provocative declarations. Through the partnership of informatics and life itself a range of cultural formations have been attributed as living processes. It is within and as part of this collection of assemblages, promoting and producing new informational and cybernetic definitions of life and its processes, that replicating strings of computer code find support in their own project as being counted as instances of life. They have been created within evolutionary computer games as things 'down there' and ascribed with the code of new life, products of culture that define our natures. The life status that is accredited to the creatures and emplacements of evolutionary computer games has come to exemplify evolutionary and cybernetic definitions of life itself. As both heterotopias of compensation and a suppletion of life itself, these emplacements epitomise and define the essence of living within the neo-Darwinian evolutionary and cybernetic definitions of life.

Creatures, its peers and predecessors enable productive practices that (re)produce new definitions of life formulated within conceptualisations of information, code, reproduction, evolution and cybernetics. These practices have continued with the recent game *Spore*, released in late 2008. Finding a theoretical heritage within twentieth-century informatics, cybernetic theory, computer and the life sciences that codifies the gene as the book and essential ingredient of life, and forging a genealogical ancestry through games and programs that develop spiritual and scientific narratives connecting silicon and carbon life in mutual histories, evolutionary artificial life games and programs claim to create new forms of life. This new life connects with common terminology, systems, aesthetics, life patterns and ties of nurturing and kinship. The formulation of life that these games and artificial life emplacements (re)create forges a unitary and essential vision of life itself. Furthermore, the material and digital are connected

spatially, through common natures and cosmologies within computational regimes. Within these patterns of emergence and connection are formed that postulates a deterministic formulation of life, nature and cosmos. Moving forward from *Creatures*, *Spore* continues the development of evolutionary computer games, with similar statements about life, nature and cosmos.

This chapter culminates the investigation of how it has become possible to talk of silicon entities as alive by incorporating a critique of computational regimes. It begins with an introduction of *Spore*, and an investigation of this game's continued aliegience with many of the ideals covered within the thesis. It moves on to ask whether evolutionary computer games, as computational regimes, and the statements that are produced within gamplay actually work. Reminded of the materialist positioning developed in chapter one and taken thoughout the thesis, it explores the similarities between carbon and silicon while respecting their differences. The chapter suggests that silicon creatures could find their own life or life-like behaviours without the need to resort to an essentialist definition of life itself.

Reworking the relationship and intra-action between silicon and carbon creatures highlights the need to find affiliations that acknowledge the mutuality between human and silicon. Reminded of the materialist position this thesis developed in the introductory chapter, and especially Barad's concept of intra-actions between things in the co-construction of the real, this chapter looks to new relations and intra-actions between human and silicon entities. Turning to Donna Haraway's investigation of the bond between human and dog species in their shared and entwined histories as companion species, similar patterns can be found in our relatively brief, new connections with silicon creatures. Reuniting the assembly surrounding artificial life and our intra-actions with the creatures it produces allows for debate over propositions of the nature of our own cosmology. Exploring the possibility of emergence without the reliance or reduction to deterministic models could open the possibility of politics, resistance and change in new co-constructions of space, time and reality. After introducing *Spore*, and before heading into these less charted territories, this chapter recalls the original query of the thesis: how it has become possible to think of digital things as living creatures and the common nature proposed between the material and digital.

Spore (2008 -): Evolution by Design

In keeping with the genealogy of evolutionary games preceeding it, *Spore* focuses on developing relationships of nurture and kinship between player and the digital entities within the game. It is not so much the breeding and genetic engineering found in *Creatures* and *SimLife* that is of interest, however, but the story of evolution and the struggle of species for survival. The player's objective in *Spore* is to enable his or her creature and future species population to survive, out-perform or even eliminate other species. To do so, the player must guide both day-to-day activities as well as design creatures with advantageous attributes, over the course of five specific game levels: cell stage, creature stage, tribal stage, civilization stage and space stage. While each of these has a ludic style evolutionary goal for successful completion, the five levels when put together form an overarching story of progressive evolutionism. While gameplay is not strictly focused on the workings of individual lifeforms, as is *Creatures*, many of the same statements about life, nature and the cosmos are structured within and produced through gameplay.

The official *Spore* website structures feeling for the game, proclaiming: "It's a bit like the present you imagine a god might get on their first birthday: a mini universe of creation in a box"[17]. Game packaging continues, headlining "Your personal universe in a box" and progressing: "evolve your unique creature, establish tribes, build civilizations, sculpt worlds and explore the cosmos". This is a game about the proliferation of life, placing the player as patriarchal godhead, with the responsibilities this brings. Highlighting the mythic journey of construction, creation and change the player will take in gameplay, both the *Spore* website and game packaging promote gameplay as four distinct activities: "Create your universe from microscopic to macroscopic; Evolve your creature through five stages; Explore other players galaxies; Share with the world"[18]. From an initial unicellular creature within "a primeval ocean with other simple creatures" (Hodgson et al. 2008: 3), to intergalactic travel in the 'space stage', "the next great leap into the heavens" (Hodgson et al. 2008: 175), *Spore* gameplay focuses on the challenge of species evolution and development. In doing so, it follows a similar evolutionary path of *SimEarth*, especially in the ultimate goal of escaping the Earth or planet; one that Richard Doyle finds responds to the "desire to achieve a position as a transcendental observer, to be off the earth, out of body, or beyond the living" (1997:120). To achieve this end state, evolution affects all within *Spore*:

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[17] http://eu.spore.com/whatisspore/index.cfm
[18] http://eu.spore.com/whatisspore/overview.cfm

Evolution is a journey in which the choices and actions you make in one game stage have consequences in later stages. The path you take as a microscopic cell, for instance, affects your abilities as a creature. Your actions even have far reaching reverberations into the future of your species. (Electronic Arts 2008: 10)

It is the player's responsibility to make decisions affecting the evolution of his or her creature and species: "At each stage of your evolutionary path, you will make choices that establish your traits... that will serve your future generations" (Electronic Arts 2008: 10). While the player is involved in some evolutionary decisions such as becoming a carnivore or herbivore, choosing the style of locomotion or becoming friendly or aggressive, there is no choice or deviation from the set evolutionary path structured within the game. The course is one of progressive evolution – from single cell organisms swimming for survival, advancing to intelligent sentient beings with culture and technology exploring the galaxy. Although *Spore* finds Darwinian roots in gameplay, based on the survival of the fittest, it is definitely not about natural selection. As with *Biomorphs* before it, it is the player's design decisions upon which creature phenotypes are based, and success is rated. Paired with the ludic objectives of each level, and overarching evolutionary narrative of the game, evolution takes on strong overtones of intelligent design[19] within play: "You begin life as a tiny cell, then you progress through the other stages on your journey to becoming a galactic god" (Electronic Arts 2008: 6). To this end players are presented with a 'History' chart, a "personal history of your generational path" so that each player can "check how your evolutionary choices and actions are tracking" (Electronic Arts 2008: 9). This graph not only plots creature 'generations', but also positions the player against the progressive evolution tracked through the game. Players are encouraged to select carefully how they shape each creature, with 'design hints', 'tips' and 'notes' guiding players to think of the consequence of evolutionary choices (Hodgson et al. 2008). What emerges is gameplay structured around the emerging progressive evolutionary story of the species, with players strategically making choices at earlier stages of play (and evolution) to affect the species at later stages.

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[19] Closely related with creationism, intelligent design is a teleological response to the question of evolution, suggesting that features of the universe and living things follow a specific design (http://en.wikipedia.org/wiki/Intelligent_design#cite_note-DIposition-0). It implies an invisible hand designing and guiding evolution, and aligns with what Mary Midgley considers evolution purposed for the development of intelligence, "To increase this intelligence is... the purpose of all life" (1985: 84). This aligns with the type of evolution professed by Teilhard in his "Main Road of Cosmic History, leading unambiguously from a pre-biotic cosmos up to the present state of humanity, and pointing firmly onward to a 'hyper-personal' future" (Toulmin 1982: 118) and his popular concept of a global brain – the noosphere, often linked within digital circles to the Internet.

Neither an essence of life as information, nor game worlds as computational regimes, are lost within *Spore*. Finding allegiance with the codification of life itself, players' scores within the game are paired with DNA. Players earn 'DNA points' through activities such as eating, and these are purposed to aid progression through the game; allowing the gaining of health, the evolutionary progression of the creature or species and the design of the creature's or species' phenotypic appearance. While the genetic and metabolic constitution of creatures is not considered as it is with *Creatures* and *SimLife*, *Spore* acknowledges its allegiance with code through these 'DNA points'. Through the 'Spore creator', a game area dedicated to the design of creatures and game elements, players can trade 'DNA points' for new or more advanced body parts (in lower game stages), or clothing and cultural artefacts (in later stages) – mimicking a move from genetic to memetic evolution as first proposed by Richard Dawkins (1989). *Spore*'s challenge is to collect enough 'DNA points' to create a successful creature design that will survive and progress through the evolutionary stages. The story of life as DNA code continues with *Spore*.

As with games before it, the system and player intra-action continues to be shaped by computational regimes, if on a staged level-by-level basis. Each of the five game stages in *Spore* operate as mini-games, separate to each other. As the complexity of the creatures increase through stages, the relationship and form of intra-action it has with the player changes accordingly. The first two stages, cell and creature, involve the player on an intimate level with his or her creature, with the player effectively playing as the creature, directing all its actions. The distinction between player-god and creature-subject is lost; the player can easily move between the two positions. From the tribal stage onwards, the player adopts a more typical participatory patriarchal-godhead role, as gameplay moves to the player giving guidance, rather than actual direction, to the species population. Throughout all levels, the player's control within the game is one of influence, as witnessed throughout the genealogy of games. Each level operates as a computational regime with the player negotiating control with the game system(s). If left running without input from the player, the gameworld proceeds. Without player direction, however, the species will either continue with its last direction, or stall and wander aimlessly. The other species of the planet continue in their quests regardless. As with the informational essence of life, while these elements are definitively present within *Spore* and not entirely ignored, the concentration gameplay takes is on the relationship that players have with their

species and the species' struggle with their rivals for survival, in a story of progressive evolution. Overall, *Spore* continues within the tradition of the genealogy of evolutionary computer games, shifting its focus to a decisively ludic style of play, with narrative scaffolding that structures play through a story of progressive and designed evolution. Gameplay follows the mythic possibilities of construction, creation and change, with close spiritual ties with Teilhard and intelligent design. Scientifically, the strong ties of playing with life itself, as found in *Creatures*, have been muted; although connections with code, informatics, and connectionism remain. *Spore* is very much about playing with life and connecting mutual evolutionary histories with our own.

How has it become possible to think of digital creatures as alive?

The enjoyment gained from playing *Spore*, *Creatures* and their peers derives from the experience of intra-acting with entities inhabiting screens and computers who claim to be alive. The aliveness of entities such as the creatures of *Spore* and Norns extends beyond a mere marketing gimmick to a more encompassing assertion of the life status replicating strings of computer machine code have professed. Tracing a history through artificial life as a field and its coupled scientific partners of computer and life techno-sciences, silicon creatures claim life status within definitions of life steeped in informatics, cybernetics and neo-Darwinian evolutionism. It has been the co-development of information science, cybernetics and genetics throughout the twentieth century, that have formed the foundations to be able to talk about life in terms of replicating strings of informational code (Kember 2003). This underlying essentialism of life itself that permits the group of things included, incorporating Norns and other artificial life creatures, in what counts as life. Importantly, for artificial life to be considered as producing actual instances of life it has been the codification of the gene and the conceptualisation of information as separate and differentiated from its material substrate that has given groundwork to ascribing computer code with life. The creatures of *Spore*, Norns and their digital kin link DNA as the central figure within the multitude cellular functions that contribute to the metabolic processes associated with living. They overlook the multitude of roles of the virtual computer in which they perform, fulfilling a role much like the various cellular intra-actions involved in carbon life. Theirs is a focus on gene action, not activation within an array of collective intra-activity.

The double assumption surrounding information underlines the ability to consider digital and physical space as identical. It has been the conceptual ability to abstract 'information' separate from the material structure of which it is a part, as well as a reductionist approach where all things find a fundamental informational composition, that has allowed our cyberspaces to hold the same essential properties as the material space that surrounds us. Artificial life has continually and actively forged connections between digital and physical that has the tendency to ignore, deny or forget differences between spaces, be they material or digital. Some, such as Steve Grand, have postulated that there is no materiality to physical space; that, as with cyberspaces, space is reduced to information. Forging an equivalent composition between physical and digital strengthens claims of actual instances of silicon life, defined by and through the digital. Coupled with aesthetics that create familiar natures and creatures that, if not analogous to any living creatures, take on the aesthetic characteristics of their carbon cousins' soft and furry bodies, the coupling of digital and material takes on many levels. Evolutionary artificial life computer games, especially the *Creatures* series, structure play through optimising the common threads that can be made between digital and material through structures that develop feelings of commonality between Norn and human. Through structures of feeling and immediate and extended play, the games dicussed in the thesis build cultures in which players are able to investigate different intensities of the ties made available between silicon and carbon, from recognising Norns' 'digital DNA' to the ability to perform advanced genetic and evolutionary experiments, and the investigation of artificial life as a technoscience with ties to biological sciences and post-modern spiritualities. *SimLife* and *SimEarth* similarly make bold connections between silicon and carbon with gamespaces, landscapes and creatures that reflect present and historic narratives of Earth, and with gameplay experiments that encourage links between the intra-actions within the game and proposed equivalent 'real life' processes. *Biomorphs* and *Tierra* also make associations with carbon biology with models of genetic space (*Biomorphs*) and evolutionary patterns (*Tierra*) that actively relate digital and material space. *Spore* continues this tradition with an emphasis on evolutionary design in a Darwinian game of survival of the fittest. Moving outside 'life-as-we-know-it' to 'life-as-it-could-be' (Langton 1996:40) is seen as an expansion of the gamut of life, as most of these games perform. The range of things that are included as alive in carbon biology is expanded upon within artificial life, although there remains a consistent defining essence shared amongst all. The twinned relationship between carbon and silicon life remains.

Evolutionary artificial life computer games and programs find ties to carbon life through forging scientific and spiritual grand narratives that tie human, carbon and silicon life together with similar histories, statements and narratives. Continually played through, mythic possibilities develop narratives of construction, creation and change. Scientifically, through connectionism, emergence, evolutionism and cybernetics, and spiritually through post-modern narratives of the interconnectedness of all things and patriarchal and emergent god figurations, gameplay builds narratives and statements produced within and taken away from play. These further entwine carbon and silicon entities and worlds. They place the player scientifically as experimenter, and spiritually as a patriarchal god; they command, oversee, observe, measure and manipulate the creatures, landscape and other things within artificial life emplacements. Developed through a genealogy of games and programs that continues with *Spore*, silicon creatures are structured by narratives as instances of life through a scientific discourse that builds upon simple structures that, by following simple rules, display emergent behaviours that evolve to display intelligent behaviour, and through a spirituality that connects silicon and carbon life within Western contemporary post-modern spiritual ideals. These mythic possibilities develop common and unitary histories between carbon and silicon. They forge universal ties between silicon and carbon life, and between digital and material spaces, with common histories, terminology, systems, aesthetics, life patterns and through developing bonds of nurturing and kinship between human and artificial life.

What Kind of Life is This Anyway?

Artificial life at once expands what counts as life as it reduces the criteria needed to qualify as life. It maps and produces a unitary discourse on what it means to be alive, what living is about, what qualifies as productive life, as well as extrapolating beyond life to condense this within a singular cosmology. It implicates a rhetoric of progress, competition and transcendence within the narrative and history of life. The central figure of the gene is involved within the type of life that artificial life champions, viewed as the defining unit containing the information necessary for the production of life. This focus supports and develops definitions of life that are similarly centred. The evolutionary definition, from a neo-Darwinian perspective, defines life as the progressive evolution and replication of self-contained units of code. Here, bodies and the experience of day-to-day living are viewed as the means by which genetic code takes to enable its

replication. The cybernetic definition incorporates the processes of living as part of the cybernetic embedded state that organisms have with their environment. The focus, however, remains on information exchanges with the ultimate goal of replication and evolution. Here, there is no true distinction between organism and environment; both are seen as part of overlapping cybernetic systems. Organisms are involved within a set of negative feedback loops within themselves, and between themselves and their environment, for the purpose of achieving one positive loop (reproduction).

Within digital artificial life emplacements structured as computational regimes, this kind of life is embedded as part of an encompassing deterministic system. All computational regimes, including evolutionary cpmuter games, find a theoretical heritage in the *Game of Life*. Through the reduction of space and time to discrete measurable units, the *Game of Life* has built a two-dimensional model that through adherence to a set of simple rules displays emergent patterns. Operating through rules connecting them to their neighbours, it is this behaviour of single units that produces emergent patterns from which proposed higher-level behaviours and intelligence form. Models of computational regimes, such as Hayles' 'computational universe', Grand's 'responsible determinism' or Fredkin's 'Finite Nature', share this common reduction to recuperated modernist notions of time as space as discrete units. It is from this founding principle that if all points within the material universe could be mapped at any one measure of time, and the rules of the system known, then it is possible to determine the state of the system at any other measure of time. Whilst investigating this model is impossible to achieve in practice, and therefore the calculation of accurate futurologies unattainable, it suggests only one determined path of unfolding. Evolutionary artificial life computer games and programs become prime working examples of computational regimes. Through organisation as bits of computer information (ultimately reduced to zeros and ones) and computational processing time clicks, following the rules set out in their programming, these games display emergent and life-like behaviour patterns. This produces a kind of life that is intimately connected with its surroundings and displays determined emergent behaviours that, at higher levels, become the measure of intelligence and self-organisation, through its ultimate reducibility to units of information systematically changing through discrete units of time by the application of simple rules. It is a kind of life that requires the external power of author and initiator to write the rules, set the initial structure of the universe and set time in motion, but also an internal power of connectionism, emergence and evolution to

maintain the ongoing history of the regime and development of life within. Evolutionary artificial life computer games, bringing together game producers, players and system or platform, demonstrate this kind of model perfectly.

Creatures, Spore and their peers are therefore heterotopias of compensation for both evolutionary and cybernetic definitions of life within computational regimes. Through the assembly brought together in gameplay, these emplacements co-construct elements that perfect the structure and system of the computational universe and the process and purpose of life. Moving beyond heterotopias of compensation, these games have come to supplant the material world as ideal instances of computational regimes. It is the cosmological concepts and definitions of life developed within these games and programs that have been reflected back to define the physical world and universe they initially simulated. Within computational regimes and evolutionary and cybernetic definitions of life, it is the material universe that adheres to the definitions and workings of our digital emplacements. Within such a conceptualisation, we adopt the attributes and essence of our silicon kin, in their discrete, rule abiding and deterministic nature. This suppletion naturalises the set of assumptions and outcomes used in the creation of new digital natures and life. Alison Adam (1998) has criticised artificial life for the type of living that is given value within its systems. She highlights how the many positions that would be judged feminine, homosexual or 'non-productive' are disqualified within these emplacements and are actively sought out and removed from the system, in favour of roles that are seen as reproductively useful within an atmosphere of capitalist competition. Prior to and along side a critique of the forms of life artificial life values, though, the recuperation of modernist formations of space and time, under the guise of radical new post-human natures, also need to be addressed.

Does It Work?

Artificial life, within the configuration of computational regimes, has produced worlds that have been postulated as so similar to our own that they exemplify and ultimately come to define life, nature and the cosmos. Moving beyond mere dioramas presenting the wonders and magic of science to a lay audience, Spore, Creatures and other evolutionary artificial life computer games and popular programs implicate players, users and other humans within their assemblies in the co-production of new worlds of wondrous and perfected life. As assemblages, these games (re)create new natures and life that, although alien to Earth, share

common essences and inform us about our own lives, natures and cosmos. They produce a common set of statements about what it means to be alive, implicated within paired spiritual and scientific grand narratives linking digital with material existences. They actively form associations between digital and material and between silicon and carbon life. Returning to the Massumi quote in the introductory chapter of this thesis raises the question "Does it work?" (1992: 8). What new things does silicon life make it possible to think and feel? What does the possibility of silicon life mean for our bodies? Answering these questions highlights both positive and inherently problematic postulations about life and our relationship as humans with the creatures around us.

Artificial life has made it possible to think about the feasibility of life outside of carbon chemistry. If the creatures it produces are held to be alive, it achieves a goal of masculine Western sciences in the creation of new life and new species. It holds the potential of developing and intra-acting with a new type of life, and one that has yet to reach its full set of capabilities. Artificial life questions what it means to be alive and challenges preconceived notions and definitions of life determined solely within carbon based biochemistry. As Kember has noted, "[the] debate within biology is of course not only with the origin and evolution, but also with the meaning of life" (2003: 14). Artificial life has the potential to open new propositions exploring definition(s) of life and our intra-action with the technologies that surround us, as humans. It challenges divisions between living and non-living, human and technology, and nature and culture. The Norns, Sporians and other creatures that we intra-act with within evolutionary computer games are things 'down there' not yet clearly defined as 'up here' as part of culture or 'out there' as part of nature. They clearly have relationships with both. Artificial life (re)creates new natures that claim to be intimately tied with our own, finding identical compositions defined within digital parameters. These place human bodies within discourses of replicating informational sets of code, abstracted from their materiality and defined by their informational formulation. Beyond life itself, artificial life emplacements make it possible to talk of an unknowable future, yet one that is ultimately deterministic. In doing so it questions whether a true politics of resistance is possible. It makes it possible to think of connectionism, emergence and evolution as powerful forces with spiritual godly overtones. It packages both time and space as knowable and measurable discrete units, in a recuperation of modernist ideals.

Norns, Albia, *Creatures, Spore* and the multitude of evolutionary artificial life computer games and programs, the creatures they produce and the cyberspatial emplacements they construct, come together as assemblages reterritorialising what life means, what our natures are, and how our cosmos operates. This thesis is not about whether Norns, the creatures of *Spore* and their silicon siblings count as instances of life; its concern lies in questions of what does it mean to talk about silicon life and new digital natures, and what new territories this opens for formulating our own lives and natures. To do so it questions an essence of life itself, abstracted as information and proposed as progressive informational evolutionism (Kember 2003, 2005). Replacing essences with a concept of habits and to think of propositions rather than statements (Latour 2004), it becomes possible to speak of the possibility of silicon life without having to evoke a form of essentialism that looks to singular universals to classify and define. Within a realist structure, essences are "thought to act as *models*, eternally maintaining their identity, while particular entities are conceived as mere *copies* of these models, resembling them with a higher or lower degree of perfection" (DeLanda 2002: 4). Each instance of an essence maintains a core universal identity; each living entity is but a copy of an essential ideal of life itself. Resisting this, Bruno Latour calls for a program of propositions and habits:

> Articulated propositions must have *habits* rather than essences. If the collective were to be invaded by essences with fixed and indisputable boundaries, natural causalities as well as human interests, no negotiation could be concluded, since one could expect nothing from the propositions but perseverance: they would persist until they won out their adversary. (2004: 86)

Latour's program of political ecology stresses the need for humans to gain a relationship with the entities that surround us, not as objects but as nonhumans, whose status and meaning must be debated within collective life. That is, "nonhumans are not in themselves objects, and still less are they matters of fact. They first appear as matters of concern, as new entities that provoke perplexity and thus speech in those that gather around them, discuss them, and argue over them" (Latour 2004: 66). The new entities of artificial life, the new natures that are constructed and the cosmology that contains them need to be discussed and argued. The debate over the life status that Norns hold instigated by the gameplay of 'Anti-Norn' demonstrates the commencement of such a debate. This needs to be elaborated upon, however, to include a debate on Norn aliveness and also the construction of natures and cosmologies within computational regimes. It is a debate in which all parties must be listened to, whilst recognising the

difference between members. Braidotti highlights this collective, "'We' are in *this* together, but we are not all the same. Dolly the Sheep and I share a structural proximity, but this cannot be adequately accounted for within the logic of rights" (2006: 131). The thesis' concern in such a debate is the importation and ambiguous use and conceptualisation of information, and the recuperation of modernist notions of time and space that have been transferred from digital to material, in the production of new meanings and definitions of life, nature and cosmos.

By assigning an essence of life that assumes the discrete nature of time and space, artificial life produces a specific model that silicon creatures adhere to though their digital composition. By applying this common essence across carbon life within informational evolutionism and models of deterministic computational regimes, questions of responsibility, politics and the opportunity for resistance become apparent. Against this, proposing a set of habits that come to characterise what life is, rather than any universal essence, opens a debate and discussion about what can qualify as life, without packaging life under any essential model. As philosopher Mark Bedau asserts, "For all we know, life might be no more unified than a collection of overlapping properties from overlapping disciplines" (from Kember 2003: 63). Within such a proposition, living things could have the habit of self-organisation, the habit of reproduction, the habit of change through generations via evolution, the habit of embedded cybernetic relationships within their environments, or the habit of defining themselves against their environments. Each new thing that asks to be qualified as living can present its habits and have its status as qualifying as living debated and decided within a collective. Importantly, within this mapping of habits, there becomes no one essential trait or one perfected model of life itself that defines or becomes the measure against which living things are assessed. Living things need not fit any ideal model of what it means to be alive. Life becomes a negotiated association of common habits between things.

Characterising life as a set of habits releases any definition of life to find a universal essence as a model for living things. There would be no requirement to define a unitary essence common between silicon and carbon. In its place, a common set of habits could be negotiated that proposed instances of life could be evaluated within. Silicon creatures would be able to qualify or be denied the status of life on the merits of their habits. We would be able to reconfigure our intra-actions with them, changing how the "world kicks back" (Barad 1999: 2) in

new, fought over and considered positions. Importantly, instead of defining carbon life through essences exemplified within silicon life, there would no longer be the justification or necessity to warrant such a suppletion. The common habits between carbon and silicon entities could be explored whilst their differences are respected. The conceptualisation of information would not need to be abstracted from its material substrate in order to produce an essential model for life. Heredity, and the intra-actions leading to heredity, would become a habit of life, allowing recognition of the different strategies types of life, whether silicon or carbon, or of different species or how individuals perform in achieving heredity, or importantly, entities that share other life habits but do not themselves reproduce. Removed from any informational essentialism, reproduction, heredity and evolution could become common habits across living things with the variety of strategies that entities employ to become part of the diversity of living.

By removing any essential defining property that must be shared across silicon and carbon entities, the need for an ontological universalism between digital and material is eliminated. Filled with habits and propositions, cosmologies of computational universes, can do away with any perfected essential model upon which our material and digital realities are defined against, as with the reconciliation of what counts as life. Within computational regimes, shared across material and digital spaces, it is the ultimate reduction of reality to discrete and ultimately knowable measures of time and space on which a shared ontology has been built. This packaged and recuperated modernist notion of time and space forms the defining essence of computational regimes. This has led to a cosmology that has been able to find a type of determinism within connectionism, emergence and informational evolutionism. It is this assumption and reduction of time and space to discrete units upon which the deterministic attribute of computational regimes is formulated. Computational regimes have found a perfected model within the closed systems of virtual computers that find a heritage in the *Game of Life*. This model has been transcribed from digital to material, establishing an essential model of the universe as a closed system containing an underlying grid of measurable points that unfold through discrete units of time. Within material space, all that is left is to ascertain the dimensions of the spatial grid, the measure of time and the rules of the system to fully enlighten the unfolding of the universe. Such a model normalises and naturalises the concept of space and time as discrete units and the universe as a computable closed system. The emplacements and gamespaces of evolutionary artificial life games become perfected new natures within this definition, defining and modelling the essence of

computational regimes. Moving to the proposition of habits, a realist or materialist ontology can be formed that does not rely on a universal composition between digital and material spaces. Such an ontological stance would "grant reality full autonomy from the human mind, disregarding the difference between the observable and the unobservable, and the anthropocentrism that this distinction implies" (DeLanda 2002: 2), yet it is one that does not depend upon any essential model of the building blocks of reality. As with life, similarities between digital and carbon can therefore be explored whilst differences acknowledged and respected. Importantly, the constitution of the material universe need not be defined and supplanted by the digital, as there would be no ideal model upon which universes are moulded.

What would artificial life and evolutionary artificial life computer games look like when taken out of essences and statements and formulated instead within habits and propositions? Returning to Latour, an important aspect of political ecology is that there strives to be universal decisions made on the status of things as entities, but this universal decision must be hard won:

> The common world we took for granted must... be progressively composed, it is not already constituted. The common world is not behind us ready made, but ahead of us, an immense task which we will need to accomplish one step at a time... The common world is now up for grabs. (2002: 29)

That is not to say, however, that Latour is here prescribing to a relativist or constructionist ontology or standpoint. Echoing the materialist positioning of this thesis, his call to action renegotiates our relationship with the real in its constant co-construction and co-production. It strives to find new ways to understand the world under common terms in which both humans and nonhumans have declared interests. It is a way for science to invent "speech prothesis that allow nonhumans to participate in the discussions of humans, when humans become perplexed about the participation of new entities in collective life" (Latour 2004: 67). It gives rise to debate "without assuming some innocent, symmetrical form of interaction between knower and known" (Barad 1999: 2). The entities of artificial life, the natures they inhabit and the cosmologies that they embody have initiated such perplexity. Their fate and constitution must be debated within collective life, without recall to essentialism as a universal bond of unity. This thesis can only suggest and deem such a debate necessary. It adds to the debate and becomes a voice within the collective, but it cannot speak for the collective as a whole. No hard conclusions are possible, only a set of propositions to bring to the table.

Doing so takes diplomacy, and my role in the last section of the thesis is one of diplomat (Latour 2002). This leaves many of the answers open to the questions this thesis asks, without knowing what the ultimate outcome of the debate will be. Again, Latour finds this an ideal characteristic; "The great quality of diplomats is that they don't know for sure what are the exact and final goals – not only of their adversaries but also of their own people" (2002: 38).

Two Propositions

The first proposition I make regards the relationship between the creatures of artificial life and humans. It is about each of these as species that share common history and evolution. Bound in an essence of informational evolutionism, the creatures of artificial life became ideal instances of definitions of life itself. Artificial life finds itself, therefore, in a position to provide a more perfect version of life itself, in a suppletion where carbon life came to be identified and defined by the simulations we created. Within this conceptualisation, a common inference made about our relationship with artificial life was one of succession. Here, silicon creatures were heralded as the next, advanced level of informational evolution. Keith Ansell Pearson offers this as one of the fashionable grand narratives where "we are offered a plethora of apocalyptic scenarios concerning an alleged phase-space transition to a new, 'higher' level of evolution based on machine intelligence, resulting in a genetic take-over of carbon life by soft machines (robots and computers)" (1997: 148). Kember finds that this is a distinct and primary discourse within artificial life:

> The discourse of alife which interlinks with that of biology is precisely about
> the generation by one dominant species of a new dominant species of
> artificial or alien life-forms. This generative praxis relies the plasticity and
> potentiality of life which lies along side more normative and regulatory
> tendencies at the heart of Darwinism. (2003: 34)

Freed from the need to deal with clumsy and slow carbon meat bodies, Norns and their silicon siblings can evolve quickly at speed within the digital emplacements we could only desire to be a part of, denied entry and excluded by our very material carbon embodiment. Fuelled by a transcendental desire towards a scientifically and technologically constructed New Jerusalem, and blocked by our inability to truly enter these digital hallowed grounds, the silicon creatures that find these emplacements home became successor species, poised to take informational evolutionism to new horizons that humans could not reach. These

exemplify the creatures Katherine Hayles suggests will constitute "a new evolutionary phylum that will occupy the same niche as *Homo sapiens*" (2005: 132). It was only a matter of time before artificial life creatures evolved beyond the capabilities of their poor human relations. The stage was set for a new type and level of informational evolutionism that left humans behind.

Against this I would propose an association between carbon and silicon life, and specifically between human and artificial life, that forms a different type of relationship than successor species. As a diplomat, I will temporarily and tentatively grant the entities of artificial life the status of life; it could be argued that they share numerous habits that we have come to define as living. It must also be remembered that there are many habits of living creatures that artificial life entities do not share (Boden 2000 for example), so their life status is far from determined. Ansell Pearson also warns of the immense danger of "conflating biology and technology" where "a new mythology of the machine is emerging and finds expression in current claims that technology is simply the pursuit of life by means other than life" (1997: 148). Whilst this challenges granting life status to the entities of artificial life, a debate within the collective need not rely on conceptualisations and mythologies of successor species in their relation with humans. Instead, I will invoke and propose a relationship as companion species, taking from Donna Haraway's canine manifesto of the same name (2003). Divorced of an essential defining model upon which life is rated, carbon and silicon life could develop a relationship based on shared common habits and retained differences. For Haraway the workings of this relationship are paramount. She finds that "what is at stake is two fold: 1) the relation between what counts as nature and what counts as culture in Western discourse and its cousins, and 2) the correlated issue of who and what counts as an actor. These things matter for political, ethical, and emotional action in technoculture" (2003: 27). Rosi Braidotti offers a similar such 'kinship system' in her figuration of *Zoe*, which "rules through a trans-species and transgenic interconnection, or rather a chain of connections which can be best described as an ecological philosophy of non-unitary, embodied subjects" (2006: 111).

Relating humans, Norns, the creatures of *Spore* and the other entities of artificial life as companion species, or as connected through *Zoe*, acknowledges our entwined histories and common futures, allowing for an analysis of relations between carbon and silicon, in how each mutually influence the other in the shaping of lives. Haraway finds the objective of companion species is in

recounting and conveying the relationship between each; "Living with animals, inhabiting their/our stories, trying to tell truth about relationships, co-habiting an active history: that is the work of companion species, for whom 'the relation' is the smallest possible unit of analysis" (2003: 20). Rather than competing as successor species, the uncovering of the relationship that silicon life shares with humans creates stories of shared histories. Within a framework of computational regimes, this has to date revolved around producing meanings of life for both human and silicon, defined within forms of informational evolutionism and cybernetics. It has presented computational regimes as the cosmological formation of our natures, with a common, digitally-defined, underlying ontological structure. As much as looking to the past, companion species are about common futures. As with other species humans intra-act and create bonds of companionship with, silicon creatures have the potential to further develop ties that will create new histories of mutuality (dogs form a potent example of this but are far from unique). Similar to our other companions, humans and silicon creatures could co-develop areas of usefulness, dependence and shared active histories. We could share developmental paths without competing for any niche position containing the essential model of life itself. Ansell Pearson proposes a similar shared development and history between species in the concept of symbiosis, where an animal is defined in terms of the assemblages with other living beings in which it enters (1997: 134). He finds that "creative evolution on earth would have been impossible without the intervention of the genetic engineering that characterizes viroid life" (Ansell Pearson 1997: 133). The symbiotic relations that organisms form with each other shape lives and evolution over generations.

If denied a qualification as living beings, the use of silicon entities within computer technoscience could continue to borrow life-like habits and processes, in the design of nonliving digital entities that would persist in creating innovative things, as with other areas of engineering and design. Continuing to forge a relationship with the life sciences, artificial life could build models and simulations of life processes, but not actual instances of life, recognising the limits of such simulations. If given the attribute of life, silicon creatures could provide an opportunity to co-create and explore new relations with novel living things that impact human life as much as our own human intra-action will impact theirs. Silicon creatures could create their own life histories, independent but intimately tied with our own. Their beings would be adapted for digital life but they would also be necessarily shaped by human needs and desires. Likewise,

silicon creatures will respectively shape humans, in what new things they do and in new things they allow us to think and do. Recognising the differences between silicon and carbon means that any instance of silicon and carbon life would necessarily be qualitatively distinct. Silicon life would explore 'life-as-it-could-be.' This would give a new appraisal of evolution:

> The point is to rethink evolution in a non-deterministic but also a non-anthropocentric manner... Central to this non-essentialist vision of vitalism is the idea of affinity among different forces, in a set of connective disjunctions which are not synthesis, but a recomposition. (Braidotti 2006: 126)

Qualifying artificial life creatures as alive through agreed habits and without recourse to any essential model of life itself or historic defining features, such as evolution, retains political and ethical implications. As well as determining the life status of artificial life creatures, the collective must also consider the ramifications of denying or granting this status, both for silicon and carbon entities. Not all silicon entities may be collectively deemed as qualifying as alive. Conversely, Braidotti, developing Guattari's machinic formulisation of autopoiesis finds that:

> This results is a radical redefinition of the generative power of 'Life'... Machines have their own temporality and develop through 'generations': they contain their own virtuality and futurity. Consequently, they entertain their own forms of alterity not only towards humans, but also among themselves. (2006: 124)

The criteria used, and the habits considered within such a decision, affects carbon as well as silicon life, as granting life status to silicon creatures would also carry corollary effects for carbon life. What the rights of silicon creatures would be would need to be ascertained; along with what responsibilities humans would have in their care and maintenance. Expanding the gamut of life into digital realms means finding living things within techno-cultural spaces that are humanly created.

The second key proposition I make concerns the construction of computational regimes. Reminded that Haraway (2003) finds one of the key foci of companion species is how they shape what counts as nature and what counts as culture, artificial life challenges popular distinctions. Silicon creatures are not only originally cultural techo-scientific productions themselves, but the computer environments they inhabit, conceptualised as digital 'virtual universes' and

'natures,' have been humanly (re)created within our computers. Within the conceptualisation of computational regimes has been the underlying discrete and rule based structure as a closed system of these virtual computer universes that has been transferred and applied to our own. Our cultural products have come to exemplify, define and become a reference for how nature is constructed within computational regimes. By divorcing ourselves from defining common essences in order to relate artificial life emplacements and material spaces, there is no requirement for each to conform to the other. Retaining a nuanced realist or materialist ontology that maintains an external real in constant co-construction, digital and material spaces can be recognised for their shared continual production. Importantly, the focus can be placed back on the material, in that the structures that produce digital space are necessarily already part of material space. In this way the digital spaces of artificial life emplacements can be constructed as closed systems of discrete time and space without limiting material space to the same constitution. Material space would therefore not be defined and confined by the structure of digital space. This has implications for each of the basic underlying assumptions within computational regimes regarding the structure of the universe. The first is the universe as a closed system. The virtual computer universes created as artificial life emplacements are necessarily closed systems, defined as a distinct section of computer memory, within a definable finite area. In contrast to this, the material universe cannot be easily negotiated as similarly closed. Computational regimes also assume the discrete unit based structure of both time and space. Wise (1997) has traced the modernist rationalisation of time, removing time from a natural durée of unfolding. Within computational regimes, time recuperates such a modernist rationalisation, allowing for the state of the system to be knowable at any given time frame. Within digital space, this rationalisation takes the form of defined computing ticks and the timing of the operation of the computer in completing each single instruction of code. Within material space, time remains open to a natural durée, although when conceived within modernity as divisible model there is no single smallest unit of time. Space is also rationalised within computational regimes. Within digital space this takes the form of discrete units as computer memory bits and displayed monitor pixels, each point within the space mapped and definable. In contrast, taking from a materialist approach, we are reminded of the ultimately unknowable state of the real. Reminded of Hayles' unmediated flux, among other similar mappings of the real, we cannot assume a similar discrete and mapped structure of material reality. This creates a conceptualisation of the

material universe as an open system of ultimately unknowable spatial structure, unfolding within a natural durée.

Coming to this understanding of the structure of the material universe has obvious ramifications within the statements that computational regimes make, which need to be open to discussion and debate. Computational regimes have been conceptualised as rule based closed systems, where each spatial point is knowable and able to be mapped, and time progresses as a series of defined units. It is from these assumptions that computational regimes have been able to present a deterministic cosmology through the use of connectionism and emergence. The universe is on a single and determined path, if humanly unknowable. Removing the underlying assumptions that structure computational regimes in the material universe means that it is no longer feasible to consider the universe as a deterministic system. With no discrete structure of time and space available to give a fully mapped snapshot of the universe at any given time interval, there is no structure upon which any deterministic model can be formed. An unmediated flux formed within an open system that unfolds within a natural durée means that no system of progressive snapshots can be made upon which a deterministic model can be built. Computational regimes as deterministic systems are only feasible in digital space where the requirements for their structure can be produced. Recognising the differences in composition between digital and material spaces has implications for the concepts of connectionism and emergence. Again, with diplomacy, I do not want to dismiss connectionism and emergence as workable concepts at the moment. Instead, I would like to briefly explore what these could look like in a more nuanced approach of a cosmology of the material universe and how this might relate to digital spaces of computational regimes. As with determining the life status of different entities, the purpose here is to highlight the need for debate and discussion within a collective assembly, not to come to any hard conclusions.

The second proposition this thesis puts forward, therefore, introduces unpredictability to connectionism and emergence. It gives the ability through a nuanced conceptualisation of connectionism and emergence to form predictions on future actions without reverting to a form of determinism. From actor network theory through to a Deleuzian view of rhizomes, there has been recognition of the relations and connections that entities form with each other within networks. Right to the molecular level, entities find connections with other entities formed within rhizomes and assemblages. Additionally, it is from within such networks,

rhizomes and assemblages that intra-action occurs. The materialist standpoint this thesis structures itself upon finds as one of its prime tenets the intra-connectivity of agents, human and nonhuman, living and nonliving. The connection between things and the emergence of behaviours and intra-action from that connectivity is not the real issue here; the question of a politics of resistance and the ability to debate the nature of the universe and its cosmology is (Braidotti 2006: 7-8). Presupposing a computational regime questions the ability for politics of resistance and highlights the issue of responsibility. Although models such as Grand's responsible determinism highlight the need to act in a responsible manner, any deterministic model ultimately negates resistance and change. Considering the universe as an open system, whilst retaining a model of connection and emergence, returns one to speaking within probabilities, possibilities and (non)predictability without being bound by an ultimate determinism. It is within such a standpoint that resistance, change and a true responsibility can emerge. Importantly, recognising computational regimes as a working conceptualisation of digital space, but within a looser model of habits, opens a debate within the collective on the ontological structure and cosmology of the universe. Other important questions that are raised by computational regimes can be examined and negotiated without recourse to an essential, singular and immobile model. The authoring and application of the rules, the construction of the universe, the initiation of time; all of these raise spiritual and scientific concerns within the conceptualisation of computational regimes when applied to the material universe. Having the ability to debate, discuss and negotiate the ontological structure of the universe, what time is and whether the universe operates to a set of simple rules, opens a discussion of computational regimes out of an essentialist model. As with a debate about what constitutes life, cosmologies of the material and digital universes can look to developing common habits, whilst retaining the properties that maintain the distinctive character of each. Whether conceptualising computational regimes and digital 'universes' under an essential model or as a set of shared habits, there are implications to what counts as nature and what this nature looks like. The collective that comes together to debate such matters must not only consider the fate of the digital emplacements the entities of artificial life call home, but also what the decisions made on these spaces say about our own material universe, its composition and cosmology. The questions raised and the conclusions drawn will have a social, political and ethical impact.

Evolutionary artificial life computer games have introduced a general audience to the possibility of life outside of carbon biology. These games connect silicon and carbon together intimately, producing common meanings of life, nature and the cosmos through play. Through developing meanings of life steeped in neo-Darwinian informational evolutionism and cybernetics, artificial life constitutes part of the assemblage reterritorialising what it means to be alive within an informational structure. Evolutionary computer games take the player on mythic journeys of construction, creation and change that produce common spiritual and scientific grand narratives between carbon and silicon life, and material and digital spaces. This has been condensed within the cosmological conception of computational regimes, which unite digital and material under a single ultimately deterministic model. It has been the matching of digital and material spaces and silicon and carbon life with common essences that has given ground to the ability to talk of the possibility of silicon life. Within such an essential model, silicon entities share an informational essence with carbon life that argues for their life status within certain definitions of life itself. Within these definitions, silicon entities become perfected models of life itself. In both the definition of life itself and in the building of a cosmology of computational regimes, our digital emplacements have come to exemplify and define what carbon life and the material universe are. Doing so, problematic assumptions over the use of information as a concept, and the recuperation of modernist notions of time and space, are naturalised and normalised within the unitary narrative computational regimes and its partnered definitions of life give. Examining the new entities produced by evolutionary computer games within Latour's program of political ecology offers the possibility to free carbon and silicon, material and digital from bounded essences to instead explore common habits and new relationships of mutual histories.

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