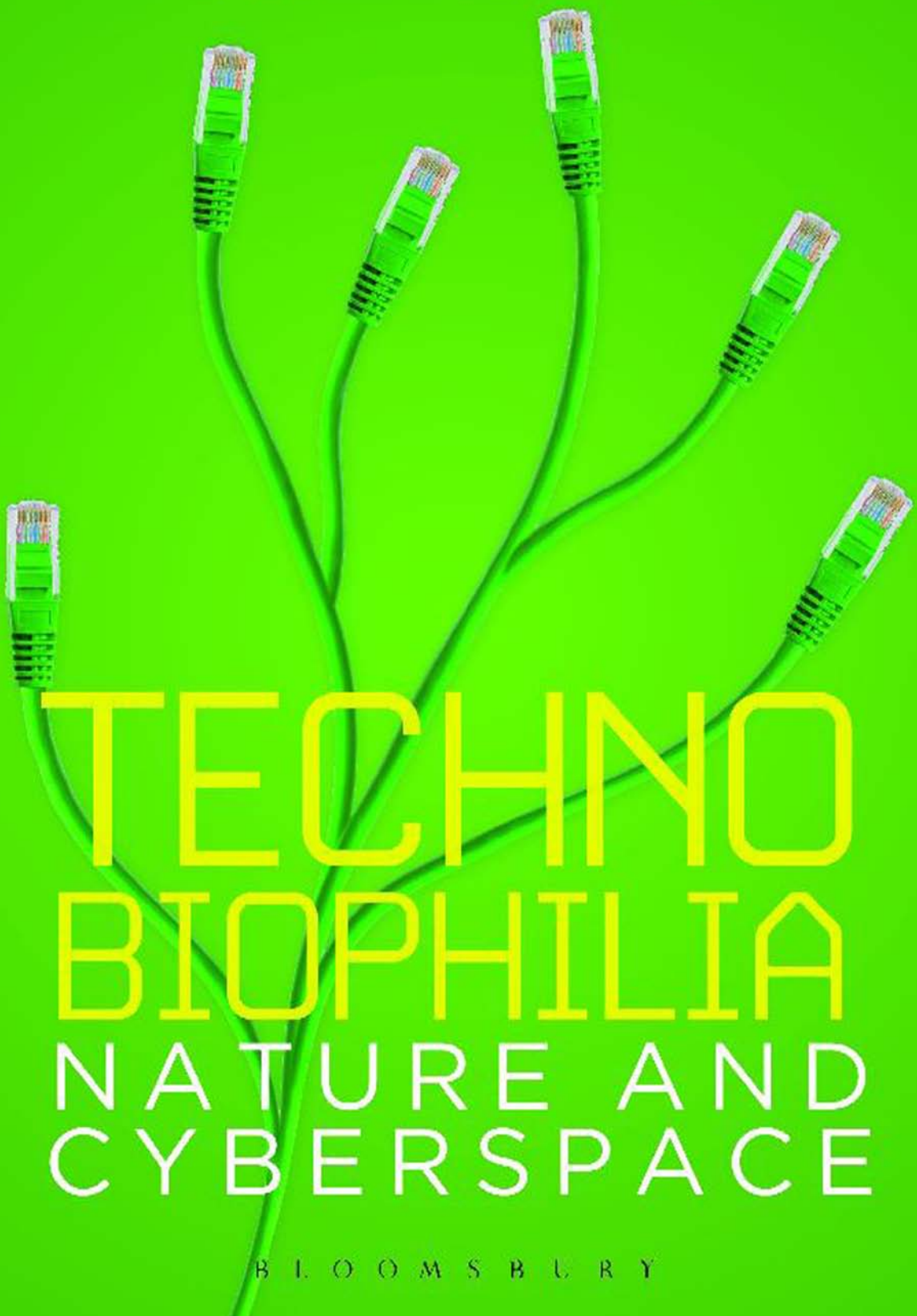
SUE THOMAS



TECHNO BIOPHILIA

NATURE AND CYBERSPACE

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Technobiophilia

Technobiophilia

Nature and cyberspace

SUE THOMAS

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For my grandsons Ethan, Oliver, Louie and Milo.
Always be curious!

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Preface

This book is for anyone who uses the internet, from beginners to the obsessed. It is also, you may be surprised to learn, for nature lovers everywhere. But rest assured: I am not going to tell you to turn off your computer and go outside, which may be what you are expecting. Instead, I plan to demonstrate the ways in which nature intertwines with the wired life to provide unexpected benefits such as an improved attention span, a rested mind and enhanced creativity. I will show that the natural world has been woven into the internet since its earliest beginnings and that there need not be an either/or choice between technology and well-being.

But first, a word about how *Technobiophilia* came to be written. My first book, a science fiction novel called *Correspondence* published in 1992, grew from a fascination with two apparently very different topics: the cyborg and the countryside. The book evolved not just from a personal longing for a rural idyll, familiar to many of us, but also from a powerful desire to somehow merge with the machine. Writing it, I began to understand that nature and technology are much closer than I could have imagined, and since then the integration of the virtual with the physical has underpinned much of my work. My second novel *Water* (1994) was a personal imaginary shaped by the properties of the ocean, and 10 years later, in the non-fiction *Hello World: Travels in virtuality* (2004), I combined memoir and travel writing in an attempt to make sense of the ways in which my own wired life had become deeply integrated with the physical world of the everyday.

Technobiophilia: Nature and cyberspace is the result of a hunch that I might not be the only one to feel that way. Other people, I realized, also experience cyberspace as if it were a physical world. I had only to look at the words we use when we talk about the internet, such as clouds, streams and viruses, to know that this is true. But why is it happening and what does it mean? I began collecting examples of metaphors and images of the natural world commonly found in computer culture and asking what they tell us about the intersections between human beings, cyberspace and the natural world.

The answers I found will be of interest to a wide range of readers including everyday users, academic researchers, educators, policy-makers, businesses – indeed anyone concerned about the impact of new technologies on our lives, health and well-being.

There is already a great deal of scholarship about the internet in relation to urban spaces and the digital body, but to date I have found very little interrogation of nature and wildness in cyberspace. The topic of technobiophilia is, like the web, an enormous, unbounded world, and this is the first book on the subject, so I cannot claim to cover it all and there are important areas I have not had the space to discuss. For example, I have not looked at the considerable number of digital artists who work with and from nature; nor have I explored virtual worlds beyond a few brief mentions. I have not had time to look in any detail at gaming, music, animation, science fiction or feature films, novels or comics. Training and education in the applications of biophilic design to the online environment are crucial but require a separate study. In this book, sadly, I can only break the first ground by looking at the most obvious attributes of technobiophilia. Much more needs to be done.

I hope more researchers will take up the baton and widen the field. I come from a humanities background and the scientific work behind biophilia has introduced me to unfamiliar areas of scholarship. I have tried to do them justice but transdisciplinarity is a notoriously difficult practice and despite my best efforts there may be areas I have misinterpreted. Subject specialists will undoubtedly identify my shortcomings in their own spheres of knowledge and I hope they will be inspired to help fill in the gaps by sending me corrections where necessary as well as developing further research from the beginnings I have provided.

Sue Thomas, Bournemouth
January 2013

Acknowledgements

This book took 8 years to write and went through many changes along the way. It began with a few simple questions but grew into a cascade of answers which frequently threatened to overwhelm me. Making sense of them, and knowing where to add and where to cut, has been the biggest part of the job. Even now I find myself with enough left over material to write another book and then some.

I am immensely grateful to everyone who helped me on that journey. Thanks to my family: Amber, Erin, Carolyn, Tim and Dominic for their patience and support. Thanks to the friends who gave me courage: Thilo Boeck, Catherine Byron, Carolyn Guertin, Martine Hudson, Ann Kaloski-Naylor, Toby Moores, Kate Pullinger, Tom Wilson and Julie Woodin. And thank you to my grandsons, whose company reminds me of what is *really* important.

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Finally, thank you to my sister Carolyn Black who captures the spirit of my research in the beautiful images which head up each chapter.

1

A place so new that some things still lack names

Like Copernicus, we are privileged to witness the dawning of a new kind of space.

MARGARET WERTHEIM, AUTHOR[1]

Life

> The web smells like life.
>
> KEVIN KELLY, founding executive editor of *Wired* magazine[2]

It is late afternoon in winter and you are weary. You have been reading and writing emails for hours; now you raise your eyes from the screen just as street lamps start to come on outside. Beyond the window cars and buses glide by, their headlights catching the pale faces of shoppers and children coming home from school. You feel trapped in a grey world. Turning back to your device, you sigh, slip in your ear buds, and open a web browser to search for some relief. Just for a moment, you need to be somewhere else, somewhere bright and warm. As you click around, a video catches your eye and you discover . . .

. . . deer wandering through a sunlit forest glade. Birds sing, a stream rushes by, people are quietly working. You notice an odd wooden structure, a complicated camera rig, and a man with a megaphone. He says 'Take One'. Someone sets a wooden ball onto a series of carpentered rails built like a long thin staircase. The ball alternately rolls and falls from one step to the next. Every time it drops, the impact generates a single musical note. Then another. You realize you are looking at an exquisitely designed giant marimba and, what is more, it is playing a familiar piece of music – Bach's cantata 'Jesu, Joy of Man's Desiring'. Eventually the ball rolls to an exact stop on a wooden ledge where two mobile phones stand side-by-side, one facing to the front, the other to the back. It is a surprise to find these hi-tech devices in this woodland grove. The screen of each phone is rectangular just like other smartphones but the case is unusual in that it is made from real cypress wood and smoothly curved to fit perfectly in the palm. The grain of each is different from the other because, of course, no two slices of wood look the same.

This is a promotional video for the Sharp Touch Wood SH-08C,[3] filmed in a forest on the island of Kyushu, Japan. The combination of wild nature with state-of-the-art technology may at first appear incongruous, but in the pages ahead we shall come to understand how thousands of years of human experience lie behind the design and marketing of this very contemporary piece of kit which has been encased in an ancient material and 'discovered' in a stand of trees.

As the film comes to an end there is a brief moment when your imagination places the phone into your hand and you can almost smell the tangy aroma of the forest. Then another email pops up and you are back in the real world of any desk anywhere. But your brief excursion has made you feel just a little refreshed and before opening the mail you follow the link in the video to check out where you might be able to buy such a phone. Maybe it would be good

to own that piece of real wood, to gaze at its patterns and feel its warmth between your fingers.

This kind of momentary reverie at the computer transports us into natural spaces which are very different from the industrial plastic and glass of modern life, and an increasing number of technology companies know that appealing to our love of nature in order to sell high-tech products is both powerful and influential. But how did this seemingly incongruous synergy come about?

It seems to be connected to the fact that as the internet developed, it generated new kinds of experiences and encounters, such as 'being online', and new kinds of innovations then grew up alongside them. But all these tools and designs needed names, and many of the names we gave them drew upon metaphors from the natural world. These terms were not imposed on us and there was no single person directing them; rather, they seem to have evolved as part of the haphazard lingua franca of cyberspace. If the idea seems unlikely, consider this: just as the town of Macondo in Gabriel Garcia Marquez' novel *One Hundred Years of Solitude* was 'so new that some things still lacked names',[4] so it was too with cyberspace. And even today the language of computers and cyberspace is still saturated with images from nature: fields, webs, streams, rivers, trails, paths, torrents and islands; flora, including apples, blackberries, trees, roots and branches; and fauna, such as spiders, viruses, worms, pythons, lynxes, gophers, not to mention the ubiquitous bug and mouse. This is somewhat surprising since internet culture is an entirely new construction built by human beings who mostly live in cities, and until very recently our engagements with it have taken place largely indoors because computers have needed to be close to an electricity supply. The advent of better batteries and mobile technologies is now changing that, but why should cyberspace have any relationship with nature anyway? As we shall see, the reasons are both unexpected and comforting in a world driven by anxieties about the effects of technology on our health and well-being.

The problem with cyberspace is that we love it and we fear that we love it too much. When it comes to our phones, tablets and computers we are constantly torn apart by passion and guilt in equal measures. Are they making us addicted? Anti-social? Brainless? But how can that be when they also make us so happy? Strange as it may seem, there could be a connection between our passion for cyberspace and our affection for the natural world. Extensive research by environmental psychologists and social biologists has already demonstrated that exposure to nature helps us in many different ways such as relieving stress and restoring attention and concentration. Author Richard Louv, who coined the term 'nature deficit disorder', writes 'The more high-tech our lives become, the more nature we need to achieve natural balance.'[5] It might seem important, therefore, that we turn off our machines and go outdoors, and there are certainly many times when this is advisable. But the

situation is more complicated than that. My research shows that some of the features we so value in the natural world can also be found online; indeed, our subconscious has already imprinted nature into cyberspace. Now we need to recognize how that is happening and harness it for ourselves.

In the following pages I explore a new twist on what is commonly known as 'work–life balance'. I will show how we might make our peace with technology-induced anxiety and achieve a 'tech-nature balance' through practical experiments designed to enhance our digital lives indoors, outdoors and online. A word of warning though: *Technobiophilia* draws upon research from numerous disciplines because that is the only way to expose previously undiscovered synergies. As a result, every reader will probably encounter unfamiliar territory at some point such as words and concepts which may feel impenetrable or irrelevant to their own experience. When this happens, do not feel guilty about skipping a page or two. You will most likely return to that spot more confidently later on as the jigsaw comes together. Why persevere? Because you will encounter illuminating surprises which are of critical importance in a world where we spend less and less time outdoors. This book does not counsel you to turn your back on either nature or the machine, but shows how the two can complement each other in very useful ways.

The start

Q: If the internet were a landscape, what kind of landscape would it be?

A: It would be vast and rolling across hills and valleys, with no ability to see what was over the next hill. It would be like a dense net on the landscape with creatures and beings that ebb and flow and interact with humans as they journey across it.

LEONARD KLEINROCK, one of the founding fathers of the internet[6]

In 2004, I started collecting examples of nature metaphors used in relation to computers and cyberspace. I soon had a list which included bug, cloud, mouse, river, root, spider, stream, surf, swarm, tail, trail, tree, virus, web, worm and many other terms. Intrigued, I took my research a step further and asked people 'if the internet were a landscape, what kind of landscape would it be?' Sometimes the response was a blank dismissal, but more often it elicited an immediate reply, as if a cyber-landscape were already lodged in that person's imagination and just waiting to be conjured up. The landscape of the internet was like a sky, I was told. A park. A jungle. An ocean. A rubbish dump. An entire world. I began to feel like an amateur psychologist excavating the unconscious minds of internet

users. These images seemed to be surfacing from an atavistic sensibility so deeply buried that we do not even realize we are expressing it. Something was going on. But I had no idea what it was or why it was happening.

Then I was introduced to the work of linguist George Lakoff and philosopher Mark Johnson. In *Metaphors We Live By* they explain how when we come across something new we try to understand it by likening it to something else which seems to have similar qualities. 'The essence of metaphor,' they say, lies in 'understanding and experiencing one kind of thing in terms of another'.[7] And once a new metaphor has been created, its very existence reconfigures the world as we know it. 'New metaphors', say Lakoff and Johnson, 'have the power to create a new reality'.[8] Until recently, for example, a cloud was a visible mass of condensed water gliding above us in the sky that sometimes turns into rain. Today it is still that, but now we also imagine it as an invisible clump of data floating over us somewhere up there. In fact, 'the cloud' is a network of very earth-based computers connected together to deliver high levels of storage and computing power. 'The metaphor of "the cloud"', writes author Nicholas Carr, 'seems to have been derived from those schematic drawings of corporate computing systems that use stylized images of clouds to represent the Internet – that vast, ill-defined digital mass that lies beyond the firewall'.[9] They remind him of 'the ancient maps of the known world, the edges of which were marked with the legend "Beyond Here There Be Dragons"'.[10] Philosopher Gaston Bachelard, writing only of meteorological clouds, provides a different but still relevant interpretation: 'clouds help us dream of transformation,' he writes. They offer 'a reverie without responsibility'.[11]

A while ago I was struck by a remark from the writer Noah Richler on a BBC World Service radio programme. He said 'The first task of story is to name things'[12] and described the way that our brains structure our experiences into stories as a matter of course. They begin with lists of what happened, he said, such as 'in Tony's restaurant you ate a pizza and had a glass of wine and your friend told you he had cancer. Then your brain sorts out the important elements of that list'.[13] This seems a useful model to help sort out the way we try to make sense of cyberspace. For example, the brain might say 'this place is new to me but it resembles something I know about – the living world – so I am going to give it the same kinds of names. So even though I don't have any personal experience of surfing this experience matches the data I have already collected about surfing so I am happy to go with that metaphor.' In other words, every individual has a personalized experience and level of skill, and we all interpret the internet differently, but many of us adopt popular memes which seem to connect with recognizable experiences. It is because of this process that a concept like 'surfing the web' became one of many *memes* to arise in cyberculture.

The notion of *memes* was introduced by English evolutionary biologist Richard Dawkins in 1976 to stand for 'tunes, ideas, catch-phrases, clothes fashions, ways of making pots or of building arches'.[14] He explained that 'Just as genes propagate themselves in the gene pool by leaping from body to body via sperms or eggs, so memes propagate themselves in the meme pool by leaping from brain to brain.'[15] Memes can arise overnight and disappear almost as quickly; they are a powerful, unpredictable and uncontrollable form of cultural transmission. But not everyone feels comfortable with Dawkins' classification. For philosopher Mary Midgley, for example, 'The trouble is that thought and culture are not the sort of thing that can have distinct units.'[16] However, in some case cyberculture can indeed generate distinct units in the form of hashtags and keywords, and many of them form an essential part of the online environment as it constantly refreshes itself with neologisms which may explain why the notion of internet memes has been widely accepted despite objections to the more general provenance of the term.

Nature writer Richard Mabey believes that the natural world helps to make sense of our everyday experiences by furnishing us with a set of concepts with which to interpret them. 'Despite our science and our humanism', he writes, 'our whole culture is infused with myths and symbols of landscape and nature, emblems of the seasons, of decay and rebirth, of the boundaries between the wild and the tame, myths of migration and transmigration, of invisible monsters and lands of lost content.'[17] Do these cultural infusions help us deal with the new and unfamiliar world of cyberspace by providing a transcendental passage between different kinds of materialities? Perhaps. Such crossover of meaning is certainly symptomatic of transliteracy, a process which is characterized by the melding of literacies between different modes and which lends itself well to the transposition of one materiality, nature, into another, cyberspace. Indeed, as soon as speech and grammar were developed, perhaps even before then, the ability to process a fact or event into transferable information has been key to cultural advancement. Marshall McLuhan believed that the spoken word was actually a technology in itself, one by which 'man was able to let go of his environment in order to grasp it in a new way'.[18] From gestures of body language and images scratched in earth or on stone, through speech, singing, painting, writing, music making and mathematics, to mechanical and electronic reproductions in audio and moving image, the twin capacities of being able to comprehend a story within the usual conventions of beginning, middle and end, and the ability to use these same conventions to in turn construct and tell a story, are among the most fundamental of human literacies. Without them we would not be able to make sense of what we learn, nor pass it on in a useful form. When my

colleagues and I developed the concept of transliteracy in 2006 we focused on the processes of reading, writing and interaction, but it can equally be applied to phenomenological experiences such as those described in this book.

At this point and before going any further, I should like to clarify some of the terms used in the pages ahead. Many people are unaware that cyberspace, the web and the internet are very different entities, so here is a brief explanation of each of them.

The internet is hardware, a tangible collection of the wires, machines and satellite signals which make up the physical body of cyberspace. The early internet was originally called Arpanet and it began as a network of computer nodes linked together first across the United States then gradually across the world, like a series of connected telephone exchanges allowing the transfer of text and data. Activated in 1969, for over 20 years the internet was mainly the province of the military and academia, but in the early 1990s English engineer Tim Berners-Lee clothed it in the World Wide Web.

The web is software, created from programming code which in turn generates text, images, sounds and functionality. Berners-Lee later wrote 'I designed it for a social effect – to help people work together – and not as a technical toy. The ultimate goal of the Web is to support and improve our weblike existence in the world.'[19] There are many ways to use the internet and the web is just one of them; email, for example, was in existence long before the web, and today mobile technologies increasingly bypass it. 'The net and the web are not the same', says the Open University's Professor of the Public Understanding of Technology, John Naughton, 'The internet resembles the tracks and infrastructure of a railway, while the web is just one part of the traffic that runs on it'.[20] In recent years we have heard a lot about Web 2.0. This is more of a concept than a specific technology, but it does depend upon software applications which allow people and machines to connect and interact as freely as possible, for data to be shared, and for community and innovation to arise. In essence, it is a step along the road towards the maturation of Berners-Lee's original intentions because, like the early web, Web 2.0 is all about people.

Cyberspace, however, is completely different from both the internet and the web. It is neither machine nor code, nor is it tied to any specific technology beyond the connecting force of the internet. In fact, cyberspace is all in the mind. It is a thought, an ecosystem, a collective imagining. So henceforth, when I use the term *web* or *World Wide Web*, I mean the pages that you can access in your browser by means of a URL; when I write *internet* I mean the engineered network of computer networks that facilitate data transmission

and exchange around the globe, and when I use *cyberspace* I am referring to an uncertain overarching and abstract domain which does not actually exist.

Cyberspace is one of three terms which appear frequently in this book. The others are *biophilia* and *technobiophilia*. Here is a brief introduction to each:

Cyberspace

> A consensual hallucination experienced daily by billions of legitimate operators, in every nation, by children being taught mathematical concepts . . . A graphic representation of data abstracted from the banks of every computer in the human system. Unthinkable complexity. Lines of light ranged in the nonspace of the mind, clusters and constellations of data. Like city lights, receding . . .[21]
>
> WILLIAM GIBSON, author

The term 'cyberspace' was coined by Canadian science fiction writer William Gibson in his 1982 short story 'Burning Chrome' and later popularized in his debut novel, *Neuromancer*, published in 1984. Historian Fred Turner has said that cyberspace began as a fictional tool with which to explore 'not only the emerging possibilities of digital technologies, but also the deeply dystopian tendencies of American life in the 1980s'.[22] Stories, whether fiction or nonfiction, are powerful mechanisms for locating ourselves in the world and 1984 saw the publication of two books which were so far apart they could have come from different universes. Yet both are key to this study.

The first was Gibson's relentlessly urban *Neuromancer*. Reading his famous description of cyberspace (above) is like staring out of the window of a 747 in descent towards the streaming lights of Las Vegas. Or like gazing at a widescreen *Koyaanisqatsi*, Philip Glass's movie of wild and urban global topographies released the year before *Neuromancer* was published. Gibsonian cyberspace is the concept of online experience that users and non-users alike have adopted as some kind of public reality, the official consensual hallucination, even though when Gibson wrote it he had never been online and had never connected to the internet. He had simply heard about it and, as a result, imagined it. But despite the lack of first-hand experience his description had an extraordinary prescience, capturing as it did the powerful sense of connectedness which has become so familiar to us.

John Perry Barlow, lyricist for the Californian band *The Grateful Dead*, is thought to be the person who first used the word 'cyberspace' to refer to the abstract nonphysical domain we enter when we connect to the internet itself, and in subsequent years it has mutated into what Turner calls a 'frantic

mingling of biological, digital and frontier metaphors'.[23] In *From Counterculture to Cyberculture* (2006) he discusses how the notion of the disembodiment of cyberspace got mixed up with mysticism and LSD for a while, but by 1994 it had been taken on board by the libertarian political agenda through the voices of Esther Dyson, Alvin Toffler and others in a 'commingling of historical streams'.[24] When they declared that 'the bioelectronic frontier is an appropriate metaphor for what is happening in cyberspace',[25] they contributed to a mix of biological, digital and frontier metaphors which, says Turner, 'marked not only a collision of ideas, or even of historical thought-streams, but of communities of interest'.[26]

In recent years the term *cyberspace* has fallen out of fashion except in military-speak, where it represents a potential combat area. In 2011, for example, the US Department of Defense issued a *Strategy for Operating in Cyberspace* in which the primary strategic initiative is to 'treat cyberspace as an operational domain to organize, train, and equip so that DoD can take full advantage of cyberspace's potential'.[27] This is a somewhat disturbing collision of ideas, to use Turner's phrase, between a non-existent hippie-like space and a potential battlefield. In the foreword of the strategy document, Barack Obama points out that 'the digital world is no longer a lawless frontier'.[28] But nowhere in the 25-page document does it say exactly what the military thinks the digital world is, now that it is not a lawless frontier. Ironically, this very vagueness is what gives the concept so much power.

The second book referred to above, also published in 1984, was an argument for a new hypothesis – *Biophilia*, by biologist E. O. Wilson. It, too, generated a new concept, and it too offered a new way of understanding an environment, albeit it a less abstract one. Just as Gibson's novel set the scene for virtual life, so this book was the seed for a new way of thinking about physical life. In the years since, these two very different strands of thought have drawn closer together than might ever have been expected.

Biophilia

> What is it exactly that binds us so closely to living things?
>
> EDWARD O. WILSON, biologist[29]

In the 1960s, Edward O. Wilson was spending a great deal of time studying the behaviours of ants deep in the forests of Suriname. It was during this period that one day he was suddenly struck by a flash of insight. He had left the village of Bernhards Dorp and headed towards the forest surrounding it. As he walked, he tried to compose the 'mental set – call it the naturalist's trance,

the hunter's trance – by which biologists locate more elusive organisms'[30] which would enable him to switch away from the usual default human-focused position. This mental trick can be difficult, but soon, he writes, 'in a twist my mind came free and I was aware of the hard workings of the natural world beyond the periphery of ordinary attention, where passions lose their meaning and history is in another dimension'.[31] This sense of being deep in nature and part of the greater whole can be at the same time both humbling and empowering: 'The uncounted products of evolution were gathered there for purposes having nothing to do with me; their long Cenozoic history was enciphered into a genetic code I could not understand. The effect was strangely calming. Breathing and heartbeat diminished, concentration intensified.'[32]

We are, he realized at that moment, 'transients of no consequence'[33] on our own planet. Although the living world is our natural domain, we came to it late in its evolution and have never fathomed its limits; this ignorance has led in turn to a perpetual sense of wonder which can only grow exponentially since the more we learn, the more mystery we encounter. The ensuing catalytic reaction, which he believes may be genetically driven, creates a loop which 'draws us perpetually forward in a search for new places and new life'.[34] It is this process of attraction, forever renewing itself, which he would later call *biophilia*.[35] The recognition that he was part of the ecosystem and yet at the same time a stranger within it moved him very deeply but it would be 20 years before he put those feelings into words. In 1984 he finally published his thoughts on the subject when, in a book of the same name, he defined biophilia as the 'innate tendency to focus on life and lifelike processes'.[36] His assertion that biophilia is innate, that is to say, genetically transferred, continues to be debated, but the notion of biophilia as the 'urge to affiliate with other forms of life'[37] is largely accepted today. Later we will examine some of the research projects designed to test what has become known as *the biophilia hypothesis*.

E. O. Wilson sees examples of the biophilic tendency everywhere, from the landscapes of childhood fantasies to repetitive patterns of culture found in many societies. In his view, such instances are 'too consistent to be dismissed as the result of purely historical events working on a mental blank slate'[38] and he even suggests that they may 'appear to be part of the programme of the brain'. In recent decades a considerable amount of research into environmental health has produced a general consensus that separation from the natural world is detrimental to human well-being. There are indications, for example, that too much artificial stimulation and an existence spent in purely human environments may cause exhaustion and produce a loss of vitality and health.[39] This may seem obvious but the results are complex and sometimes unexpected. We will see later how research in hospitals, prisons, workplaces and schools has produced remarkable data to show that many human beings

undergo transformative biophilic experiences not just from being outside in nature, which is the common expectation, but even from simply *viewing* it through windows and on screens. Could biophilia help us connect the planet beneath our feet with the planet inside our machines?

Technobiophilia

> We are in wonder about nature and all its glories, most of which we cannot understand, especially since we did not create the natural world. The Internet has now reached a level of complexity and unpredictability that it shares the wonder and surprise, and the emergence of unanticipated behaviours.
>
> LEONARD KLEINROCK[40]

Awareness of biophilia is spreading in materials design and popular culture. Sharp's curvaceous cedar wood mobile phones are a good example, but the most powerful expression to date is *Biophilia,* Icelandic artist Bjork's 2011 innovative experiment for the iPad, in which music, voiceover, text, video and animations appear in a richly designed organic environment. The opening piece, a cosmic swirl of black and white abstractions, is narrated by the venerated English broadcaster and naturalist, David Attenborough, and any idea that this may just be another pop song is rapidly dispelled by his familiar combination of gravitas and environmentalist passion. With its music, visuals, mathematics and scientific essays about plate tectonics, genetics and biorhythms, the work 'teems with invention'.[41] 'What I always wanted to do', Bjork told the *New York Times*, 'was to reconnect musicology with nature'.[42]

It is unlikely that Bjork could have conceived her album without knowing cyberspace. Its coming has presented us with a new landscape which, while inarguably virtual, is also deeply resonant of the physical. 'Despite the purposeful design of its human creators, the web is a wilderness' wrote Kevin Kelly in 2009, continuing 'Its boundaries are unknown, unknowable, its mysterious uncountable. The bramble of intertwined ideas, links, documents, and images create an otherness as thick as a jungle. The web smells like life.'[43]

From the very earliest years of the internet we have found the experience of entering cyberspace intense and even sometimes life-changing. Many people encounter a powerful sense of presence within its abstract environs, and the language and concepts we use often reflect a strong sense of the online world as a real place. We even make frequent references to the body, as if virtuality has prompted us to remember, rather than forget, their earthly

existence. Indeed, despite the indisputably industrial provenance of the internet it somehow inspires us to conjure a sensorium drawn directly from physical nature, and we use it to construe the digital in much the same way that we have always used it to interpret the rest of experience. So it seems that when we first entered cyberspace, we took the natural world along too. Our knowledge and imaginings of the physical helped us understand the new terrain and, like seeds in the mud on our shoes, we carried it in on the vehicle of language. Later, when technology allowed it, we imported pictures and sounds which reminded us of nature. Indeed, some of the internet's own noises triggered sensations of nature in our minds and hearts, such as the now largely forgotten tones of the dialup modem, the electronic song which heralded each entry into the virtual. These incongruous couplings of abstract technology with a deeply grounded and atavistic earth-bound connection have continued to evolve in powerfully affective ways.

I have chosen to call this phenomenon *technobiophilia*. Developed from E. O. Wilson's original definition of biophilia, technobiophilia means 'the innate tendency to focus on life and lifelike processes as they appear in technology'. It can be seen in our everyday experiences online, and found in many of the internet's most deeply embedded stories.

We have travelled a long way from a mobile phone advertisement filmed in a Japanese forest, but we can be certain that while cyberspace is just like many things we already know, it is at the same time completely different from anything we have ever experienced. I started out with a question about why we brought nature with us into the online world and the answer, it seems, lies in an experience with very primordial roots. The biophilic sensitivity which is necessary to survive in the wild, a reaction so deeply embedded within us that E. O. Wilson believes it to be innate in origin rather than culturally conditioned, seems to somehow be triggered when we enter the realms of the virtual. It drove our choice of metaphors in the early years as we struggled to locate ourselves in strange new territory, and it continues today to drive an atavistic urge to build biophilic relationships with our technological and virtual environments. But a word of caution: we are not passive recipients of whatever the technology industry cares to throw at us. Rather, the traces of biophilia described in the following pages show that we still retain our oldest and deepest sense of how the world is and suggests that we will benefit from trusting our ancient instincts in cyberspace.

This book is informed by many sources, from scientific papers to social media. The biophilic evidence is taken from studies conducted by a wide range of leading scientists and scholars including E. O. Wilson, Rachel and Stephen Kaplan, Stephen Kellert and Richard Louv. The cyberspace research

has a more varied provenance but all the views have been chosen because they represent authentic knowledge drawn from experience. This question of authenticity is best explained through the anthropological terms 'emic' and 'etic' which are used to distinguish between two types of narrative. An emic perspective expresses the views and behaviour of individuals who are immersed and socialized within a given culture, while an etic account comes from an external perspective and is often part of an attempt to be culturally neutral, such as a scholarly account. In the early years of the internet and even still today, many of the stories and studies of cyberspace circulated by the press, academia and popular opinion are etic in nature, which is to say that they are informed by very little 'native' knowledge of online life and often convey predigested popular or scholarly opinion. Emic information about cyberspace, on the other hand, comes from within online culture, from those who build and develop the environment as well as those who use it on a regular basis. The voices talking about cyberspace in this book are all, to the best of my knowledge, coming from an emic perspective.

My thinking is also informed by transliteracy, the literacy of convergence. It offers a unifying approach to literacy which focuses on the ability to read, write and interact across a range of platforms, tools and media from signing and orality through handwriting, print, TV, radio and film, to digital social networks. Today's transliterate individual can read, write and interact across a range of different platforms and media, including both the virtual and physical universes. An awareness of the process of transliteracy will be helpful in perceiving many of the synergies discussed here.

The chapters of this book are organized as follows: Chapter 1 provides an overview and introduction; Chapter 2 discusses research by environmental psychologists which demonstrates how we use encounters with nature to restore and revitalize our powers of attention, and discusses how we regularly access such restorative experiences through our interactions with computers and the internet, and Chapter 3 looks at the role played by California culture and the ways in which the West Coast of the United States formed cyberspace in its own image. In Chapter 4 we are reminded that the founder of the World Wide Web, Sir Tim Berners-Lee, has speculated that 'a single hypertext link could lead to an enormous, unbounded world'[44] and we apply the lens of biophilic design to the compelling idea of cyberspace as an ecosystem of networks complex beyond our imagining. Chapter 5 is about the wildlife of cyberspace, including humans, and Chapter 6 looks at practical suggestions for how we might enhance our digital lives through a set of biophilic experiments to be tried indoors, outdoors and online.

I conclude this chapter with a sequence of stories about the spirit of the camp. Every culture develops its own foundational story, the tale which

explains the origins of a civilization, sometimes driven by myth or religion, and sometimes by human agency alone. The problem for the United States is that when European settlers came to colonize the 'New World', they knew very well that they were not the first humans on that great continent and they had to find a way to position their legacy. As historian David Nye explains:

> For those who arrived after Columbus, neither ancient sacred places nor local stories of origin were possible. Instead, the new Americans constructed stories of self-creation in which mastery of particular technologies played a central role. The Native Americans' self-conception was inseparable from the first creation of the world; former Europeans had to project a second creation. They started without a detailed knowledge of the land itself, and they could not imagine away their belated arrival. Instead, they constructed stories that emphasised self-conscious movement into a new space.[45]

One feature which clearly characterized their difference from the native people was their use of technology. This was something they could take ownership of, and they set about constructing technological foundation stories 'primarily to explain their place in the New World'.[46] As a result, the foundation stories that emerged and circulated during the nineteenth century were about creating society by applying new technologies to the physical world: the axe, used to create the log cabin and the clearing; the mill, the centre of new communities; canals and railroads and so on.[47] Nye explains that 'Second-creation stories depict not heroic founders so much as generic first settlers. They express in secular form the beginnings of a new social world, and they establish the ideal ground rules of the society'.[48] The very first colonists constructed stories to self-creation in which mastery of particular technologies played a central role.[49] Later, it would be a simple matter for their descendants to use a very similar perspective to interpret their own foundational technologies, and since the internet was invented in the United States it played straight into historical notions like American exceptionalism and manifest destiny. Interestingly however, a concept arose from one very anti-technological foundational story which would later play a transformative role in the rise of that very same industry. That concept was creative truancy.

The spirit of the camp

> Walking: 'a constellation whose three stars are the body, the imagination and the wide-open world.'
>
> REBECCA SOLNIT, author[50]

In 1903, President Theodore Roosevelt wrote to the famous conservationist John Muir with a personal request: 'I want to drop politics absolutely for four days and be out in the open with you'.[51] The two had never met, but Muir, by then aged 65, was famous for his passionate environmental activism. His family had emigrated from Scotland to Wisconsin when he was 11 years old, and in adulthood he became a naturalist and writer, much given to spending long periods of time alone in the mountains. Theodore Roosevelt, in contrast, had grown up in New York City but developed a passion for the outdoors as a way to compensate for serious childhood asthma. By 1903, the year of the camp, he had been President for 2 years and had acquired a firm reputation for championing the environmental movement.

Planning the trip, the President requested that he and Muir should travel alone and set aside politics in favour of communing with nature. Other than that, we know little about their days together. There is a photograph of them standing on Overhanging Rock at the top of Glacier Point in Yosemite, but no information is provided as to whether it was taken at the start or the end of the trip. Muir looks wiry and fit, sharp-featured and with a long straggly beard. He wears what could be a suit or simply jacket and trousers, probably tweed or some such rugged material. Standing to his right, Roosevelt has a rounder face and a rounder belly beneath a light coloured sweater. He sports a loose jacket and knickerbockers, and his knee-high boots and neckerchief give him something of a cowboy swagger as he leans towards the camera, a hand on one hip.

What did they talk about out there in the mountains? How did they pass the hours when they were not walking? We can find a clue in Muir's 1869 account of his first summer hiking in the Sierras. Perhaps their evenings were something like his earlier camp on Mammoth Mountain when, at sundown, 'a solemn, awful stillness hushed everything in the landscape'.[52] He describes how he crept into a hollow by the side of a small lake, 'smoothed a sheltered spot, and gathered a few pine tassels for a bed'.[53] He lit a fire, made a tin cupful of tea, and lay down to listen to distant rumbles of thunder in the mountains and the noise of torrenting waterfalls nearby 'making a glorious psalm of savage wildness'.[54] As he fell asleep the stars shone clear in the strip of sky between the huge dark cliffs above him and when he woke the next day they had been replaced by sunbeams pouring through the canyon.

Perhaps it was like that. In truth, we know little of their day-to-day pursuits beyond the fact that they did indeed discuss politics. As the founding President of the Sierra Club, fast becoming the most influential grassroots environmental organization in the country, Muir could not stay silent when he had the President's ear. He wanted the chance to 'do some forest good in freely talking around the campfire' with the President.[55] At that time, Yosemite

and the Sierra Nevada mountains were under threat from deforestation by clear-cut logging, a process which alters the habitat by dramatically removing giant swathes of trees. And there was also another assailant, in Muir's eyes even more dangerous than logging – domestic sheep. He had watched these 'hoofed locusts' ruin large stretches of grassland and was vigorously campaigning for all livestock to be banned from wilderness areas. His arguments were convincing, and by the time the two men emerged from the wilds of Yosemite, Roosevelt had agreed to a wide range of detailed protective legislation.

But there were moments of personal joy too. One night they slept outside and woke to five inches of snow. Afterwards, the President is said to have shouted ecstatically that it had been 'the grandest day of my life!'[56]

This presidential campout at the cusp of a new century has come to stand as an example of how the natural world can restore an appreciation of the essential human values. Historian Frederick Turner would later write of the occasion 'Two major figures in American history enacted in microcosm one of the culture's most persistent dreams: creative truancy in the wild heart of the New World.'[57] Before the end of that same century, however, another New World would be discovered, and it would have the potential for creative truancy beyond anyone's imaginings.

I came across the account of Roosevelt's camping trip while looking for information about computer geeks and their fondness for wilderness sports. It is just one of the many disparate events which combine to make up the story of nature and cyberspace, a narrative which crosses previously untrodden territory and lays new pathways between two very different histories: the development of the internet, and the growth of environmental consciousness. Not only do both involve new kinds of spaces, but at first sight they also seem to represent entirely different world views. As we shall see, however, there are many connections between nature and cyberspace.

Although he died in 1914, John Muir is still extremely influential in the thinking of many West Coast innovators today. He helped open America's eyes to its own phenomenal natural heritage and his writings still balance the rush to the future with a patriotic respect for the wild. The Sierra Club, which he founded in 1892, continues to advocate for communities, wild places and the planet itself. In a country of many religions, Muir was the priest of the outdoor life, and he spent a good deal of time campaigning against large-scale engineering projects such as the Hetch Hetchy Reservoir in Yosemite National Park, so it is perhaps ironic that today's technology community is home to some of his most ardent followers. For example, when internet pioneer Jon Postel died in 1998, the readings at his memorial tribute at the University of Southern California included an excerpt from Muir's *The*

Mountains of California.[58] Postel's fondness for backpacking in the Sierras was well-known.[59] In his remembrance address, his friend Vint Cerf, today Google Vice President and Chief Internet Evangelist, affectionately described him as 'bearded and sandaled . . . our resident hippie-patriarch at UCLA'.[60] There is no record of which of Muir's writings was read to the congregation that day but perhaps it included the line 'We all travel the Milky Way together, trees and men.'[61] Those words would be an apt tribute for an individual who, ever since the earliest days of the internet, had managed each new connection as it was added to the network. The World Wide Web had not yet been invented, so there were no website addresses starting with http://, but every connection was given a unique identifier to locate it. Somebody, after all, said Cerf, 'had to keep track of all the protocols, the identifiers, networks and addresses and ultimately the names of all the things in the networked universe'. That person was Jon Postel. Postel saw his role as figuring out a consistent path through the growing space of the internet. Without that level of management there would today be no coherent system of domain names and website addresses, no trustworthy waypoints by which to navigate. And the man who first mapped out every single place on the fast-growing internet spent his leisure time hiking the Californian mountain trails with Muir's books in his rucksack.

The spirit of the camp rose up again in 2001, when Silicon Valley, found itself in trouble. In the second half of the 1990s the fast-developing World Wide Web had created an enormous speculative bubble which expanded until the inevitable happened, and in 2000 it began to pop in a spectacular fashion. By 2001, financial winter had hit the Valley and its industrial base was falling into rapid decline. One of those hit by the crash was O'Reilly Media, a company established in 1978 which had made its name publishing books and magazines for the very same computer industry that had begun to fall into decline. It had expanded its real estate and added new offices to its campus just before the downturn set in, but as the bubble burst it became clear there would be nobody to occupy them. Like every other organization dependent upon a healthy technology ecosystem, O'Reilly Media was suffering. But rather than give in to the malaise which was crippling some companies, CEO Tim O'Reilly and Sara Winge, Vice President of O'Reilly Radar, decided to build upon O'Reilly's self-appointed role as a chronicler and catalyst of leading-edge development in the technology community. They would add a new item to their list of company goals: to inject hope into the industry. And they would do it by calling upon the spirit of the camp.

The majority of technology companies in Northern California are based south of the Golden Gate Bridge in Silicon Valley, but O'Reilly had built its offices 50 miles north in the small town of Sebastopol, Sonoma County.

Once a fruit-growing area, most of Sebastopol's orchards are now vineyards. O'Reilly's own offices are built on a former orchard and, due to the downturn, they had plenty of empty space which could be used for an informal gathering. O'Reilly and Winge decided that if you get really interesting people together they will do interesting stuff and, maybe, something important might happen. So why not invite people up to their place to try it out? They wanted to do something different from the traditional conference with a pre-arranged programme so they looked at Open Space Technology, a popular method of running unstructured unconferences, and adapted it to their own purposes. The weekend would begin with a completely empty programme, and participants would be invited to step up and offer to do a session themselves. Back in the office, only Sara Winge and Tim O'Reilly were excited by this plan. 'Everyone else at O'Reilly thought it was a nutty idea,' Winge told me.[62]

They devised an informal immersive programme to run 24/7 from dinner on Friday night to lunch on Sunday. It was important that the participants added value to the event, so they hand-picked about 200 people who they thought would make useful contributions. This group later came to be known as the Friends Of O'Reilly (FOO), and the gathering acquired the name of 'FOO Camp'. O'Reilly would provide the food and everyone would sleep on site, either in the empty buildings, or outdoors if they preferred. They sent out invitations with some trepidation, unsure whether anyone would come, but within hours they received their first RSVP – an enthusiastic email from Ray Ozzie, the then Chief Software Architect at Microsoft and heralded by the *New York Times* as 'one of the world's great programmers'. Ozzie was excited and more than happy to plunge in. 'And this', said Winge, 'made us think we were onto something'.

In the run-up to the weekend they thought carefully about the layout. Many Californian buildings have breezeways – open hallways between structures designed to reduce the impact of high winds. They ensured that the breezeways would act as common routes so people would stay in close touch with each other. This would encourage contact and networking, nurturing new conversations and opportunities to work together either indoors, or on the lawn, or in the orchard upon which part of the campus is built. The idea was to create a temporary village with lots of wifi. At night, some of the guests camped out under the apple boughs or on a nearby lawn, while others pitched tents inside the buildings, or crawled into sleeping bags indoors. 'It was not so much about being outside as about the spirit of the camp,' says Winge.[63] Some even slept on the deep sills of dormer windows, indoors but under the stars. Everyone agreed this was definitely not like the usual Silicon Valley gathering, but of course it did not please everyone. English author Andrew Keen, invited to a later FOO camp, wrote scornfully 'Part Woodstock,

part Burning Man . . . and part Stanford Business School retreat, FOO Camp is where the countercultural Sixties meets the free–market Eighties meets the technophile Nineties.'[64]

He was right in one respect, perhaps, because it is probable that at one time or another quite a few FOO campers had also attended the venerated Burning Man Festival. Let us take a detour to learn more about it. Burning Man began on Baker Beach in San Francisco in 1986 when Larry Harvey and Jerry James built an improvised wooden figure and burned it in honour of the Summer Solstice in front of an audience of about 20 people. After 4 years of holding the ceremony at the beach the event had grown so popular that it was becoming dangerous and the organizers were persuaded to move it to a more suitable location. So, giving a firm promise that the event would have no lasting environmental impact on its location, Burning Man moved to the Black Rock Desert in Nevada. Thousands of people still gather there once a year to create Black Rock City, 'a temporary metropolis dedicated to community, art, self-expression, and self-reliance'.[65] But this is not easy camping in grassy orchards. On the contrary, it is something of an endurance test. The Event Survival Guide explains that the Black Rock Desert is a 'thoroughly flat, prehistoric lakebed, composed of a hardpan alkali, ringed by majestic mountains. Daytime temperatures routinely exceed 100°F and the humidity is extremely low, which rapidly and continually wicks the moisture from your body'.[66] Despite the horrendously unpleasant environment of the desert playa upon which the festival takes place, people come in huge numbers to participate. Even in the economic slump of 2009, when numbers were down on previous years, attendance exceeded 40,000. That year, the 'man' they built and then burned was 50 feet high and stood atop a 25-foot tall base 'resembling the double helix of a DNA strand'.[67] 'We are the people who make things' boldly declares a 2007 Burning Man poster.[68] 'We make our own civilisation in the Black Rock Desert each year – a fresh, new ordering of what humanity could be . . . We are the people who are out in front so far, you don't know we are out there. The scouts. The guides. The finders of new ways.'[69] Burning Man campers have a powerful sense of mission, and it is strongly encapsulated in their vow to each year leave the playa exactly as they found it. 'In Burning man's list of principles,' writes Fred Turner, 'to leave no trace is depicted as an ecological ideal. It also hints at an almost Buddhist understanding of the temporariness of experience and with it, the importance of paying attention to the immediate present.'[70]

O'Reilly's FOO camp did not aspire to such lofty aims, but it did aim to have a powerful impact and inject hope into the industry at a time when many companies were going under or stuck in the doldrums. So did it work? John Battelle, a journalist working for CNN at the time, certainly thought so. He

wrote afterwards 'When geeks go camping, ideas hatch. Get 200 or so smart folks with a lot in common together in one place at one time, let them pitch tents, toss in a wifi network, and see what happens. Turns out, quite a lot.'[71] And not just work. For relaxation, he reported, 'campers drank microbrews, tossed Frisbees, and disassembled a Toyota Prius, then put it back together again. Clearly, this was not your average technology conference.' Driving home at the end of the weekend he reflected that maybe 'it just takes a couple of days in the woods to realize that we are well on our way out of them.'[72]

FOO spawned many more campouts organized by programmers with the mission of achieving a practical goal over a few days of convivial outdoor gatherings. So-called bar camps were open to all-comers and considered to be an antidote to FOO's invitation-only policy although 'Barcamp.org' has now itself become a brand. The Barcamp website lists events in numerous countries and describes itself as 'an ad-hoc unconference born from the desire for people to share and learn in an open environment.'[73] The meme of FOO, bar, or geek camps looped back into corporate companies too, and on 1st November 2007, a small group of 'entrepreneurs, technologists, executives, bloggers, press, and professional campfire tenders'[74] gathered at sundown around a flaming brazier and an upturned log to celebrate the launch of Google's new *OpenSocial* initiative. The event took place in the gardens outside Building 43 at the company's Mountain View campus, where guests were presented with OpenSocial blanket rolls and encouraged to relax their weary bodies into camping chairs after a hard day's travail at the digital frontier. Behind them, the famed Google tyrannosaurus rex replica loomed among the trees.

Mountain View is part of Silicon Valley, but you will not find Silicon Valley on an authorized map. It is simply the colloquial name for the Santa Clara Valley and its surrounding area. Before colonization the area was inhabited by a loose collection of hunter-gatherer tribes collectively known as the Ohlone people, who have lived there since around 600 CE. From the era even before them, remains have been found of villages dating back to 4000 BCE. Today, the Muwekma Ohlone Tribal Office can be found close to San Jose International Airport, in the heart of Silicon Valley. As traffic streams by and planes circle overhead, it takes a powerful effort of the imagination to remember that this was a tribal area for thousands of years. In 1990, Stanford University performed an act of repatriation when it returned to the Muwekma people the skeletons of 550 individuals which had been excavated by archaeologists from the nearby Coyote Hills in the 1960s. Today, the Muwekma Ohlone Tribe believes that its continued existence provides a bridge between its ancestral past and its future, and it works hard to preserve Native American culture by organizing campouts in the Sunol Regional Wilderness where young people

get the opportunity to learn horseback riding, fire making, Indian games and tribal drumming.

In the late seventeenth century, Spanish colonial Don Mariano Castro was granted a plot of land close to El Camino Real (The Royal Road), a thoroughfare built between 1683 and 1834 when Spanish missionaries established a series of religious outposts, each roughly a day's ride apart, along a 600-mile route between California and Baja California Sur. El Camino Real still threads through California, marked in most parts as a heritage trail. Today, it runs through Silicon Valley and right past Stanford University, and much of it looks like any other bumpy American highway. The distinctive Bell Markers along its route are a powerful reminder of the millions who passed this way before. By the late nineteenth century much of Don Mariano Castro's land had been sold off to farming families who planted orchards, and as recently as the late 1960s what we now call Silicon Valley was a prosperous fruit-growing area famous for its apples, peaches, pears and cherries. When archaeologist Christine Finn explored the history of the area in 2000, she searched for evidence of the orchards that, she had been told, had crowded the horizon just a few decades before.[75] She met many long-time residents who had no involvement in the technology industries, and for whom 'this is still "The Valley of Heart's Delight" and, in their memory's eye, one of the most glorious and bountiful places in America'.[76]

But back to Campfire One, where Google executive Vic Gundotra warms his hands above the flames against a country music soundtrack and turns to his audience: 'We believe that this format of bringing developers together in an intimate setting to work collaboratively in the open is the best way to engage with the developer community.'[77] The message is clear – being outdoors in nature frees up creativity and facilitates new ideas. The OpenSocial system is designed to empower developers to build applications that can run across multiple social networks using a set of common APIs, instructions that interpret between different websites such as Facebook and Flickr. And the log, blanket-rolls and brazier at Google Campfire One hark back to all those people who worked on that very same land at earlier times – the Indian tribes, the Spanish missionaries and soldiers, the European fruit-growers and the Chinese railroad workers who brought them there – and somehow implies that there is a place for everyone at this camp, out here in the open.

For Fred Turner, who lives and works in the area, there is a stark comparison between the young territory of the West and the legacy-ridden East Coast where 'you can sit in your car and see buildings from the 17th and 18th centuries all around you – farmlands that have been farmed five or six times over – trees that have been chopped down, grown up, chopped down, grown up and chopped down again.'[78] 'That's not here', he told me. 'I can show you

places even in Palo Alto where the very first buildings are being erected on land that has not been built on in a thousand years.'[79]

There are other ways to mix the outdoor life with technology. In 2009 I met Chris Dunphy and Cherie Ve Ard at a conference in San Jose. They had taken the spirit of the camp in another direction when they embarked upon full-time careers as technomads. Describing themselves as 'two gen-X geeks using technology to engage in a full-time traveling lifestyle which combines their hi-tech careers with a rich and fulfilling life full of travel and adventure',[80] they support themselves by freelance coding and design while on the road. Starting in 2007 they travelled back and forth across the United States several times in their customized RV, part of a community of people who are mostly young, mostly couples, mostly without children, and mostly North American, who sell their material possessions to fund a nomadic lifestyle on the road. The practice of the nomadic has a long history in the technological counterculture, as described by Andrew G. Kirk in *Counterculture Green*, who notes that although we may assume that only environmentalists think about nature, in fact most Americans think about it a good deal 'and especially about ways to avoid being killed by it, enjoy it, adjust to it, and master it'.[81] But this is not like the European tradition of embarking on lightweight travel across their continent and beyond, voyages which involve exposure to new cultures. For technomads in the USA, there are no different currencies or foreign languages to deal with, and only slight cultural variations. With an RV and regular satellite internet feed, American technomads can feel at home wherever they are.

The way that geeks choose to camp varies between countries and cultures, and here is one final camping story, this time from England. The summer of 2008 brought unusually pleasant weather to Great Britain and, like many of their neighbours, a good number of the software developers based in the city of Sheffield took the opportunity to visit the nearby Peak District, the oldest National Park in the UK and with 555 square miles of uplands, escarpments and rivers. Sometimes the group made the trip with their families, but just as often they went alone or with friends to indulge in the traditional Sheffield outdoor pastimes of climbing, cycling and walking. But one of their number, a software developer called Jag Goraya, spotted an opportunity. At the time he was running a series of 'Geekups', user groups for developers living and working in the area. They met up regularly to discuss their work, often in the evenings, usually in pubs, enjoying the kinds of intensive knowledge sharing and innovative practices favoured by people who are often self-employed and isolated from each other during their working day. Sometimes their gatherings also took the form of days out in the Peak District.

But Goraya had sensed an underlying tension in the group. Almost all of them were men, and almost all had partners and young families, but while

they were out at night meeting in pubs, or away at the weekend walking and climbing in the countryside, their families were left alone in the city. That year the good weather had made the issue even more contentious, but it gave Goraya an idea. What if all of them – the developers and their families – went camping in the Peaks together? That way, the families would get to know each other and the community as a whole would be strengthened. 'It would be much less about the tech, and more about the social,' he told me later.[82] In the end, it proved impossible to organize a camp in 2008 but the following year, in September 2009, half a dozen families attended the first Geeks in the Peaks camp.[83] The Sheffield community had no connection with any of the American projects like FOO camp or Burning Man, indeed they were barely aware of them. Just as those camps had grown out of American wilderness culture, so Geeks in the Peaks had risen from British traditions like rambling along the public footpaths, fell-running and rock-climbing.

At the first camp they felt their way along as to how it should work. They wanted a mix of socializing and collaboration. Some campers wanted to experiment and brought kites with cameras attached to try out some airborne filming. One person brought the components of a minirocket, which the families built and launched together. Some eschewed the digital and focused instead just on sharing their traditional camping skills. That first camp proved a great success and Geeks in the Peaks has since established itself and developed its own traditions. It takes place twice a year, usually in May and September, and attracts around 30 participants including perhaps 6 to a dozen children and around 24 adults. Most come from Sheffield, but a few campers travel from further afield to renew friendships made the previous year. The emphasis has always been on purposeful activity which, says Goraya, is about 'putting everything else aside' in favour of building community. Along with co-organizer Richard Allsebrook, whose Twitter stream alternates between tips on coding and campfire cooking,[84] he encourages participants to leave their digital kit at home and puts the emphasis instead on offline geeky activities like bushcraft, making bows and arrows, fire-based technologies and survival practices. Of course, compared to the thousands who attend Burning Man, Geeks in the Peaks is very small-scale, but that is how they like it and there are no plans to expand. It does its job well, reviving and strengthening the technology community in Sheffield, and sending participants home charged with enthusiasm and, perhaps, a few new skills under their belts. Goraya recently added another project to his portfolio, Geek Cadets, a club where geeky kids can learn programming and build electronics. Unsurprisingly, this next generation are also regular attendees at Geeks in the Peaks and will be the inheritors of this new Sheffield tradition.

Frederick Turner believed that Roosevelt's trip into the wilderness embodied one of America's 'most persistent dreams: creative truancy in the wild heart of the New World', and it was this same sense of creative truancy which fed the notion of the first FOO camp. After several years of what John Battelle calls the 'nuclear winter' of the 2000–2002 dot com crash, conversations at the first FOO Camp turned out to be refreshingly optimistic, revolving around the new opportunities of social software and ubiquitous connectivity. And since its faux-campfire launch in 2007 Google's OpenSocial has evolved into a multicompany project with Yahoo! and MySpace joining the board. Today in Silicon Valley, nature-related activities feature increasingly heavily in the list of employee perks[85] as companies compete with each other for the best talent.[86] Apart from general benefits like flexible working, childcare, free food, sports, carwashing, drycleaning, laundry, haircuts, bike repair, field trips and regular high-level lectures, companies offer a wide range of restorative benefits including rock-climbing walls (Google, Twitter, Clif Bar); running trails (Google); massage (Google, Linked In, Tagged); boot camp (Linked In); gyms (Google, Linked In, Tagged, Gaia); yoga, pilates and Tai Chi (Google, Linked In, Twitter, Tagged, Eventbrite); wellness allowance (Tagged); meditation spaces with different names such as *quiet room* (Tagged); *Zen room* (Eventbrite) and a *beanbag lounge* (Linked In). Some even have *nap rooms* (Ben and Jerrys) or *Energypods* (Google, AOL Huffington Post) for half an hour of restorative shut-eye. Many provide green atriums, gardens or other biophilic spaces, and some will even let you bring your dog to work. And such places are not just found in California. Google London, for example, boasts an indoor park where employees can sit in deckchairs or even in a rowing boat on a faux-pond. The surrounding walls feature photograph of lawns retreating into woodland while tree trunks rise from the floor and disappear into the ceiling.

The spirit of the camp, championed by John Muir and reawakened by O'Reilly and others, continues to generate many forms of creative truancy. Where might it lead? Philosopher Timothy Morton offers a signpost: 'When you realize that everything is interconnected', he writes, 'you can't hold on to a concept of a single, solid, present-at-hand thing "over there" called Nature'.[87] In Chapter 2 we look at what this means in everyday practice.

2

How nature soothes our connected minds

The Island Paradise Desktop

Today's featured desktop combines the pleasures of a desktop vacation with the functionality of having oft-used folders, controls, and information right on the desktop. Flickr user ashleyann56 built this desktop for a tropical, watery theme that can take you away from the work you're doing without taking you away from the information you need.

LIFEHACKER WEBSITE[1]

Now this is bandwidth

Technology is the enactment of the human imagination on the world.
ROBERT ROMANYSHYN, psychologist [2]

One morning in 1995, the author J. C. Herz logged off at dawn, walked the four blocks from her apartment to the blue Atlantic, and jumped in. 'Wow', she thought, 'now this is bandwidth'.[3] Herz's best-seller *Surfing on the Internet* (Figure 2.1) describes her pre-web student adventures in the early 1990s as she rushed between bulletin boards, games, MUDs and MOOs, learning about the hidden and addictive 24/7 world which at that time was mostly occupied by academia and the US military. The book starts as she tumbles dizzily out of an all-night session in the university computer centre and ends with a dive into the sea. By then, she has been transformed from a naïve newbie into a total net-head, and as her feverish account of life online draws to an end, she begins to realize the huge significance of cyberspace and its relationship to the physical world. 'The online and offline world aren't staying in their boxes like I thought they would,' she wrote. 'They're bleeding together.'[4]

Such blending of the real and the virtual will be familiar to many, but do we understand why it happens? This chapter looks at how we bring nature into cyberspace, often so unconsciously that we do not even realize we are doing it. We will see how, from right inside the screen, nature soothes our connected minds, helps us escape the day-to-day, and nudges us towards more effective work habits.

In the 1980s, experimental psychologists Rachel and Stephen Kaplan studied the effects of nature on people. Although the concept of nature is very much part of the human experience, the language we use to talk about it is neither rich nor precise,[5] and bringing this important yet deeply sublimated information to the surface can offer a significant challenge. For this reason they decided to focus their enquiries on peoples' personal preferences, looking at the kinds of experiences which are widely known but little researched and for which there is only a limited vocabulary.[6] In other words, they set out to discover what kinds of landscapes their subjects liked best by finding out what people preferred. They worked from the assumption that preference has a powerful evolutionary history. 'Animals,' writes Stephen Kaplan, 'have to like the sort of settings in which they thrive'.[7] If animals – and humans – are forced to relearn the constituents of a favourable environment every year, for example, the outcome could be dangerous and even fatal. Far better to develop a set of remembered preferences related to the potential usefulness and supportiveness of a given place. However, it is important to remember that such preferences may not relate to a current situation, but could be deeply

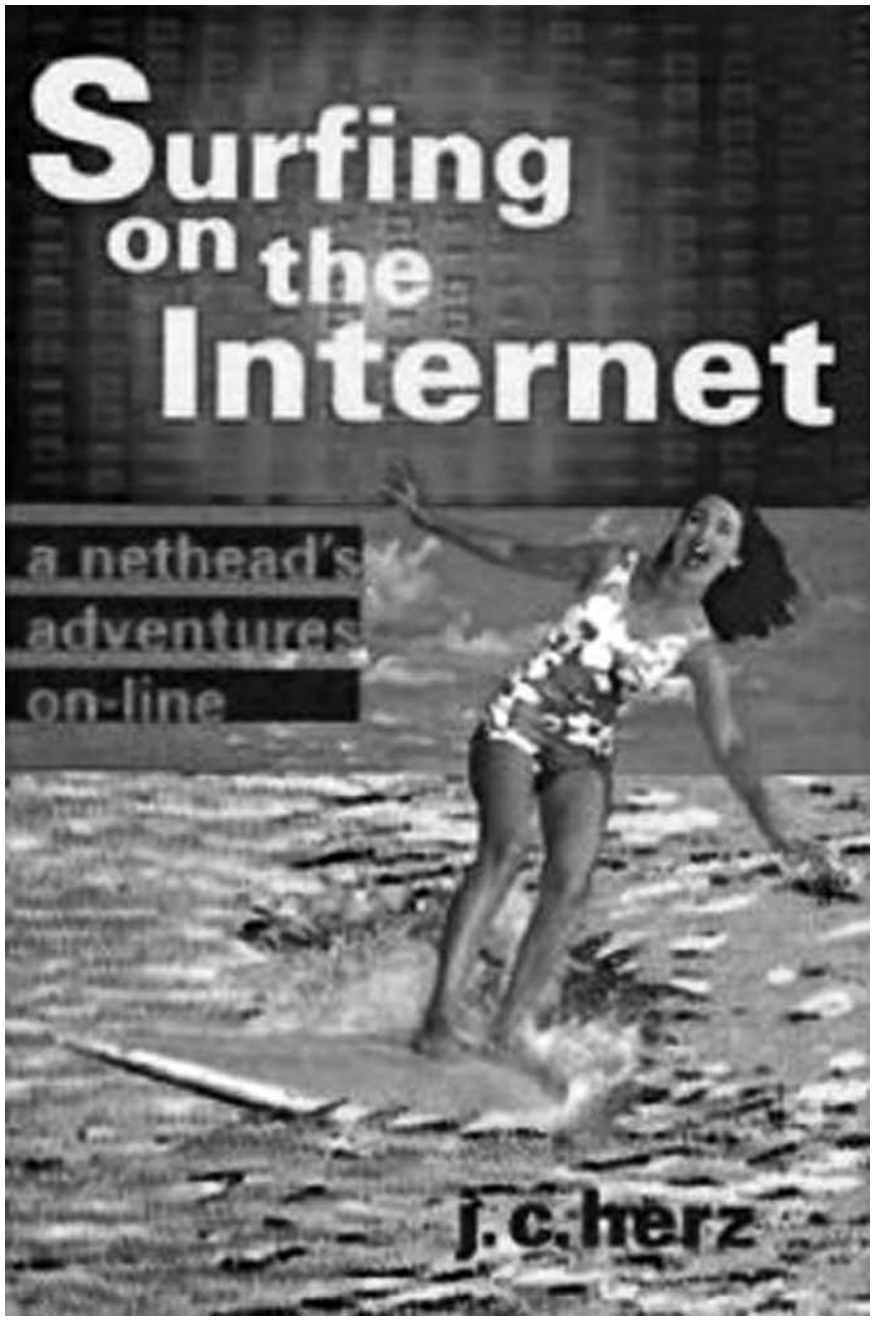

FIGURE 2.1 *Surfing on the internet (Little, Brown Book Group)*

embedded in the past. 'What was functional during the evolution of the species', notes Kaplan, 'is presumably what would be preferred, quite independent of what might be functional today'.[8] 'The natural world can be far from benign, and your surroundings can mean life or death, so it is no surprise their results revealed that people preferred to be in settings where they were likely to thrive, and disliked environments where they might be harmed or rendered ineffective.'[9] These outcomes may seem to be at best underwhelming, but they provided well-researched evidence for something that had previously not been measured – the fact that although aesthetic reactions may appear casual or trivial, they actually constitute a guide to human behaviour that is both ancient and far-reaching.[10] And on the basis of their evidence, they created a resource that had not existed before – a picture of what is necessary for a human to 'function effectively'[11] within the natural world.

In a similar vein, I have looked for expressions of an affiliation between the natural world and cyberspace, affiliations which are largely unconscious but which I felt sure were there. The evidence I found, accumulated through a combination of observation and qualitative interviewing, has convinced me that we do indeed bring nature into cyberspace. But why? And how has it happened?

People in many industrialized countries harbour a deep longing for an imagined past when closeness to the land brought authentic experience and trustworthy community values. There is a sense of some kind of default wild countryside, and we are always trying to get back to it. But of course it never existed. It is a very long time indeed since any part of England, where I live, was a wilderness. And we certainly would not wish to go back to the days when it actually was wild, when feral meat-eaters roamed the forests, travel was perilous, and food and shelter were hard to come by. Yet we feel we have lost something. What is it? Could it be the field you played in as a child but which has now been turned into a housing estate? Or is it perhaps not the field itself, but the experience of being there? The memory of flopping down on your stomach in the summer grass with the coolness of the earth beneath you, the warm sun on your skin, the buzz of insects and songs of birds in your ears? Did you tug plump clover petals from the flower and suck out the honey? Do you recall flipping onto your back to gaze at puffy white clouds gliding silently across the blue sky and knowing that you are part of it all? That you are connected to the invisible life going on in the soil beneath you, to the whole planet and to the universe beyond? Did you sometimes write your address as The Earth, The Solar System, The Universe? What do you miss most of all of those memories? The field next to your house, or the sensations of nature that the field could give you?

But what do we mean by 'nature'? In the Classical world it was understood not as a gentle escape but as evidence of a higher guiding hand. For the

Greeks, it was personified in the goddess Phusis, sometimes called Physis, who ruled over the origin and ordering of nature. Her Roman equivalent was Natura, and both were midwives. According to historian Clarence J. Glacken, in this period 'what is most striking in conceptions of nature, even mythological ones, is the yearning for purpose and order.' He describes, for example, the Sumerian belief that the cosmos was created and continues to be governed by a pantheon of superhuman immortal beings. The rationale for this was modelled on the fact that since men created and managed cities, temples, farms and so on which would fall into disrepair unless they were looked after, it made sense that the cosmos itself would be created and governed in a similar way but on a much more complex level.[12] Hence the respect for an ordered universe. And part of that order were the earthly aspects of human behaviour. 'Natural' could also refer to the properties, inherent characters, and vital powers of people, animals or things, or more generally to human nature. In such a universe, explains scholar Carolyn Merchant, to 'go against nature' was to disregard our innate impulses.[13] By the sixteenth century, this somewhat abstract character of human nature had taken a back seat and 'natural' came to mean 'having a real or physical existence as opposed to what is spiritual, intellectual or fictitious; pertaining to the physical (as opposed to the spiritual) world.' By the seventeenth century a further meaning had appeared – 'existing in, or formed by, nature; not artificial'.[14] Today the abstract side of the term has completely disappeared, and 'nature' is now recorded in the Shorter Oxford Dictionary as the 'material world, or its collective objects or phenomena, the features and products of the earth itself, as contrasted with those of human civilisation'.

But even this most recent definition bears little resemblance to reality since most landscapes on this planet have been affected by human civilization, and we appreciate that many of the features we speak of as 'natural', such as hedgerows or wetlands, are the result of human interference – enclosures in the case of hedgerows and wetlands created by Iron Age deforestation. It is helpful therefore to turn to the poet and environmentalist Gary Snyder, who provides a practical solution when he clarifies the two different ways in which nature is usually interpreted: One he says, is the *outdoors* – 'the physical world, including all living things. Nature by this definition is a norm of the world that is apart from the features or products of civilization and human will. The machine, the artifact, the devised, or the extraordinary (like a two-headed calf) is spoken of as "unnatural"'. But the other meaning is much broader, taking the first, adding to it the products of human action and intention, and calling it 'the material world or its collective objects and phenomena'. 'As an agency,' writes Snyder, 'nature is defined as the creative and regulative physical power which is conceived of as operating in the material world and

as the immediate cause of all its phenomena. Science and some sorts of mysticism rightly propose that everything is natural. By these lights there is nothing unnatural about New York City, or toxic wastes, or atomic energy, and nothing – by definition – that we do or experience in life is "unnatural".'[15] He prefers to use the second, broader, sense.

By Snyder's second definition, cyberspace can definitely be seen as a natural phenomenon. If we so wished, we could choose, as Polish critic Tomasz Sikora suggests, to 'perceive cyberspace – the space generated exclusively through the agency of technology – as (part of) nature, a natural extension of "real space"'.[16] Indeed, the science writer Margaret Wertheim observed in her history of space from Dante to the internet that 'Like Copernicus, we are privileged to witness the dawning of a new kind of space.'[17] To contextualize her remark, Copernicus' treatise on the rotation of the Earth around the Sun was not published until he was on his deathbed in 1543, aged 70, some 10 years after it was completed. He had been researching and writing *De revolutionibus orbium coelestium* for much of his professional life but for most of that time he was reluctant to publish his ideas beyond a small group of friends for fear of exposing himself to public scorn. The suggestion that cyberspace is real space might seem as preposterous today as the notion that the Earth is not the centre of the universe did in the sixteenth century, but what we already know for certain is the following: that while the internet upon which it rests is certainly a material technology, cyberspace itself is a virtual entity generated by the imaginations of people who use it. And it is those very imaginations which close the loop with Snyder's definition. For example, at Down House, Darwin's former home in Kent, England, visitors may notice that a small area of grass has been fenced off and left to grow without interference.[18] There is not much to see, just different plants clustered together in a few square inches of soil, but it is a living example of the kind of experiment Darwin liked to conduct in his garden. It is also a vivid reminder of the very last page of *The Origin of the Species* where the great scientist encompassed the complexity of the natural world in a single mental image. He wrote:

> It is interesting to contemplate an entangled bank, clothed with many plants of many kinds, with birds singing on the bushes, with various insects flitting about, and with worms crawling through the damp earth and to reflect that these elaborately constructed forms, so different from each other, and dependent on each other in so complex a manner, have all been produced by laws acting around us.[19]

Ursula Martin, widely-honoured Professor of Computer Science at Queen Mary University of London, once offered this to me as her favourite

cyberspace metaphor. It is, she said, a very powerful example of Darwin's 'entangled bank'.[20] As we shall see in the following sections, there are many more unlikely symmetries to be found between our perceptions of the digital domain and our lives in nature.

Attention and restoration

> For those combating some form of techno-addiction, Dr. Rosen advises regularly stepping away from the computer for a few minutes and connecting with nature; just standing in your driveway and staring at the bushes, research shows, has a way of resetting our brains.
>
> DR LARRY D. ROSEN, quoted in *The New York Times*[21]

The Kaplans were not just interested in peoples' personal preferences with regard to nature, they were also curious about the role played by natural surroundings in alleviating *mental fatigue*. You might recognize the experience of mental fatigue after a tiring day at work, or at the end of a period of intense concentration or heavy-duty multi-tasking. It can arise when you are ready for a break after a period of creative flow, or from focusing on something you enjoy. Far from being connected to physical tiredness, it often comes from a lack of physical activity accompanied by a sense of inertia and difficulty in focusing. But mental fatigue in one area does not incapacitate you from reacting competently to other situations. It is not just about being mentally tired. Your task may be boring and you may be feeling sleepy, but if something interesting happened you would be able to spring into action immediately. This is *involuntary attention*. This may sound contradictory but it is involuntary because you have no choice about it; you cannot stop yourself from doing it. For example, a loud noise on the street outside can attract your attention automatically, often without any intervening deliberation. Is it a car back-firing? A gun shot? Without even thinking about it, you jump up and go to the window to see what is happening.

But there is another kind of attention – *directed, or voluntary, attention*[22] – and that involves the hard work of forcing yourself to maintain focus on something that is not at all interesting. According to the psychologist William James, 'involuntary attention' refers to 'attention that requires no effort at all, such as when something exciting or interesting happens'.[23] In contrast, 'voluntary attention' arises when effort is required to pay attention to something which is not particularly interesting. Not surprisingly, the Kaplans thought that James' term 'voluntary' engenders confusion so instead they used *directed attention*. Your directed attention is constantly doing battle with your *involuntary attention*. So if an instant message pops onto your

desktop, up jumps your voluntary attention to drag you away from your task. It takes persistence to ignore it and get back to work. Involuntary attention is probably an ancient adrenalin-fuelled response to external alerts and it is very necessary for survival in a wild world. But directed attention requires you to make an effort, to avoid distractions, and to focus on the task in hand. Although directed attention may sound like a problem, at times it acts as a vital inhibitor. It prevents impulsive actions triggered by external stimuli, and it balances our kneejerk responses. In fact it is an invaluable behaviour which allows us to concentrate in the face of continuous distractions as well as helping us to control and inhibit our behaviour in situations where it might otherwise be dangerous. Research has shown that without the brake of directed attention, people are likely to be rash, uncooperative and less competent.[24]

But if you exert too much self-discipline and become expert at sidelining all those external distractions, you could encounter a problem. You might become overwhelmed and unable to cope, both symptoms of Directed Attention Fatigue (sometimes known as DAF), a syndrome which can also severely affect your ability to get on with people. DAF can make you irritable and cause a decline in your ability to maintain positive social relationships. Other symptoms include aggression, intolerance and insensitivity to social cues. Does this sound like any of the overworked colleagues in your office?

The answer is not to eschew directed attention all together – after all, it is essential for effective functioning in the modern world in which 'much of what is essential to pay attention to is far less interesting than are the competing stimuli'[25] – but you can learn to manage it sensibly. The Kaplans point out that increasing specialization has meant that 'each of us spends longer hours pursuing a single activity, as opposed to the variety of tasks pursued by our ancestors'.[26] Such persistence requires discipline, they say, and that depends heavily on directed attention. In a bid to combat the difficulties of directed attention fatigue, they devised Attention Restoration Theory (ART), which proposed that concentration is improved by spending more time in nature or even just from viewing nature.

Today the distracting nature of online life has turned attention into a hot topic, but surprisingly little connection seems to have been made between ART and online experience. Where ART is mentioned, such as in Nicholas Carr's 2011 book *The Shallows*, it is used as a vindication for those who lobby against what they see as the dark side of the information revolution. For example, Carr cites research by psychologist Marc Berman which tested levels of memory and attention in subjects who were required to spend time walking either in a secluded woodland park or on busy city streets. Seventeen students were paid $20 each to walk around the Ann Arbor Arboretum,

Michigan, and undertake some tests before and after. They were given a route to follow and a GPS watch to check that they had stuck to it. Before setting off, they completed three tasks. First, their mood was assessed by ascribing values to different positive adjectives such as *enthusiastic.* Then they listened to sequences of numbers and repeated them back in reverse order, a test called a backwards digit-span. Finally, they undertook a 35-minute task designed to suppress the information in their short-term memory and cause them to be mentally fatigued. Only after all of that were they sent out on the walk, which ran for a distance of just under 3 miles. When they returned, they repeated the mood assessment and the number sequence task, and answered questions about the walk. A week later they came back and repeated the whole thing again for another $20, only this time their route took them around downtown Ann Arbor via the traffic-heavy Huron Street which is lined with university and office buildings.

The team conducting the research project included Stephen Kaplan, originator of Attention Restoration Theory (ART), and his former PhD student Marc G. Berman. They were looking for evidence that walking in nature really can improve directed-attention abilities when measured in that way, and their experiment provided it. The results showed a significant improvement in performance of the backwards digit-span test when participants walked in nature, but not when they had walked downtown; and the results were not affected by changes in mood or different weather conditions. They then repeated the experiments but this time, instead of going outside, the subjects viewed photographs of scenery in Nova Scotia and urban settings in Ann Arbor, Detroit and Chicago. The outcomes were the same in both cases, demonstrating, in the words of the researchers, 'the restorative value of nature as a vehicle to improve cognitive functioning'.[27]

Nicholas Carr, however, makes a cognitive leap which is not in the data. He picks up on the negative results from the city streets and posits an assumption that the online environment has the same qualities. 'There is no Sleepy Hollow on the internet', he warns, 'no peaceful spot where contemplativeness can work its restorative magic. There is only the endless, mesmerizing buzz of the urban city street.'[28] Such an emotive statement will naturally appeal to those wishing it to be true, but as this book will demonstrate, it is incorrect. In fact, there are numerous places for contemplation and restoration to be found on the internet as well as in our computers and even inside our mobile phones. And Carr misses the most intriguing result of all – that the images had an equally strong effect as the physical walks.

The Shallows covers an important debate and is required reading for anyone interested in issues around attention, but it should be read with caution. Even *Slate* reviewer Michael Agger, certainly not a Luddite, indulged

in something of an overstatement when he called the book 'a *Silent Spring* for the literary mind'.[29] The powerful *Silent Spring*, written by biologist Rachel Carson in 1962, exposed the detrimental effects of pesticides on the environment, particularly on birds, and was a major catalyst for the environmental movement. Its publication led to crucial changes in pollution legislation, including the banning of the chemical DDT. Is Agger really suggesting that the internet has triggered a life-threatening crisis of similar proportions to those outlined by Carson?

Howard Rheingold takes a measured approach to attention research in his 2012 book *Net Smart*. In 2009, Rheingold's Stanford colleague Clifford Nass[30] published a study which concluded that most media multitaskers were worse at it than they thought. Contrary to their own expectations, their performance was shown to degrade during periods of multitasking. But Rheingold was interested in the few for which this was not the case. There were still, he said, a small number of successful multitaskers.[31] After examining other studies promising to deliver similar results, especially those involving fighter pilots, he decided that something else was going on. What is really happening, he proposed, is not parallel processing but a constant shifting of attention, each shift separated by a lightning short interval during which 'you must reorient, refocus and filter out competing information in order to move from one stable theme to another'.[32] He describes research by George Miller in 1956 which demonstrated that most people can keep around seven chunks of information in their working memory at any one time. 'In order to work with more than seven chunks, some brain mechanism has to swap out the current information under attention's spotlight and fetch another chunk from memory.'[33] Adding the switches between voluntary and directed attention contributes further complexity to that short interval between them.

Rheingold also discusses the notion of partial attention devised by Linda Stone, who has spent her professional life working for high-powered Silicon Valley tech industries including both Microsoft and Apple. Stone does not discount the concept of multitasking. She says that it is driven by the impulse to get things done, a driver which is very different from the urge to 'pay partial attention – CONTINUOUSLY (*sic*)'. It reflects the desire to constantly be a live node on the network. She writes 'We pay continuous partial attention in an effort NOT TO MISS ANYTHING (*sic*). It is an always-on, anywhere, anytime, any place behavior that involves an artificial sense of constant crisis. We are always in high alert when we pay continuous partial attention.'[34] 'In a 24/7, always-on world', she warns, 'continuous partial attention used as our dominant attention mode contributes to a feeling of overwhelm, over-stimulation and to a sense of being unfulfilled. We are so accessible, we're inaccessible.'[35]

This sounds like the effect of being in a perpetual mode of voluntary attention, with no time or space to access the inhibition provided by directed attention. That certainly would feel like being in constant crisis, and it would not be at all efficient. As mentioned above, the Kaplans point out that without directed attention one is likely to be rash, uncooperative and far less competent. Early hominids who enjoyed being in this state, they say, 'would have been far less likely to survive and hence would have been unlikely to have become our ancestors'.[36] Stone's solution is to learn to manage attention, including turning off technologies and paying proper attention to others. After noticing her own habit of holding her breath while checking her email, she also advises paying attention to the way you breathe: 'Notice what happens to your breath as you pull down and check your email or vmail. Most of us hold our breath. Some of us tighten our upper body. If we're aware of what we're doing and we are able to manage our breath – that is, keep breathing – the stress response is minimized.'[37]

It is easy to have sympathy with the frenetic habits she describes but hard to believe that they do not contain somewhere therein a modicum of directed attention too. In the hope that they do, let us hypothesize a new model. Take the Kaplans' switching between voluntary and directed attention and add in Rheingold's interval shifts to create a formula which probably runs across microseconds for most of the time. The time periods would vary considerably and the shifts need not alternate consistently, but there must be an interval for each shift. A period which is difficult to settle down to at the start, but then features an extended period of concentration interrupted at the end by a distraction could then look something like this, where V = voluntary attention; D = directed attention, and i = interval.

V i D i V i D i Di V i D i D i DiDiV

The intervals between shifts will of course be much shorter than the attention periods themselves, probably imperceptible. But what might happen inside those tiny intervals? Perhaps they are ideal opportunities for brief restorative moments which help get us back on track. You do not need to take much time or travel very far to find the kind of environment to fill that interval. It might be very close at hand. The Kaplans called this phenomenon *nearby nature*.

Nearby nature

Digital living will include less and less dependence upon being in a specific place at a specific time, and the transmission of place itself will start to

> become possible. If I could really look out the electronic window of my living room in Boston and see the Alps, hear the cowbells, and smell the (digital) manure in summer, in a way I am very much in Switzerland.
>
> NICHOLAS NEGROPONTE, architect and founder of the MIT Media Lab[38]

Instances of *nearby nature* are small suggestions of the natural world which, although seemingly insignificant and often out of physical reach, can play a powerful role in human well-being. Even the sight of a few trees viewed through a window can provide a sense of satisfaction[39] and people with access to nearby natural settings have been found to be healthier than those without; studies show they experience increased levels of satisfaction with their home, job and life in general.[40] Nearby nature does not have to be beautiful or complex, and you do not even have to be physically close to it to gain the benefits. It appears to be just as potent when viewed through a closed window or seen pictorially via a photograph, painting, video, or even something as mundane as a wall calendar, so it seems reasonable to assume that it can also be experienced via the screen of a computer or phone.

The most frequently cited research in this area was conducted between 1972 and 1981 by environmental psychologist R. S. Ulrich. He and his colleagues conducted research into ways to reduce stress levels by engagement with natural settings.[41] They worked with people who had undergone stressful experiences such as taking exams, watching scary movies or viewing videos of industrial accidents. The stressed subjects were either taken to natural or urban settings, or shown videos or slides of similar settings, and their emotional and physiological responses were measured. They found that, compared to urban settings, natural settings led to a reduction in physiological indicators of autonomic arousal and an improvement in mood. Later, in another influential study, they attempted to determine whether assignment to a room with a window view of a natural setting might have restorative influences in hospitals. During that period, half of a total of 46 patients recovering from gall bladder removal surgery in a suburban Pennsylvania hospital were assigned to a room with a window facing a brick wall, and half to a room with a window overlooking a natural scene. Of the two groups, those with windows looking out onto a natural scene were found to have had shorter postoperative hospital stays, received fewer negative evaluative comments in nurses' notes, and took fewer potent analgesics than the 23 matched patients in similar rooms where the view was confined to a brick wall.[42]

Another study found that prisoners in cells with nature views beyond their windows displayed less stress and had fewer digestive illnesses and headaches. In yet another, students who could see nature from their windows did better in tests than those who did not. Other researchers have found that 20 minutes

spent outdoors in a park before sitting down to study helps children with ADH to concentrate better. Several studies of workspaces found that workers with views of trees and flowers expressed less stress, fewer headaches and more job satisfaction than those with views of built environments. And this was true not just of the workplace, but in domestic scenarios too. 'By far the most popular scenes in most homes', wrote Winifred Gallagher in 1993, 'are the ones framed by windows, especially when they include a tree'.[43]

All of the above examples feature windows looking out onto real nature – gardens, parks and so on. But, surprisingly, it works with pictures of nature too. Ulrich, who ran the original hospital window test, conducted further research which showed that slides of 'unspectacular' scenes of nature elicited an increase in positive mood, while slides of urban areas produced a decline in mood.[44] He concluded that scenes of nature, particularly those depicting water, had a beneficial influence on the psychological state of participants.

So does simulated nature really have a similar effect to actually being in it? It seems that it does. Australian researchers measured stress recovery and immunization in subjects exposed to one of four simulated drives (drives with forest/rural scenery, drives along the outside of golf courses, drives through urban scenes and drives through mixed roadside scenery) immediately following and preceding stressful events. Stress recovery and immunization was found to be much higher in those who had experienced nature-dominated drives rather than those who had undergone artefact-dominated drives.[45]

In a UK study, five groups of 20 subjects exercised on a treadmill while watching a series of scenes projected on a wall. Researchers tested four types of scenes: 'rural pleasant,' 'rural unpleasant,' 'urban pleasant' and 'urban unpleasant.' The subjects' blood pressure, self-esteem and mood were measured before and after the treadmill sessions. The researchers reported that

> There was a clear effect of both exercise and different scenes on blood pressure, self-esteem and mood. Exercise alone significantly reduced blood pressure, increased self-esteem, and had a positive significant effect on 4 of 6 mood measures. Both rural and urban pleasant scenes produced a significantly greater positive effect on self-esteem than the exercise-only control. This shows the synergistic effect of green exercise in both rural and urban environments. By contrast, both rural and urban unpleasant scenes reduced the positive effects of exercise on self-esteem. The rural unpleasant scenes had the most dramatic effect, depressing the beneficial effects of exercise on three different measures of mood. It appears that threats to the countryside depicted in rural unpleasant scenes have a greater negative effect on mood than already urban unpleasant scenes.[46]

The researchers concluded that such 'green exercise' has important implications for public and environmental health, yet peculiarly it was hardly 'green' at all. The subjects were indoors on exercise bikes and looking at images on screens. The results would seem to support the idea that digital nature images can produce positive effects, but whether that experience can be called 'green exercise' must be in question!

In Spain in 2008, researchers looking at the use of 'virtual nature' scenarios in the marketing of 'green' products found that simulated nature experiences could be remarkably powerful. In a study of Spanish energy consumers, Hartmann and Apaolaza-Ibáñez examined responses to a new marketing campaign by one of the leading energy brands, Iberdrola Energia Verde, which was attempting to green its image with a television campaign developed to evoke virtual nature experiences through the use of pleasant nature imagery such as flying eagles, mountain scenery, and waterfalls, and emoting altruism and self-expression ('Now, every time you switch on your light, you can feel good because you are helping nature').[47] They found that consumers responded very positively to the new branding. It was evident across the demographic, from those considered to be already environmentally conscious, to the nonconcerned who nevertheless experienced 'warm glow' benefits and a positive feeling of participating in the common good of the environment. The researchers concluded that

> because our society has become more urbanized and it is increasingly difficult for people to get access to nature, people will tend to experience simulated nature experiences through their exposure to virtual nature in the media. To the extent that this captures their experience of nature, it is meeting the human desire to experience nature and gain the psychological benefits (pleasure, stress reduction, etc.) of interacting with nature. Accordingly, the current research gives support to the hypothesis that in societies in which real nature experiences are becoming scarce while life is becoming increasingly virtual, the consumption of green products – adequately conditioned with virtual nature experiences – may serve as a surrogate for the 'real' contact with nature.[48]

It appears that not only does contact with nature have a positive effect, whether that nature is tangibly and sensorially real, or just a view, image or simulation, but also that in many cases the benefits are much the same. In other words, you can gain equal benefit from walking in a forest as from viewing an image of a forest. This seems surprising but is a common result in these kinds of experiments. And it worries Hartmann and Apaolaza-Ibáñez, who caution that 'people may eventually downgrade the value of local natural environments

because of their experiences with virtual nature.'[49] That is certainly a possibility, especially if the concepts of biophilic design, currently applied mostly to urban environments, are brought more consciously into virtual environments and hardware design. If a company believes it can achieve the same restorative benefits from putting nature pictures on its office or factory walls as could be gained from providing outdoor spaces for its employees to visit at break times, the temptation to save money would be great.

Whether indoors, outdoors or online, it is clear that nearby nature has a profound effect on well-being. We cannot escape the pressures of directed attention, but we can create deliberate strategies designed to provide a balance in the form of anything from a brief physical or mental escape to a more profound restorative experience.

When they devised Attention Restoration Theory (ART), the Kaplans identified a group of four restorative settings in which each provides different kinds of experience. *Being away* implies that the setting is physically or conceptually different from one's usual environment; *extent* involves a setting sufficiently rich and coherent that it can engage the mind and promote exploration; and *fascination* includes either content or mental processes evoked by the setting that engage attention effortlessly, thus allowing fatigued directed attention to rest. Fascination can be either 'hard' (very intense, riveting one's attention and leaving little room for thinking things over) or 'soft' (of moderate intensity, enough to hold attention, although still leaving room for reflection).[50] The last setting is *compatibility*, which involves finding a good fit between one's inclinations or purposes and the kinds of activities supported by the setting. How do these four categories relate to cyberspace? We will consider each one in turn.

Being away

A portable Zen garden in your pocket.

Cultivate Virtual Peace and Tranquillity

iZen Garden(TM) gives you all the peace and tranquillity of a beautiful Zen Garden in your pocket, without the sandy mess!

Every day when you start iZen Garden, you'll be greeted with your 'Daily Zen' – a tiny bit of Zen Wisdom to help put you in the right state of mind. A relaxing ambient soundtrack plays in the background. You select a bonsai tree, some stones, some leaves from the over 100 objects included. You rake, creating beautiful circular ripples in the sand. When it's finished,

> you can fire up the meditation timer and sit in quiet contemplation, or even better, share your beautiful creation with your friends and family on Facebook, Twitter, or through Email.
>
> Available from the App Store for iPhone and iPad
>
> IZEN GARDEN™[51]

Sometimes we long to escape to a place which is completely different from our everyday. We long to *be away*. For most people in the industrialized world, regular visual and physical access to nearby nature outside of holiday time is confined to a limited range of cultivated landscapes, both public and private, and to wilderness areas such as the slim strips of vegetation alongside roads and railway tracks or urban brownfield sites where self-sown species can flourish undisturbed. Many of us have grown used to snatching our restorative moments in public parks, next to potted plants on balconies and patios or, for the lucky ones, in our own patch of garden – a place which, as landscape architect Anne Whiston Spirn has noted, is a potent and complex symbol that embodies pleasure, fertility, sustenance and renewal.[52]

The Kaplans call this restorative setting *being away*, 'involving oneself in cognitive content different from the usual'.[53] The human, they say, is a conceptual animal and the experience of being away involves what is going on in the head as well as what is going on in the environment.[54] So mental distance can be as important as literal distance. Even if you travel no further than your own garden, making the rounds to find new buds and make sure all is well 'can feel like being quite distant from the world of pressures and obligations'.[55] However, they point out, not all of being away is about the urge to leave one's current situation; it can just as easily come from the wish, not to escape from one's current environs, but to deliberately head *towards* a place of nature.

How does *being away* happen online? In recent years the internet has probably reached the top of a list of things that many of us want to escape from, so it might not be immediately obvious that cyberspace is full of nature-like places we might visit in order to be away. An interesting example can be found in the comparatively old online community of LambdaMOO, which opened its virtual doors to the world on 30 October 1990. It was designed and built as a hobby project by researcher Pavel Curtis, a 'simple country hacker' as he called himself.[56] Curtis was employed as a researcher in programming language design and implementation in the Computer Science Laboratory of the Xerox Research Center on Coyote Hill Road in Palo Alto, California. A MOO is a virtual world where there are no pictures or sounds, just screenfuls of monochrome text which scroll live before your eyes as remote participants

type into it. It looks something like a giant chat room, but inside it you can do much more than chat. Members use simple programming code to create personas and homes as well as any kind of object you can imagine, because that is what a MOO is – an enormous collective imagination built from text. It is an ideal place for writers, since if you can describe something, you can make it real. The nearest equivalents today are worlds like Second Life which, unlike MOOs, contain rich multimedia resources. But way back in the 1990s, text was all you had.

The plain text environment of LambdaMOO does not run on the World Wide Web but on an obscure application called Telnet which these days has to be installed specially on many computers and might not run on your smartphone at all. LambdaMOO is one of the very earliest online communities and a venerable ancestor of all the social media we use today, so logging in feels more like visiting an ancient monument than surfing across the shiny interface of its descendant Second Life. Curtis based the design on the geography of his own real-life house and the rooms were mirror descriptions of the real ones. They each had a written description plus a set of commands which joined them together and allowed the user to 'exit' to another location in the rapidly growing real estate of LambdaMOO. In the first MOO he visited and which inspired him to create his own, Curtis had met two talented Australian graduate programmers and he was keen to invite them to see his new creation. So on the day before Halloween, 1990, he emailed them to announce that LambdaMOO was open to the world: 'on Halloween we three met there together, the first drops of water in what would later become the rushing river of LambdaMOO.'[57] Little did they know that it would soon attract thousands of members and eventually become known as the Mother of all MOOs.

One of the early aficionados was programmer and teacher Elizabeth Hess, aka 'Yib'. Later, in 'Yib's Guide to Mooing', Hess described how she built many places in LambdaMOO, including The Formal Garden.[58] To visit The Formal Garden, you must first log in to LambdaMOO[59] and then teleport to Room #59102. Your entrance triggers Hess's written description to scroll across the screen and it describes your virtual location:

> You are in a formal garden, south of the main part of the house. Wide, gently curving grass pathways wind their way through the expansive grounds; the grass is lush, and meticulously kept, its quality echoed on a not-too-distant decent piece of turf, though here there is not a single weed, unsightly stump, bald patch, or divot to be seen. The shoulder-height grey brick walls that surround the garden can be glimpsed through trellises and climbing foliage. To the north is a wrought iron gate, and

there are open archways to the east and south; a caretaker's cottage is situated in the southwest corner. A Victorian bench provides a place for quiet reflection or conversation. Near the Victorian bench is a small sign. Though the night is cold, the white flowers of late winter brave the season and light up the garden: the catkins of a silk tassel bush, winter-flowering heath, sweet box, and the miniature lampshades of common snowdrops. A stand of Kashmir birch trees forms an intricate tracery of twigs against the winter sky, and their white bark seems almost luminous. A tangle of whitewashed brambles reaches for moonbeams, and the scent of winter jasmine perfumes the air.

You close the gate behind you.

You sit down on the Victorian Bench.

You are admiring a garden built only from text and being generated in real-time by code from inside a server somewhere in the United States. Sentences scroll before your eyes like vertical ticker tape. The words are white, the screen black. The Formal Garden does not actually exist, but nevertheless things are happening around you.

A spider quietly works on her web in the silk tassel bush.

The spider is not real either.

As an experienced MOO user, you know what to do. Typing *@examine here* you discover which commands will work, and it appears that the garden flowers are perfumed, so you type *smell flowers* and the system immediately responds:

You smell a cascade of milk-white saxifrage. The scent is lovely.

Stimulated by the description, your imagination releases a burst of sweet odours into your brain. Of course, these delights are not real.

A cricket chirps from somewhere in the greenery.

Hess programmed the Formal Gardens with embedded messages which changed in response to day and night, and to the passing of each month.[60] She added extra touches, so that visitors could actually 'pick' the flowers and even 'take them away'. Today, she laughs about the fact that the flowery prose of their description was based not on her own experience, but that all of it – even the scents – were 'fabricated from a bunch of flower gardening

books'.[61] But she also created a scene which was much closer to her heart. 'The Green Cathedral' is a description of a real place,' she told me, 'or a place that *was* real, before houses got built there'.[62]

> The Green Cathedral
>
> You are in a tiny clearing nestled deep in the woods, surrounded by beech trees. The branches overhead form an arched canopy of green, their leaves intertwining one with another, giving shelter to a carpet of soft, dry moss below. The soft light of morning filters through the trees. There is a stillness here.
>
> A narrow path leads to the south, though it is almost completely overgrown.

She explained, 'The name came from the name of a clearing in the woods at a summer camp I attended. The description is based on a very secluded mossy clearing in the woods behind the house I grew up in, in Maine.' During this conversation we were type-talking together in the MOO and there was a pause at this moment, as there often is when the database checkpoints, but this felt like a different kind of pause, more pensive. 'It's worth walking to or from,' she typed after a few seconds of silence. 'There are nice exit messages. The path to the green cathedral was one of my favorite parts.' I understood that the Green Cathedral meant a lot to her. Later, I logged on again to check it out, typing 'S' to travel south from the Green Cathedral, and then 'SW' to go southwest.

> S
>
> The bushes seem to hug you as you make your way along the path.
>
> Forest (near the Green Cathedral)
>
> You are in a forest of old-growth trees, at an intersection of paths. The main path bends here, arriving from the east, and continuing further into the woods to the southwest. You can just barely make out a third path, leading off to the north, but it is almost completely overgrown.
>
> SW
>
> You continue further into the forest.
>
> Forest (near the Japanese garden)
>
> You are in a forest of old growth trees. To the southeast is a wooden archway, and beyond it you see a Japanese garden. A path leads to the northeast.

One could choose either path, and continue wandering in LambdaMOO forever. There are thousands of these virtual rooms, some connected by pathways, but most simply floating free in the ocean of data which is in turn contained within the box securely tucked away in some server farm somewhere. Thousands of locations, all of them both real and not real. Their designs are programmed in many ways – architectural, conceptual or horticultural are just a few of the possibilities. Indeed I have built my own landscapes there. In years gone by I regularly logged in to a space which I programmed to represent the English fields I drove past on my way to work. With this on the screen, I was no longer in my office but transported instead just a few miles to the south, where I could spend a minute or two now and then just *being away* (Figure 2.2).

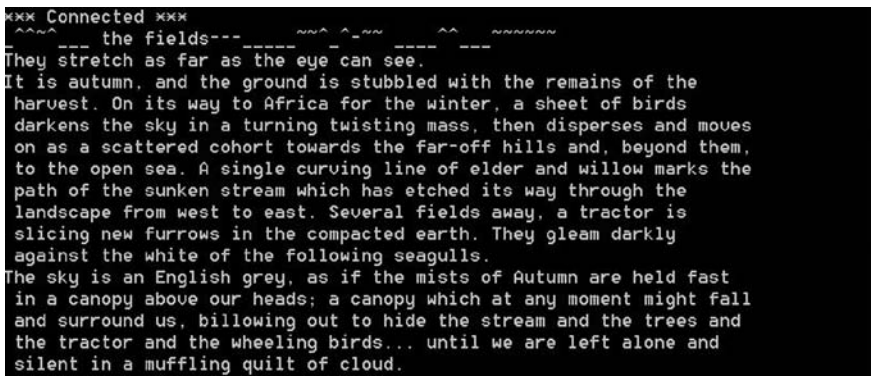

FIGURE 2.2 *LambdaMOO fields (Sue Thomas ©2013)*

In Facebook if you want to grow plants, you do not code them yourself as you would in LambdaMOO or even craft them as you might in Second Life (where you can buy things crafted by other people too). You play FarmVille. This online game created by Zynga lets players cultivate their farms by ploughing, planting and harvesting crops and trees, as well as caring for farm animals including milking cows and collecting eggs. In 2009–2012 it was by far the most popular game in Facebook and even in 2012 was still endorsed with over 30 million 'likes' from users worldwide. Like many commercial online games, players begin for free but soon find themselves persuaded to pay for acquiring and feeding animals, mastering the art of crop-growing, creating buildings and so on. The farms require regular care and the FarmVille community thrives on in-game gifts, trading and cooperative crafting. In fact, FarmVille offers all the opportunities (except possibly worship) described by Spirn in her account of real community gardens which, she says, are not only places for planting, growing and harvesting food, 'but they are also the locus for many other life processes: for sharing and trading, for meeting

and play, for making and building, for dreaming and worship. They are the scene of both cooperation and conflict.'[63] The best part of all is that you can spend your coffee break milking your virtual cows or planting out your virtual tomatoes, take screenshots of your tiny avatar working hard, and post them on Facebook.

FarmVille is constantly innovating. In 2010, for example, Mashable reported the planting of 310 million virtual organic blueberries when Cascadian Farm, a real-life organic foods company, offered a crop of virtual organic blueberries for sale in the FarmVille Market in a month-long marketing campaign for the company. On its website, Cascadian extols the sumptuous virtues of its Home Farm, 'nestled in the foothills of the breathtaking North Cascades mountain range'[64] where you can stop at roadside stands to buy a pint of berries or homemade organic ice cream. Within a week of appearing in the FarmVille Market, these non-existent blueberries had been purchased by more than 1 million players for 20 credits (around US$4) each, according to Mashable,[65] which points out that it is the first in-game branded crop to ever appear in the FarmVille Market. Although Elite Taami Nutz was behind the first ever brand-sponsored peanut crop earlier that year, Cascadian was the first to get their logo and brand into the Market. 'Since the launch of the in-game blueberries, Cascadian Farm's 'Farmer Joe' – the man who tends the virtual farm – has received close to 5,000 friend requests on Facebook, Mashable tells us, adding 'The fact that FarmVille players are taking the extra step to friend the virtual farmer shows that there is a positive brand association between the crop and the company' and that such an association could easily extend to the offline world.[66]

But cultivation on the internet does not just happen in FarmVille. In the hands of Tim O'Reilly, founder and CEO of O'Reilly Media, it is also a powerful metaphor for open source development. The growth of open source, he told a conference in Toronto in 2000, is like the development of a rich humus. 'Topsoil grows at a rate of an inch every 100 years. You can grow fabulous plants quickly in that soil, but the soil itself is a product of slow time.'[67] And what is more 'we learn the importance of recycling, of putting nutrients back into the soil. A key part of open source is not just what big flowers you grow, but how much rots and is plowed back in to enrich the next generation.' One of the big differences between open source and commercial software, he says, is the extent to which code is recycled 'and that doesn't just mean "code reuse" – it means that ideas, freely shared, form the compost from which other ideas can grow. It means that failed projects are as important to the open source ecology as those that succeed'.[68] Indeed, O'Reilly certainly has something of the farmer about him. He dresses in practical country clothes in earthy colours and his Irish heritage gives him a rather rugged look.

At the huge O'Reilly conferences, where many of the thousands of delegates sport office wear even in California, O'Reilly looks as if he has just travelled in from the country. And he probably has, because while most successful technology businesses operate from the urbanized environs of Silicon Valley, O'Reilly Media is based in the small fruit-growing town of Sebastopol, 50 miles north of the Golden Gate Bridge. The company has learned that the benefits of actively *being away* can include independent thinking and a fresh outlook.

Extent

> With cyberspace, a whole new space is opened up by the very complexity of life on earth: a new niche for the realm that lies between the two worlds [etherealized and concrete]. Cyberspace becomes another venue for consciousness itself.
>
> MICHAEL BENEDIKT, author[69]

The restorative setting of *extent* promises a continuation of the world beyond what is immediately perceived. Much of the Kaplans' work on extent derives from a research project with participants in an outdoor wilderness challenge. They found that subjects who were new to wilderness exploration needed to learn the area in small pieces then stitch them together in a bigger mental image: 'it is important to be confident that the fragments of a mental map they are piecing together are reasonably representative of the larger terrain.' The experienced person, on the other hand, takes pleasure in the fitting of new patterns into old knowledge, affirming existing information and stimulating new understandings. In this way, extent encompasses the imagined as well as the seen. It can provide a sense of connectedness between what you are experiencing in the moment and what you know about the world as a whole.[70]

The Kaplans cite Japanese gardens as an example of extent because 'the miniature creates extent through intensity rather than through the suggestion of distance, so that a "whole little world", or microcosm, may be captured in a small space.'[71] I experienced this myself at Dartington Hall in Devon, England, where I visited a Japanese garden designed by Philip Booth. In the notes displayed close by he had written: 'Some call Japanese gardens miniaturised landscapes. The truth is more complicated. The natural world is not copied, it is suggested'. It struck me very forcefully at the time that exactly the same could be said of cyberspace. The ways

in which we conceive of the digital often subconsciously suggest familiar physical landscapes, just as the imagination expands a group of tiny bonsai trees and stones into a forest on a rocky mountain. And as a result, the shared and evolving lifeworld of cyberspace gradually comes into being not as a simulacrum of something else, but as a real and integrated extension to human experience. And this despite the fact that, unlike a miniature garden, the domain of cyberspace has no materiality at all and so, by the same token, no physical extent. Yet, extent plays a powerful role in our preoccupation with it.

We sense that cyberspace is enormous yet we can only experience a small part of it at any one time. It is similar to the Kaplans' description of nearby nature: 'the sense of being away and a conceptual vastness of the experience are often difficult to separate.'[72] Exploring cyberspace is not like making landfall in a new country or on a distant planet, it is not a place we have deliberately travelled to for the purpose of exploration. Rather, it has suddenly been made manifest among us. We created it, but we strive to understand what it is. In trying to create a picture of its extent we draw upon our knowledge of what already exists in a process which nature writer Richard Mabey describes as 'constantly referring back to the natural world to try and discover who we are'.[73] In cyberspace, each person's sense of the natural world, whether via real experience or imagination, draws upon the same myths and symbols, then projects them into the virtual.

The tool we use to gauge the extent of virtual life, to get a sense of how it continues beyond our own experience of it, is that most ancient of instruments – the metaphor. Metaphors help us understand one thing in terms of another. As Aristotle said, 'ordinary words convey only what we know already; it is from metaphor that we can best get hold of something fresh.'[74] Although the concept of the metaphor has been in use for thousands of years, it gained a new lease of life in 1979 when George Lakoff and Mark Johnson wrote *Metaphors We Live By*. Their experientialist approach shed new light not just on issues of language, truth and understanding, but on questions about the meaningfulness of our everyday experience.[75] In cyberspace, not only do metaphors play 'a very significant role in determining what is real for us',[76] to quote Lakoff and Johnson, but they also determine how the ephemeral unreal can be shaped into the real. We may not see what happens in cyberspace as 'real' (although many of us do), but the metaphors we use for it, both publicly and privately, can *make* it real. It seems cognitively correct, since they are the products of technological innovation, and since cyberspace is the urban fantasy of a cyberpunk writer, that digital networks have popularly been understood in terms of human-made artefacts, especially the built environment of roads, railways, cities,

town and villages. But there is a hidden element in this discourse, one which can be found in the conversations of the cyberspace lifeworld itself, in the casual everyday namings, and even in the codified building material of the systems with their directory 'trees', data 'fields' and 'paths'. These are the metaphors which describe the restorative setting of *extent*. So how did they come about?

In the 1990s, when the internet was already over 20 years old, researchers began to try to identify which metaphors were coming into use in cyberspace. There was a growing need, both cultural and commercial, to understand and quantify the impact of this new technology on society, culture and politics, linguistics and philosophy, literature, music and art, business, economics and law. At the same time, the growing numbers of interface designers were anxious for advice on how to create the most effective user experience, and marketers wanted to know how to promote and sell goods and services online. Educationalists and trainers were keen to understand the most appropriate pedagogy for the wired learner. So there were two main strands of study – those seeking to understand the impact of computers and the internet via the culture evolving around them, and those wanting to impose pre-designed metaphors in a bid to exert influence into what was often a conceptual vacuum.

In 1996, Ruth Palmquist, a librarian at the University of Austin, Texas, conducted a study of one hundred articles published in 1995. During this period there was an outpouring of writing designed to guide internet novices and she was interested in which metaphors were most commonly used to achieve this. Her final list was divided into categories as follows: Travel/Explore; Fire or Water; Commerce/Politics; Animals; Anthropomorphic; Communication; Tools/Machines/Process and Other. This was perhaps the first attempt to express the extent of cyberspace. Palmquist concluded that there were two distinctly different relationships to be modelled between human and computer. The first was based on metaphors related to specific software functions such as trash can, file folder, etc. The second she described as a newer type of relationship – 'that of the computer as an access route to a broader environment of information sources and services'. She also points to the 'surprisingly large' 43 per cent of references which could be classed as anthropomorphic, while reporting that 25 per cent of the metaphors gathered 'defied classification and were assigned to the inevitable Other category'.[77]

In 1998, interface researchers Maglio and Matlock extended Palmquist's research when they argued that the particular language people use when talking about web activities 'is metaphorical and is motivated by basic image schemata which emerge from embodied experience'.[78] They found differences between experienced and inexperienced web users in the way

they talked about their web actions, but their data showed that 'even novice web users conceive of themselves as actively moving on the web under their own steam'.[79] They believe that the power of spatial metaphors lies in the fact that they are, perhaps, innate. 'They cannot help but use them,'[80] they noted. Could such metaphors come from the evolutionary impulse of biophilia?

Another librarian, Lee Ratzan, wanted to know why users described the internet as they did.[81] He was especially interested in comparing the differences between metaphors used by novices and those of more experienced users. He reported that 'metaphors from novices often bear a sense of confusion, complexity or frustration while experts are much more anchored in reality.'[82] Moreover, 'intangible metaphysical metaphors were used solely by Experts and never by Novices.'[83] He thought this might be indicative of a cognitive paradigm change triggered by 'the amorphous nature of the Web'.[84] When asked to complete the sentence 'The internet is a . . .', some Experts contributed terms which he categorized as 'metaphysical', such as 'new dimension', 'void of omnipotence', 'cooperative chaos', 'fractal', 'world that exists in consciousness'. He concluded that metaphor images seem to change as skill level develops, and noted that 'Novices tended to use finite, tangible, delimited, closed, delineated metaphors while Experts tended to use more metaphysical, intangible, open metaphors.'

Metaphysical metaphors may have been popular in some contexts, but companies were starting to make money from the internet and were in need of more defined boundaries which could be used in disputes. In 2002, Blavin and Cohen[85] analysed the evolution of internet metaphors in relation to law, pointing out that 'When courts encounter new technologies not yet anticipated by the law, their reliance on analogical reasoning plays a profoundly important role in the application of proper legal rules' and cautioning that 'By failing to adopt appropriate metaphors in regulating new technologies, courts risk creating bad law.' They discussed three main inferences which had been the subject of legal deliberations: the information superhighway, cyberspace and the internet as 'real' space. In the early years the majority of internet use was in the United States, and many of the law suits discussed in relation to the information superhighway related to interstate trading and issues of federal versus state law. For example, in New Mexico in 1998, a judge granted the American Civil Liberties Union an injunction stopping a bill that would censor free speech on the internet from taking effect. 'Senate Bill 127, which Gov. Gary Johnson signed in March, would prohibit the dissemination of material deemed harmful to minors involving simulated or depicted nudity or sexual conduct.' The ACLU joined with 20 other plaintiffs to claim that the bill violated the First Amendment and the commerce clause of the US Constitution. Ann

Beeson, an attorney for ACLU, argued that 'Like the nation's railways and highways, the Internet is by nature an instrument of interstate commerce that should not be burdened by inconsistent state laws.'[86]

The eventual conclusion of the courts was that the information superhighway is *not* like a regular highway; its links are *not* like road signs, and its structure is *not* like a mere conduit but instead embodies several destinations, each with its own content. The concept of 'cyberspace' caused a different set of difficulties because it suggested not that internet space was like something else, but that it was another kind of actual geographic space, unique and distinct. This proposal was reinforced by John Perry Barlow, libertarian rancher and former Grateful Dead lyricist, who proposed that the electronic frontier 'resembles the 19th-century American West in its natural preference for social devices that emerge from its conditions rather than those that are imposed from the outside. Until the West was fully settled and "civilized" in this century, order was established according to an unwritten Code of the West, which had the fluidity of common law rather than the rigidity of statutes. Ethics were more important than rules. Understandings were preferred over laws, which were, in any event, largely unenforceable'.[87]

But Blavin and Cohen would have none of that, remarking that 'in sharp contrast to the utopian vision expressed by Barlow' et al., an increasing number of commentators have argued that the internet 'is not a mysterious place hermetically sealed from the real world' and that 'Unlike a "brick and mortar outlet" with a specific geographic locale, and unlike the voluntary physical mailing of material from one geographic location to another, the uncontroverted facts indicate that the Web is not geographically constrained.'[88]

The debate did not end there. If the internet is seen as real space, different conditions apply; it can be zoned, subject to trespass, and divided up into holdings similar to real property. In Reno vs ACLU in 1997, Justice O'Connor had anticipated this development when she announced that '[c]yberspace undeniably reflects some form of geography'.[89] In his 1999 book *Code and other Laws of Cyberspace* Lawrence Lessig fought back with the argument that the internet is an artificial environment architectured from code and that there is nothing inherent about it which makes it a space divorced from traditional territorial boundaries, human values or government control. This interpretation was widely taken up and used in the courts. Blavin and Cohen concluded that 'many courts no longer view the internet as a "borderless frontier" intrinsically disconnected from territorial boundaries. Rather, they have at least begun to investigate whether the ever-advancing architecture of the internet is indeed capable of being accurately linked to real space.'[90] The question of whether the internet can be linked to real space has taken

a new turn with the advent of the internet of things, to be discussed later in this book.

The language of the internet was born in the USA and America is still the dominant source of metaphors. Localized internet terminology has been very slow to develop because there are so many new terms to learn that it is often easier to use the original American English, or to retain the sound of a word by simply transposing its local spelling, resulting in peculiar new words which mean something completely different when directly translated. In an attempt to circumvent this problem, Microsoft funded an initiative to produce translation glossaries of new terms for internet users in countries such as India, Ethiopia and the Ukraine. In 2005, one of these projects was based in the Canadian Arctic, where a group of local people searched the Inuktitut language for suitable translations to be implemented in customized software packages. They looked through their culture for equivalent meanings, and for the word 'internet' they settled upon a Shamanistic term which they felt most closely represented the net. The term 'ikiaqqivik' means 'travelling through layers'. It comes from the word used to describe what a shaman does when asked to find out how loved ones were doing, or where animals had gone, by travelling through time and space. 'They used to travel all over the world – even to the moon,' says Aariak, a former Nunavut official languages commissioner. The 1969 moon landing did not impress local elders, he added. 'They said: 'We've already been there.'[91]

Such magical thinking can be helpful at times, since the very abstractness of cyberspace is part of its allure. In 2008 geographer Martin Dodge asked 'How do you explain the internet when you cannot touch it?'[92] Early in the internet's entry into the public consciousness, he explains, 'it had an imaginal malleability as people had no fixed conception of what it was, how it worked, whether it was valuable to them, or whether they could trust it.'[93] In his view, metaphors 'must be read as political because their linguistic power can effect social change in terms of the way a new phenomenon is perceived, in the service of certain interests'. Dodge classifies internet metaphors into three main categories. Firstly, metaphors of invisibility, which he subdivides into (1) materially unseen (2) transparent in use (3) disappearance by social naturalization and (4) occlusion through institutional normalization. There is a tendency to think of the internet as invisible, but doing so leaves the door open to fudging issues of infrastructure, title and responsibility. Secondly, the usual linguistic spatial metaphors such as the superhighway, frontier and other mostly transport-oriented metaphors, and thirdly, visual metaphors for internet infrastructure. He identified four groups of images of the internet. The most common visual analogy to explain the internet as a spatially extensive infrastructure is a physical network of wires – not a web, which would be too

conformist in shape. Then there is the global view, with network arcs or data flows shown encircling the world, followed by machinic portrayals – the world in miniature inside the machine. Lastly, and most relevant to biophilia, he lists abstract visions which are often of an organic nature: 'These metaphors draw on naturalistic iconography of organic structures (fractal branching of trees and leaves, structured lattices and webs, the fine filigree patterning of brains or veins) and emergence aesthetics redolent of meteorology and astronomy (cloud patterns, glowing gas nebulas and star clusters).'[94]

The organic is increasingly the metaphor set of choice. In 2004, East Coast writer Douglas Rushkoff told the industry conference Poptech that the set of concepts they should be thinking with were those of ecology, not economy. Will city-centric pressure shape the cyberspace of the future? Or will biophilia intervene and take a central role in the technologies of urban life? We are already a long way from the information superhighway and cyberspace is after all, as John Perry Barlow wrote almost 20 years ago 'an act of nature' which 'grows itself through our collective actions'.[95] What will it grow into? Jeff Bezos, founder of Amazon, has eschewed any kind of metaphor at all, stating firmly 'What we want to be is something completely new. There is no physical analog for what Amazon.com is becoming.'[96] And when the technology we need in order to be permanently connected is so small, cheap and ubiquitous as to have become invisible, we may lose our preoccupation with the materiality of connectedness altogether and begin to pay more attention to its abstract qualities. The extent we experience today may become something quite different in the future.

Soft fascination

> The hackers' response to the computer is artistic, even romantic. They want their programs to be beautiful and elegant expressions of their uniqueness and genius. They relate to one another not just as technical experts, but as creative artists. The Romantics wanted to escape rationalist egoism by becoming one with nature. The hackers find soul in the machine – they lose themselves in the idea of mind building mind and in the sense of merging their minds with a universal system.
>
> SHERRY TURKLE, sociologist[97]

The word 'fascination' has its origins in the Latin *fascinare*, meaning to bewitch or enchant. For the Kaplans, the term calls forth our capacity for involuntary attention, allowing us to function while also having some respite from directed attention. Stimuli which attract us in this way include sex, violence,

wild animals, growth, predation, competition and cooperation. Process-based activities with elements of uncertainty, such as gambling, have a similar effect, as do following interesting threads of information (learning) and mysteries of all kinds. The Kaplans point out that process-based fascinations engage most strongly when they are not random but connected to some larger perceivable framework where there is a mutually supportive relationship between extent and fascination. 'Connectedness, or relatedness, or the existence of some larger pattern is required in order to engage this high-level human motivation.'[98] Biologist Madhav Gadgil believes that 'humans possess a fascination for all sorts of complex entities, living and nonliving, natural and artificial.'[99]

Many of the experiences described above are highly active but there is also a more passive version, called *soft fascination*, in which the involuntary aspect is of only modest strength and in which there is often an important aesthetic component in which the mind is invited to wander. Clouds, sunsets, scenery and the motion of the leaves in a breeze are good examples of soft fascination which can often be found in the nearby environment.[100]

In the case of technology, the nearby environment can be very close indeed. Take, for example, the live wallpaper app on my mobile phone (Figure 2.3). Produced as a free app by Kittehface, it generates animated Koi carp, long, plump and sleek. Some are pure orange with white fins; others have black mottled markings along their orange backs. They glide, twist and turn above a bed of flat pale sand fringed by rocks and the bright green leaves of

FIGURE 2.3 *Koi Live wallpaper (Kittehface software)*

something like watercress. Sometimes they swim right out of view, leaving me to gaze at the empty scene in the certain knowledge that they will soon reappear. When I gently press my finger against the screen, the water ripples and the fish swim away. Eventually, they cruise out from behind the Google widget, appear from underneath the Facebook icon, or sneak around the corner of Contacts. My phone is state of the art, brimming with clever apps which know who I am, where I am, and what I'm doing at most times of the day. It synchronizes everything I do with everywhere I go. So why do I feel the need to add a faux fish tank to this amazing engineering achievement?

In 1984, an experiment took place in the busy waiting room of a dentist's office in North America. On some days, before the surgery opened, researchers installed a busy aquarium. On other days they took it away. They measured the patients' anxiety in both environments, and the results were very clear. On aquarium days, patients were less anxious in the waiting room and more compliant during the surgery.[101] A different group of researchers in a different dentist's office used a large nature mural instead of an aquarium and got similar results. A third experiment found that stressed blood donors experienced lowered blood pressure and pulse rates while sitting in a room where a videotape of a nature scene was playing on TV. The general conclusion was that visual exposure to nature not only diminishes patient stress but can also reduce physical pain.[102] I am not in pain when I look at my mobile, although I may well be stressed. Is that why I take time to gaze at my virtual aquarium? Is my mobile fish tank providing me with a biophilic moment of soft fascination?

Watery metaphors are common across the internet, a fact which is perhaps surprising in an environment which runs on electricity. Water certainly provides a powerful sense of extent. When I asked 'if the internet were a landscape, what kind of landscape would it be?', I also thought about how I would answer it myself. For me, it is an estuary, a mysterious habitat of varying depths where life forms breed, evolve, survive or perish in a vivid and unstoppable cycle. In my own sense of cyberspace, fanned-out fresh water tributaries pass into the spreading salty ocean beyond, then are sucked back in again by the tide along with strange new materials which fertilize yet more novel processes and tenuous hybridities, only some of which will fully develop. But I was curious to know what others thought too. My vision was watery, but perhaps I was the only one. As it turns out, the most common answer to my question was some kind of watery scenario. Author Bruce Sterling proposed a 'bubbling primal soup full of worms and viruses'.[103] Tim O'Reilly thinks of it as an ocean: 'The sea is a sustaining medium, most of which is invisible to us and which, like our atmosphere, we largely take for granted. But elements of it occasionally swim within our

range of vision. I think the internet is a lot like that – we see very little of it at any one time.'[104] We use watery metaphors to express the sublime, such as when a Facebook user posted a message on the wall of the 'Where are you now?' group, writing 'my body is at home . . . in Córdoba, but me . . . i am flowing on the net',[105] and frustration, like technology author Nicholas Carr, annoyed by the ever-changing online environment which can actually inhibit that flow: 'Once I was a scuba diver in the sea of words. Now I zip along the surface like a guy on a Jet Ski.'[106]

'Nearby nature with an element of water is especially potent,' write the Kaplans, since 'rivers, lakes and oceans have always held a strong attraction for all life-forms. It is a highly-preferred element in any landscape.'[107] According to philosopher Gaston Bachelard, water provides 'the essential, ontological metamorphosis between fire and earth'.[108] And in his beautiful account of wild swimming, *Waterlog*, Roger Deakin explains how it provides a rite of passage where 'something like metamorphosis happens. Leaving behind the land, you go through the looking-glass surface and enter a new world'.[109] For me, logging on feels just the same, although in these always-on wireless days that pleasure is not as noticeable as it used to be, as if the looking-glass surface is less obvious than it once was.

There is one watery preference which, despite the fact that it is deeply culturally specific and geographically constrained, has been widely adopted by internet users worldwide. The story of the spread of the word 'surfing' to describe internet browsing begins far from the sea, in 1992 in the Liverpool Public Library near Syracuse, New York, where librarian Jean Armour Polly sat at her desk thinking about cyberspace. She had been commissioned to write an article introducing the internet to librarians, but how could she convey what it was like? By then the network was already over 20 years old but very few people beyond the US military and some privileged academics had even heard of it, let alone used it. In the years ahead, the act of entering cyberspace, along with the entering of outer space, would come to be seen as one of the most profound experiences of the twentieth century, but then it was mostly terra incognita. So how to describe an activity so new that it did not yet have a name? Most particularly, she needed a title for her article.

> I wanted something that expressed the fun I had using the Internet, as well as hit on the skill, and yes, endurance necessary to use it well. I needed something that would evoke a sense of randomness, chaos, and even danger. I wanted something fishy, net-like, nautical.[110]

At the time she was using a mousepad designed by Steve Cisler, leader of the Apple Library User's Group in Cupertino, California. When they employed him

Apple had been reluctant to give Cisler the job title of librarian, considering it too uncool, so they had settled on 'Information Surfer'. He subsequently designed a mousepad for himself bearing that same title, and in what was perhaps one of the first examples of internet-initiated cargo culture in action, one of the mouse pads eventually washed up on Jean Armour Polly's desk. She had no connections with surfer culture and was not even a keen swimmer, but the metaphor arrived as a form of cultural flotsam and she was inspired to grab it. She later wrote that the mousepad 'pictured a surfer on a big wave. "Information Surfer" it said. "Eureka", I said, and I had my metaphor'.[111] Her article, 'Surfing the Internet', was published in print in June 1992.[112] There are other claims to the title of originator of the term 'surfing the internet', most notably San Franciscan futurist Tom Mandel who used it in an executive overview of the internet for the Stanford Research Institute International Business Intelligence Program. His article was called 'Surfing the Wild Internet' and it was published about a year after Polly's, but it is unlikely that he had seen her piece in the Wilson Library Bulletin. Polly's is generally thought to be the source most often cited, and the notion of surfing the internet has been picked up worldwide by people who have never mounted a board, perhaps never even seen a beach, yet their imaginations are fired by the idea of carefree riding in a sea of information. In 2010 Polly told me that she herself had never had any connections with surfer culture. She wrote: 'I don't even like to swim! But my vision of surfing was that it was cool, dangerous, fun, hard to do, addictive, and required a lot of skill. Like using the Internet was back then.' She had expressed a preference based, not on her real experience, but upon a fantasy of the ocean, and this fantasy has persisted among land-locked users worldwide who still talk about surfing the internet.

Often we find a metaphor which plugs into our own cultural mindset, like the moment when Alan Liu went online to explore the newborn World Wide Web in 1994. Liu, a Professor of English at the University of California Santa Barbara, later recalled how, after an extended period of net-surfing, he rose from his keyboard and walked to the bluffs overlooking the ocean near his home. 'Looking out over the Pacific at sunset that day', he recalls, 'I felt I was on the edge of something vast and unfathomable: new media as ocean. And I remember thinking of that "wild surmise" that came to Cortez at the end of Keats's "On First Looking into Chapman's Homer"'.[113] One night in October 1861, the poet John Keats had stayed up very late with his friend Charles Cowden Clarke reading, with great excitement, a print copy of Chapman's translation of the *Iliad* and the *Odyssey*. Previously they had only seen Alexander Pope's much less evocative translation. Keats went home at dawn and when Clarke came down to breakfast at ten o'clock, he

found on the table an envelope containing no message other than the gift of a new sonnet. In the poem, Keats compares his experience of encountering Chapman's *Homer* to his imagining of how the explorer Cortez[114] may have felt when he saw the Pacific for the first time: 'Like some watcher of the skies, When a new planet swims into his ken'.[115] In a parallel, if less intense account, Owen Linzmayer tells the story of how Apple Macintosh's first logo, drawn by Ronald Wayne some time before 1976, 'contained a portion of a William Wordsworth poem[116] running around the border: "Newton . . . a mind forever voyaging through strange seas of thought"'.[117]

It seems contradictory that the highly energetic pursuit of standing upright on a long wooden board and riding it along the top of towering and scary ocean waves has become synonymous with sitting in an almost completely stationary position in front of a computer screen, using your hand to move and click a mouse, and sometimes pressing on a keyboard. Or, in the days of tablets and smartphones, tapping the screen with a finger or stylus. Yet this unlikely metaphor has gained worldwide popularity and opened up new ways to think about the internet. Oceans, streams, rivers, clouds, even swimming pools, regularly appear in online discourse: 'Technology is a swimming pool. You see the clear water, the surface of the water and its boundaries' writes a blogger called Nic.[118] And watercraft. J. P. Rangaswami remarks 'Twitter is fast becoming my personal submarine and periscope to the ocean of the World Wide Web, the personal areas I want to go to defined by my relationships to people and ideas.'[119] And fishing paraphernalia. David Sibbet writes 'the living global network is like a fishnet with an ocean of indigenous life flowing in and around, and the net is fragile.'[120] Even ice: 'Think of the web, of the Internet itself, as water,' blogged Anil Dash in 2007, continuing 'Proprietary platforms based on the web are ice cubes. They can, for a time, suspend themselves above the web at large. But over time, they only ever melt into the water. And maybe they make it better when they do.'[121] And meeting places: many writers, including David Thornburg, have described telecommunications itself as something like 'a vast global watering-hole'.[122] Interaction designer Brenda Laurel lives high in the Santa Cruz Mountains, west of Silicon Valley, and is a keen scuba diver in the nearby Pacific kelp forests. Laurel imagines the landscape of cyberspace to be equally fluid and indeterminate because 'the topology of the internet is always changing as energy moves from here to there and new social and economic topologies form and collapse.'[123] And National Public Radio's Siobhan Gorman echoed that sense of movement in a report for *All Things Considered* on cyberspies hacking the US electricity grid. She explained the ease with which this can be done 'the internet is aquatic – once you get into the ocean it is easier to swim from one place to the next.'[124] Way back in 1986 and referring more to coding than to the internet, but certainly

in tune with the zeitgeist, the English cyberneticist Stafford Beer published a poem about 'that green computer sea'.[125]

The fact that seas can be dangerous was in the mind of Google Vice President of product management Bradley Horowitz in 2010 when the company was battling with Facebook for social media supremacy. The codename 'Emerald Sea' had just been chosen for a new project to lead the fight – a project that would later be released as Google+ – and Horowitz was moved to idly Google the term for image ideas. The first picture he came across was by the German artist Albert Bierstadt. Painted in 1878, it depicts a ship being broken up and consumed by giant surf. Steven Levy later wrote about this moment for *Wired* magazine, explaining that the painting so impressed Horowitz that he commissioned a pair of art students to copy it on the wall facing the fourth floor elevators.

> That way, the hundreds of workers contributing to Emerald Sea would draw inspiration as they headed to their computers to remake Google into a major social networking force. The massive wave symbolizes the ways Google views the increasingly prominent social aspect of the web – as a possible tsunami poised to engulf it, or a maverick surge that it will ride to glory. Beirstadt's turbulent vision is the perfect illustration. 'We needed a code name that captured the fact that either there was a great opportunity to sail to new horizons and new things, or that we were going to drown by this wave,' Gundotra said last August, when Google first showed me a prototype.[126]

Watery metaphors might not be lucky for Google. One of its earlier watery social network projects, *Wave*, unfortunately drowned quite soon after its launch in 2009. There were high hopes for Google Wave, which was intended to create a live shared space on the web, and suspense was high in the months running up to its release in September ('Is gmail slow today from that huge rush of Wave invites flowing across it? #googlewave' tweeted @kirbstr),[127] but by Spring 2010 it was on the rocks. Over-complex, overambitious, certainly overhyped, Google Wave disappointed by being just too difficult to surf.

From the start, the widespread adoption of 'surfing the internet' did not please everyone, however. According to *The Hacker's Dictionary*, the term was current in hacker culture in the early years of the internet but they gave it up when it went mainstream. *The Hacker's Dictionary* is the best source of information about early hacker culture in the United States. It began life in 1975 as the Jargon File, a collection of jargon from technical cultures including the MIT AI Lab, the Stanford AI Lab (SAIL), members of the older communities such as ARPANET, and companies such as Bolt, Beranek and Newman. When Raphael Finkel released the first version he called it 'a comprehensive

compendium of hacker slang illuminating many aspects of hackish tradition, folklore, and humor'.[128] He devotes almost a page to the definition of a hacker and offers eight interpretations, of which the first and simplest is 'A person who enjoys exploring the details of programmable systems and how to stretch their capabilities, as opposed to most users, who prefer to learn only the minimum necessary.'[129] The Jargon File was crowd-sourced across the wires by enthusiastic contributors, and added to intermittently until Spring 1981, when parts of it were published in *CoEvolution Quarterly*. Until then it had only existed in virtuality as a disembodied computer file. It was transformed into *The Hacker's Dictionary* by Guy Steele in 1983, and under the editorship of Eric Raymond has since been through several editions. The last edition of the dictionary appeared in 1992 and it now stands as a kind of hacker's Rosetta Stone to many forgotten terms forged in the white heat of the programmer's cubicle. The Dictionary is quirky, irritable, opinionated and probably untrustworthy in many places, but it makes for an energizing and amusing read and has provided many of the arcane terms included in this book. Hackers shaped much of the early language around computers and the internet, although their influence declined as the number of users increased and the language acquired a broader appeal. 'Hackers love wordplay and are very conscious and inventive in their use of language'[130] writes Raymond in the Introduction. And in that spirit, the Dictionary remarks grumpily of the term 'surfing', 'The passive, couch-potato connotations that go with TV channel surfing were never pleasant, and hearing non-hackers wax enthusiastic about "surfing the net" tends to make hackers feel a bit as though their home is being overrun by ignorami.'[131] In an early edition Raymond had this to say on the subject of hackers and sport: 'Many (perhaps even most) hackers don't follow or do sports at all and are determinedly anti-physical. Further, hackers avoid most team sports like the plague. Volleyball was long a notable exception, perhaps because it's non-contact and relatively friendly.'[132] However, 'hacker sports are almost always primarily self-competitive ones involving concentration, stamina, and micromotor skills: martial arts, bicycling, auto racing, kite flying, hiking, rock climbing, aviation, target-shooting, sailing, caving, juggling, skiing, skating, skydiving, scuba diving.'[133] No mention there, surprisingly, of surfing.

So do hackers qualify as the first explorers in the cyber-wilderness? They are certainly not known for their physicality 'Tans are rare' proclaims the Dictionary, somewhat proudly, 'despite an occasional fondness for "outdoorsy" clothing – ("in case a mountain should suddenly spring up in the machine room", as one famous parody put it), khakis, lumberjack or chamois shirts, and the like'.[134] But then physical strength is not what is needed in the electronic universe, where quick intelligence and high levels of abstract reasoning are much more likely to save your life in times of crisis.

There is a further footnote to the story of surfing. When the first Apple computer[135] went into production in 1976 it was just a circuit board. But after a few months the company commissioned a nearby cabinet-maker to clothe it in cases made from koa, a valuable hardwood found only on the island of Hawaii. Koa wood is historically the material of choice for carved ocean-going canoes, which made it very appropriate for the machine upon which we would all soon be going surfing. And, although it has not entered web-surfing lore, there is an interesting synchronicity between surfing the internet and traversing the ocean as understood by Polynesian culture. When Polynesian people speak of navigation they do not conceive of themselves as moving objects travelling across the sea, but rather as static objects which the sea travels past. You are not moving, but the landscape moves past you, in rather the same way that the computer user sits in her chair and watches cyberspace move past on her screen. An intriguing example of extent.

There are oceans, and then there are rivers and streams. For landscape architect Anne Whiston Spirn, rivers are places of concentration and exchange. They chart paths into and out of remote territories, and provide somewhere to gather.[136] In cyberspace, they perform much the same function. In 1995 Christopher Anderson explained to readers of The Economist that data packets are 'just a drop in a passing river',[137] and Technorati guru David Sifry sees the web as a 'river of human chatter', constantly joined by other creeks and constantly flowing.[138] The micro-blogging site Twitter has been variously described as a twisty canyon with a fast flowing river,[139] zillions of tiny rivers connected yet apart[140] and, of course, a stream. 'We plug into the data stream as casually as we plug into an electric socket today,'[141] writes Chris Anderson. Social media entrepreneur Chris Brogan sees Twitter as a stream but thinks that 'Facebook is both a stream and a stopping point (but mostly a stream).'[142] His readers take off with the metaphor and develop the scenario further. One asks 'At what point would you say that you need to build a dam for the stream? Say you want to share your stream with everyone, but you also want to ensure that people come back and picnic beside your stream – how do you build the dam to keep the picnickers?'[143] And another observes that 'Making a Tweet is very much like tossing a leaf or twig into a stream' and 'I guess you might say clicking on someone's page is akin to stepping out onto a steady rock in the middle of the stream.'[144] For Microsoft researcher danah boyd the idea is that you are 'living inside the stream: adding to it, consuming it, redirecting it.'[145]

In the twenty-first century the stream feels very busy and loud, but it was not always like that. It was certainly much less crowded in 1995, when the Buddhist magazine *Shambhala Sun*, whose readers mostly comprised the

wired West Coast counter culture community and who were already well accustomed to experiments with chemical and vegetal realities, confirmed that the internet was yet another way to turn on and tune in. 'The off-line data stream of our everyday lives'[146] becomes part of the flow, enthused Shambhala. 'We download it, and it downloads us, and the cycle goes on and on.'[147] Today, perhaps, we have a less transcendental view of what it means to be online, but for many users the sense of connectedness is as strong as ever. Herman Melville described something very similar when in the first pages of *Moby Dick* he painted a picture of the ordinary citizens of a coastal town regularly drawn to spending their free time just gazing out to sea: 'Circumambulate the city of a dreamy Sabbath afternoon', he wrote. 'What do you see? – Posted like silent sentinels all around the town, stand thousands upon thousands of mortal men fixed in ocean reveries.'[148] What do they feel connected to? Each other, for sure, but also to a sense of something more, something *beyond*.

Soft fascination in the form of watery metaphors is widespread on the internet, but there are many other examples too. The tickertape scroll of a live Twitter feed, or the constantly renewing posts on Facebook, may not be aesthetically beautiful, but they captivate the user with a gentle stream of process activities – news, queries, greetings – which cast a spell over us as surely as waves breaking gently on the shore.

Compatibility

> We're trying to build a virtual mirror of the world.
>
> MARISSA MEYER, Then Vice President, Location & Local Services, Google[149]

Of the four restorative settings described by the Kaplans, *compatibility* can be the most difficult to understand. It relates to our preference for environments which resonate with our personal inclinations. 'An environment may offer fascination and extent and still fall short as a setting for restorative experiences' they explain.

> The final property of restorative settings involves compatibility between one's inclinations and environmental circumstances. Such circumstances include both what the setting requires from the individual and what it offers in terms of information and opportunities. . . . One might, for example, wish to relax and enjoy the sunset but feel called upon instead to watch for marauding mosquitoes. Or one might wish to walk in the woods but

> be expected to attend a family gathering. Alternatively, one might want to finish a project only to find that some crucial information is missing. . . . These are all instances of incompatibility, and they add to mental fatigue. One solution some people seem to adopt is to engage in activities which take place in a natural setting, such as hunting and fishing, gardening and caring for pets, watching animals in the wild or in zoos, and survival skills.[150]

Incompatible experiences may arise from the amount of effort required to function well in more 'civilized' settings, say the Kaplans, even though these days our familiarity with them is far greater than with natural settings. But look at the larger timescale. For millions of years our ancestors evolved in a wild landscape. Modern humans have been around for the last 200,000 years. The Industrial Revolution, when the timetable of our daily lives really began to be driven by the machines we made, and technology pervaded homes and workplaces like never before, began only 300 years ago. So when the Kaplans point out that the environments humans evolved in are 'far more natural than those in which we live now',[151] their argument about the importance of compatibility makes obvious sense.

With this in mind, what makes for a satisfactory and compatible experience? The Kaplans say that control over the type of engagement appears to be crucial. Some people are drawn to what they see as authentic activities with a practical purpose, such as growing or catching food, building a shelter, gathering wood for the fire or, indeed, making creative use of a computer. Others prefer the opposite, wishing to give themselves up to an unseen order and in the process, perhaps, experience a sense of the sublime. We will return to the sublime later, but for now let us consider an element of the first group: the use of crafts and tools in the development and application of important skills. And the tools we are interested in are computers.

There can be a deep pleasure in using computers, from the most basic skills of learning to use the machine and its entry-level software, through developing expertise with particular programs and applications, to actually writing code. Cyberspace is full of people enjoying the pleasure of being creative and in the process developing expertise in building a personal photo collection, social networking, playing complex computer games or many other pursuits. What they are doing, in fact, is learning craftsmanship, which philosopher Richard Sennett calls 'the skill of making things well'.[152] He describes craftsmanship as 'an enduring, basic human impulse, the desire to do a job well for its own sake'.[153] Yet for some reason the satisfaction of using computers well is not valued as much as, say, the ability to make a good fire or build a shelter. It is as if older craft ways have more authenticity than new skills. Those who

design and build computers, the engineers, programmers and others, know that of course this is not true, and in terms of popular culture the psychology of tools has intersected with the digital ever since *The Whole Earth Catalog* was launched in San Francisco in 1968.

The *Catalog* focused on pioneer-style living, and that included many kinds of technologies including computers. It offered not just a huge variety of items to purchase, but a lifestyle too. In the words of Stanford historian Fred Turner, buying a backpack or a tent did not simply offer a means of escape into the woods, it also offered readers 'a chance to join an invisible community of nomads, to act in accord with the ancient energies of nature, and to become a more "whole" person in the process'.[154] Looking back on the history of the Catalog, Theodore Roszak noted that 'alongside the rustic skills and tools, we discover high industrial techniques and instruments: stereo systems, cameras, cinematography, and, of course, computers. On one page the "Manifesto of the Mad Farmer Liberation Front" (Wendell Berry's plea for family-scaled organic agriculture); on the next, Norbert Wiener's cybernetics'.[155] Roszak says that this juxtaposition jarred with him at first until he interpreted it as seeming to say 'that all human ingenuity deserved to be celebrated from the stone axe and American Indian medicine to modem electronics'.[156] This echoed Stewart Brand's enthusiastic remark that 'If you get into cybernetics and your head is just a minute ago full of organic gardening and ecology, then cybernetics starts to come alive for you in a different way.'[157] Today, websites like *Make*, *Craft*, and *Instructables* combine social media culture with hobbyist expertise to produce a community of makers busily weaving in and out of the online world and cross-pollinating traditional techniques with the latest in robotics and other electronics. They exemplify compatibility in several ways: they demonstrate an ability to shape their surroundings to a level which feels intuitive and comfortable; they engender what the Kaplans call 'a profound sense of relatedness'[158] to their environment; and they allow the pursuit of an activity which feels like a worthwhile contribution, one which is 'a good fit', by which one might enjoy comfortable and peaceful reflection.

There also is a growing interest in inventing new perspectives on traditional materials. As long ago as 2006 I wrote about the passion for 'modding' (modification) of Moleskine notebooks.[159] Perhaps because of its very simplicity and enjoyable tactility in a world of virtual objects, the Moleskine has attracted the special attention of the geeky life-hacking community, and they have devised many handmade modifications for it. What is interesting about these modifications is that they were inspired by the PDA (personal digital assistant), a forerunner of the smartphone. The plan was to address the same design goals of a PDA by reverse-engineering towards a plain

paper notebook without losing the functionality of the stylus, bookmarks and metatags that could be found in the PDA. There were extra innovations too, like a pencil sharpener which, of course, has no equivalent in the PDA but which caused much excitement. One user reinvents the old-fashioned loose lined page that can be laid underneath plain paper: 'Hey . . . You could also print ruled lines on some card stock and cut to fit in the pages so that if you have bad handwriting you can write in a straight line in a sketchbook . . . then all you have to do is put the ruled page behind the page you are using and you should be able to see the lines. By the way, love the pencil sharpener.'[160]

In 1952 Kurt Vonnegut published his first book. *Player Piano*, a novel about a future where nothing needs mending anymore and unemployed engineers and mechanics hang around on street corners desperate for something to fix. They miss the satisfaction of exercising their skills and using much-cherished tools with their bare hands. Sixty years on, we are moving towards that future even faster, and of course much of it has already come true. But communities like MEND*RS are appearing to fill the gap. Aiming to reinvigorate mending cultures in everyday life, MEND*RS held its first Mending Research Symposium in the English Lake District in 2012. The group intends to build a mending network 'to unite practitioners of a marginal, disparate, often domestic activity with designers, craftspeople, small businesses, social enterprises, environmental and social wellbeing groups, local residents and researchers operating across diverse disciplines'.[161]

This focus on the traditional is increasingly popular in cyberculture, especially in relation to design. However, the decision by Apple to develop a range of skeuomorphic designs has upset many dedicated users. The term comes from the Greek words 'skeuos', meaning a vessel or a tool, and 'morphe', meaning shape. Skeuomorphism is less about the function of a tool, than about its appearance, and it has fired hot debate in the world of user interface design. Skeuomorphic design contains elements which simulate the features of earlier iterations of an object but which have become irrelevant to the way it is now used. A typical example can be found in the design of some Apple products, most notably the iPhone and iPad, where applications such as the Compass, Calendar and the iBook reader have been deliberately designed to mimic traditional paper formats and haptic qualities. The reason for this may lie in a drive to attract more traditional users for whom an iPad may be their first computer, but it provoked fury in designer Adam Greenfield when he picked up his new iPhone 4 and saw 'the page-curl animation (beautifully rendered, but stick-in-the-craw wrong) in iBooks. Feast your eyes on the leatherette Executive Desk Blotter nonsense going on in Notes. Open up Calendar, with its twee spiral-bound conceit, and gaze into the face of Fear.

What are these but misguided coddles, patronizing crutches, interactively horseless carriages?'[162]

It appears that the impetus for this strange departure from the coolest of cool Apple interface design can be found in the Apple Human Interface Guidelines which urge designers to 'add a realistic, physical dimension to your application. The more true to life your application looks and behaves, the easier it is for people to understand how it works and the more they enjoy using it'.[163] Makers of iPad cases have followed the same principle and produced styles in distressed faux leather, fake vellum and ageing parchment. There is something here about trying to engage iPad owners' sense of compatibility in a bid to help them feel more comfortable while using such an advanced product but the end result feels, to paraphrase Greenfield, just plain wrong,[164] especially when coming from a company which heretofore has set the standards for cool.

But there is another problem with our digital kit. Despite so many advances in hardware design, we still have to squeeze into cyberspace through squarish screens on equipment which is not especially satisfying to look at or to hold. Undoubtedly these problems will be solved in the future, but at present most digital devices have very rectangular windows and are made of materials which have unsatisfying haptic qualities, which is to say they don't always look or feel comfortable. Also, they are frequently manufactured by unsustainable methods in factories with questionable standards of employee care. Very few of our mobile phones, tablets and PCs meet the standards of 'restorative environmental design', a paradigm which aims to achieve both a low-environmental-impact strategy and a design approach that fosters beneficial contact between people and nature.[165]

It is interesting here to look at the concepts of 'carpentered' and 'noncarpentered'[166] created by Yi Fu Tuan to distinguish between natural and built environments. He wrote 'The carpentered world is replete with straight lines, angles and rectangular objects'[167] but nature and the countryside 'lack rectangularity'.[168] In his view, these differences can have a powerful impact on the way we perceive and measure our environments. For example, rural people living in cold climates spend more time indoors than do their peers in hot climates. By virtue of their everyday surroundings, those in cold climates will find that their sense of the world is influenced by the shape and sensorium of the indoors, meaning that the perceptual judgements they make will probably differ from their outdoor peers as radically as those between city and country dwellers. Or compare the lifeworlds of people living on a flat featureless plain with those who live in clearings in dense rainforests or in small courtyards surrounded by towering tenements. There must assuredly be significant differences in their spatial perception.[169] Quite simply, they view

the world differently from each other. He also compares the experiences of Congo Pygmies, rainforest people, and Hopi Indians, plateau-dwellers. For the Pygmies, 'The sky is seldom visible. The sun, moon and the stars, from which many societies derive their measure of recurrent time, can rarely be seen.'[170] There are no high places, visual space is restricted, aural space is generally in the form of ambient sounds, and the lack of seasons minimize any sense of time passing. The Hopi, in contrast, live on a panoramic semi-arid plateau with very little vegetation and clear dry air. They can see great distances across both land and sky.

Tuan remarks that 'Plans and diagrams of ideal cities often show them as circular – real ones rarely are.'[171] The same is true of computer design. In the twentieth century, many images of the future included round-faced TV sets and other gadgets, but to date our digital devices remain doggedly rectangular. Contemporary hardware and software designs contain very few circles. Apart from occasional exceptions like the Touchwood phone described in Chapter 1, most hardware is generally angular; most screens flat and sharp-cornered. Even the keys are square despite the fact that the tips of our fingers are semi-circular. The applications which run on our rectangular screens are, of course, designed to be rectangular too – 'all in boxes, little boxes' as the Pete Seeger song goes. At the moment, material constraints force us to interact with cyberspace this way, but in the future we can expect to see wider use of the kinds of multi-touch user interfaces shown in the 2002 science fiction film *Minority Report* and now available in Microsoft's *Xbox* 360 gaming console via the *Kinect* motion sensing camera. And the television industry is working towards interactive wall-sized flat screens featuring tiled content and which 'can be any shape you like, not just rectangular arrays',[172] but although they may be less 'carpentered' we still have a long way to go and probably more new materials to develop before effective biophilic design becomes the norm in the technology industry.

As the debate over skeuomorphism shows, digital technologies are causing considerable debate about whether they should offer a sense of restorative compatibility between one's inclinations and environmental circumstances, or whether by their very nature they are incapable of satisfying our need for that compatibility. In a controversial article for *Orion* magazine, Michael Shellenberger and Ted Nordhaus of the Breakthrough Institute address that tension by calling for a new secular theology in the form of a worldview that sees technology as humane and sacred, rather than inhumane and profane. 'It will require', they say, 'replacing the antiquated notion that human development is antithetical to the preservation of nature with the view that modernization is the key to saving it'.[173] The Kaplans have made it clear that they see the relationship between humans and our environment on a sliding

scale from the pragmatic to the spiritual. The pragmatic includes health benefits and a decrease in human error when mental fatigue is dispelled. The spiritual includes what they describe as 'the remarkable sense of feeling "at one"',[174] a feeling which they say often – but not exclusively – occurs in natural environments. And this brings us to an area of practice that has been overlapping between the two worlds for quite some time: mindfulness.

Mindfulness

> The real voyage of discovery consists not in making new landscapes but in having new eyes.
>
> MARCEL PROUST, novelist[175]

Our understanding of most of what has been discussed above is still in its infancy. The Kaplans' work on the experience of nature continues to be developed, extended and tested but the relationship between their research and the online space has been largely unexplored beyond this book, with one exception. The connection between mindfulness and online attention, especially in an education context, is attracting extensive research and may unlock a better understanding of the other aspects of restorative behaviours online.

The Kaplans concluded that human beings find satisfaction in a natural environment because its aesthetic qualities include both a feeling of mystery and a sense of organization through its patterns and rhythms, and because it can provide the pleasure and sense of comfort which aid recovery from mental fatigue. They suggest that the resulting restorative functions make four specific contributions to the recovery of mental effectiveness:

- clearing the head so that residual clutter can be discarded
- recovering the capacity for directed attention which is so vital to our cognitive functioning
- providing cognitive quiet, especially that produced by soft fascination when it allows us to process long-standing 'cognitive residue', and finally
- offering an opportunity to engage with the 'examined life' in the form of time to reflect, reassess and review one's priorities.

The Kaplans note that this last element came as a surprise to them because the examined life is an aspect of the restorative experience that 'we would never have suspected had it not emerged so clearly in our data'.[176] They

compare the kind of physical space that supports such reflection to the sacred grove which appears in many religions: a quiet forest clearing where sunlight pierces the tall trees and the only sounds are birdsong and the whispering of leaves in the gentle breeze. A grove, in fact, which is not unlike the clearing in Kyushu forest where the wooden marimba we encountered in the opening chapter was filmed.

How might these four functions, or qualities, soothe our connected lives? To date there has been very little research into this area yet it offers the opportunity for many enlightening experiments. For example, we all know how much mental residual clutter is generated by a computer-based-social media-driven life, and where it might cluster during the course of each day. Before doing any interventions it would be interesting to test how far we already alleviate its effects by switching subconsciously between the micro-sized restorative intervals described earlier. The same intervals may also be being used for resting and recovering directed attention. Cognitive quiet and the time to reflect may be more difficult to identify at first, but look at the images which often arrive inside our factory-fresh computers and phones. What piece of kit does not feature at least one sacred grove style screen wallpaper? We choose one, or perhaps we use our own picture or design. Although there is a battery of research into interface design and human computer interaction, I have found no discussion of possible biophilic reasons behind such choices. Perhaps this is because environmental psychology and internet culture are two topics which rarely appear together. But once they are interleaved with biophilia the synergies become clear, and nowhere is this more obvious than in the practice of mindfulness.

Being mindful involves maintaining a conscious focus on what is happening in the present moment. One is aware of one's body, thoughts, feelings and the wider world around, but all are observed in a state of calm equilibrium. It is closely associated with Buddhism, especially the branch of it known as Zen, but the technique is also widely practised in other religions and in secular contexts. Zen Buddhism is popular in California, not least in the Silicon Valley area where there is a long history of employees of the technology industries also being active practitioners. From relatively early on, many people could see synergies between the internet and Buddhist practice. As early as 1995, the magazine *Shambhala Sun*, for example, described the net as an esoteric place for meditation which provided 'a feeling of complete and total immersion, in which the individual's observer-self has thoroughly and effortlessly integrated and is at one with the experience of the moment'.[177]

In *The Distraction Addiction*, Alex Soojung-Kim Pang puts this into practice when he applies the discovery Linda Stone made when, in the course of examining partial attention, she realized that she held her breath every time

she checked her email. Pang turns the moment into a mindfulness exercise. Check your mail now, he instructs his reader, but

> don't think about the messages that might be waiting in your inbox, or how you really should have already answered those messages from last week. Try not to let your thoughts wander. Instead, pay attention to yourself. Try to observe what you do. Watch how the computer reacts to you, and how you react to it. In particular, notice how you breathe. Did you hold your breath? Chances are, you did, and that small unconscious habit is a window into a big world of issues. It shows how relationships we think of as disembodied transfers of information that transcend our normal physical actually have a bodily, physical dimension. It illustrates how we don't just 'use' information technologies, the way we use bicycle pumps or elevators or salad tongs: they turn into extensions of our minds and memories. They become entangled with us.[178]

Pang sees Stone's 'email apnea' as an important but usually unrecognized dimension in our relationships with information technology: the degree to which technology insinuates itself into our minds.[179] But the process is not always passive, of course. For example, Steve Jobs, the late CEO of Apple, was well-known for his association with Zen Buddhism. His engagement with it began in 1972 when he was inspired to establish a meditation room in the attic of his shared house. At that time, psychedelic drugs were also interwoven with the counterculture Buddhist scene, and were sometimes part of his activities, but for the most part he and his friends simply meditated there.[180] Jobs' biographer Walter Isaacson reports that he became deeply influenced by the emphasis placed on intuition by Buddhism and began to realize the importance of intuitive understanding and consciousness. But Jobs' intensity, says Isaacson, made it difficult for him to achieve inner peace; 'his Zen awareness was not accompanied by an excess of calm, peace of mind, or interpersonal mellowness'.[181] Nevertheless, he continued his meditation practice to the end of his life and it is generally held to have deeply influenced his aesthetic.

In the highly entertaining *Zen Computer* (1999), Philip Toshio Sudo demonstrates the Zen Buddhist approach to computers. He advocates we make switching on the machine into a mindful act. 'Each time we start the computer marks a new beginning. Even if we're applying ourselves to tasks left over from the day before, today's start is a new start – a chance to remind ourselves that, in this moment, we embark down the path of spiritual growth with a fresh step and a beginner's mind.'[182] And Howard Rheingold, a longtime practitioner of mindfulness, advocates using it to strengthen your

attention processes. He describes his habit of meditating for a short period every day before lunch and notes that 'the practice of watching my mind for a small part of each day has had an observable effect'.[183] The technique has helped him focus awareness and surf the web with more intentionality and with less distraction.

Even Google has embraced mindfulness. In Spring 2012 it launched a new free course for its employees called *Search Inside Yourself*, a title which sounds like a good Buddhist joke. It is taught by Chade-Meng Tan whose job description at Google is to 'enlighten minds, open hearts, create world peace'.[184] The business website Forbes.com reports 'It's a rock-solid business-friendly mindfulness course in three acts: train your attention, develop self-knowledge and self-mastery, and create useful mental habits.'[185]

This chapter has explained how, since the internet was first connected, we have embedded restorative settings into our online lives and how for the most part this has happened subliminally, below the threshold of consciousness. As Peter Bishop wrote of the imagining of Shangri-La, 'In one sense, natural landscape does not exist. We inescapably shape the world, even if only with our minds and not our hands. When we shape the world, we create places.'[186] The gardens of LambdaMOO; Second Life; World of Warcraft; along with Farmville and many other virtual worlds and games; the extensive metaphors of nature; the watery adventures; the grounding of compatibility – these are just some of the ways in which we bring nature into cyberspace. Often the connections are so unexpected that at first glance they might easily be dismissed, but a closer look reveals that our attraction to life and lifelike processes as they appear in technology permeates the online environment and helps to soothe our connected lives. It is technobiophilia in action.

But there is another influence at work, one which is so powerful it cannot be ignored. The internet has become a global phenomenon, but it was born in the American state of California and its development has been strongly influenced by that very particular cultural climate. In the next chapter we look at how Californians created cyberspace in their own image.

3

Cybernetic meadows: The California connection

Good weather plus earthquakes creates an utterly different environment. On a day-to-day basis, you can concentrate on your goals, with no need for contingency plans. Your softball game, your picnic, your wedding won't be rained out. But everything could change in an instant. You can't anticipate earthquakes, can't plan for them, can't even predict when and where they'll strike. Instead of providing the certainty of seasons, nature promises a future of random shocks. All you can do is develop general coping skills and resources.

VIRGINIA POSTREL, Writer[1]

West of the West

> Bodies and minds bear the marks of the contexts that shaped and shape them: sea and savanna, city and cyberspace.
>
> ANNE WHISTON SPIRN, landscape architect[2]

I stood by the emergency exit door and gazed through its tiny window at icy broken landscapes far below, staring down at clouds of steam rising from far away geysers. I was on a flight from London to Los Angeles and at that moment we were travelling over Hudson Bay, towards Lake Winnipeg. It felt like virtual reality, to be standing perfectly still inside a metal box while speeding in and out of clouds above Canada at 500 miles an hour. At 38,000 feet below me in the real world – IRL, as we call it in cyberspace, 'In Real Life' – the icebergs looked fragmented and close to melting, like the moment when you drop a cream jug into a washing up bowl and the liquid inside curdles and spreads, cracked and oily, across the surface of the water. I would not be descending into those snow fields that day, however, and there would be no opportunity to touch. Instead, I was on my way to California to look for stories about a different kind of virtuality – the landscapes of the internet.

That evening I arrived in Santa Monica, checked into my hotel and grabbed a few hours sleep. By 8 am the next day I was driving north on Ocean Boulevard towards the California Incline and down onto the Pacific Coast Highway, known locally as PCH. The air was full of the scent of the eucalyptus trees and alongside the freeway the early Sunday morning beach stretched out empty. Beyond it the ocean glistened in a shimmering array of blues. Eric Clapton's *Layla* was on the radio. Somehow, *Layla* is *always* on the radio in SoCal.

Southern California is the place I go to think about cyberspace. Of course, I am not by any means the first person to do this. Much of the early internet was imagined here long before it was built and spread across the globe. But I confess that I am fascinated by this place. Spending time here feels like being on the edge in every respect – creatively, intellectually and certainly physically. The nets hung along the bluffs above the roads to hold back mudslides are a constant reminder of that, as are the earthquake warnings, the automobile accidents, deserts, canyons, coyotes, mountain lions, Africanized honey bees and rattle snakes, and all the other dangers which are part of everyday life in Southern California. It is impossible to forget that this state lies at the end of a very long westward journey. It is the culmination, one might even say the fruition, of a vast continent. As President Theodore Roosevelt is credited with declaring 'When I am in California, I am not in the West, I am west of the West.'[3]

That morning I was driving to Goleta, a little way beyond the city of Santa Barbara. In so doing I was retracing part of the route between two of the earliest nodes of the internet – the first, at the University of California at Los Angeles (UCLA), close to my starting point in Santa Monica, and the third, at the University of California at Santa Barbara (UCSB). UCSB is that most archetypal of Californian institutions, a university on a beach, and for the next few months I was to be based there as a research scholar. As I drove, I thought about the momentous years I was about to study. Forty years earlier two of the most profound experiences of the twentieth century, the act of entering outer space, and the entrance into cyberspace, had taken place within weeks of each other. In July 1969, humans landed on the moon. In September, they entered cyberspace. Today the mountains of the Moon remained largely neglected and unexplored, but cyberspace has evolved into a deeply familiar habitat with a geography shaped by those who build and use it.

The internet was seeded on a September day in 1969 and by December of that year there would be four nodes on the network. During my trip I planned to visit three of the cities which hosted them: Los Angeles, Menlo Park and Santa Barbara. In other words, I was going to see three of the first four places in cyberspace. 'The 1969 connection was not just a symbolic milestone in the project that led to the Internet, but in the whole idea of connecting computers – and eventually billions of people – to each other',[4] writes Marc Weber, founding curator of the Computer Museum's Internet History Program. Before that time, there were only single large computers and although several people could have an account on one of them and exchange files and messages, none of the machines could communicate with each other. 'Each of those little communities was an island, isolated from others', he continues. 'By reliably connecting different kinds of computers to each other, the ARPANET took a crucial step toward the online world that links nearly a third of the world's population today.'[5]

I dawdled on my journey up PCH, stopping off to look for surfers at Malibu and for dolphins at Zuma, so it was afternoon by the time I reached Goleta State Beach. Hot and tired, I parked the car, took off my shoes and strolled along the waterline for a while until I reached the point where the tidal estuary broadens out and runs into the Pacific. There, suddenly and unexpectedly, I found myself overcome. I sat down heavily facing the sea and the sun, at the meeting point of salt and fresh, close to the creek's steady flow across the deepening bed of smooth sand towards the ocean. I closed my eyes against the heat and listened to the faint splashes of diving pelicans, the smooth shushing of the creek, and the bursts of gentle waves coming up to meet it against the soft roar of the surf. And at that moment I had a sense, it could be called no more than that, that this estuarine interface

where the fresh snow melt from the mountains meets the salinity of the ocean reflected the merging of cyberspace with what we call 'real' space. It was an instant of fuzzy logic, neither wholly fresh nor wholly salt, but both at the same time. I imagined a conceptual estuary where any mutation might be possible.

Lo

> There are new lands, new men, new thoughts.
>
> RALPH WALDO EMERSON, author[6]

Although the idea of an electronic network seems somewhat abstract, each node of it has a physical reality in a box in a room in a building somewhere. In the case of ARPANET, the boxes resided in four very different areas and of those, three represented a range of dissimilar aspects of Californian life – the international city of Los Angeles; the university suburb of Menlo Park and the spiritually minded coastal community of Santa Barbara. The fourth was the University of Utah, located in Salt Lake City and famed as the headquarters of the Mormon Church. Utah was chosen for its expertise in digital graphics, but it would be the Californian partners who would influence the development of the internet not only technically but also culturally.

The campus of the University of California at Los Angeles (UCLA) is green and spacious, its northern edge bounded by Sunset Boulevard. From UCLA you can drive west on Sunset, past the Lake Shrine Temple on the left and Will Rogers State Park on the right, and soon you will see ahead of you the wide blue Pacific Ocean. Or go in the opposite direction, east on Sunset from UCLA, and pass through the rich private estates of Beverley Hills until you reach Hollywood a few miles further on. Or you could simply walk across the Boulevard from the university to find yourself on the borders of the exclusive Bel-Air Country Club.

It was at UCLA that Professor Leonard Kleinrock established the Network Measurement Center where the first node, or IMP, of ARPANET went online in Room 3420, Boelter Hall on 2nd September 1969. That was the day it connected to the network, which at that moment consisted of only two places – a computer terminal in Room 3420 and another around 350 miles north at the Stanford Research Institute (SRI) in Menlo Park, just south of San Francisco. 'If you want to be, shall I say, poetic about it', Kleinrock told Vanity Fair in 2008, that was the day 'when the infant Internet took its first breath'.[7]

Connection is one thing, but actual communication across the network did not happen until several weeks later. On his website, Kleinrock describes

'The Day the Infant Internet Uttered its First Words' when, late in the evening of 29th October 1969, Kleinrock and his student Charley Kline set up a message transmission from the UCLA SDS Sigma 7 Host computer to another programmer, Bill Duvall, at the SRI SDS 940 Host computer in Menlo Park. The transmission itself was simply to 'login' to SRI from UCLA. Kleinrock explains how they succeeded in transmitting the 'l' and the 'o' and 'then the system crashed! Hence, the first message on the Internet was "lo", as in "lo and behold!"'.[8] They did manage the full login about an hour later, but that initial 'lo' was an appropriate greeting for what would turn out to be one of the most significant 'births' in the history of technology.

ARPA engineer Danny Cohen would later write, in a characteristic combination of humour and reverence:

> In the Beginning, ARPA created the ARPANET.
>
> And the ARPANET was without form and void.
>
> And darkness was upon the deep.
>
> And the spirit of ARPA moved upon the face of the network and ARPA said, 'Let there be a protocol,' and there was a protocol. And ARPA saw that it was good.
>
> And ARPA said, 'Let there be more protocols,' and it was so. And ARPA saw that it was good.
>
> And ARPA said, 'Let there be more networks,' and it was so.[9]

By the end of that year there were four nodes on the ARPA network: (1) University of California Los Angeles (UCLA); (2) Stanford Research Institute (SRI); (3) University of California Santa Barbara (UCSB) and (4) University of Utah. The internet had been born.

Planet Earth

Q: If the internet were a landscape, what kind of landscape would it be?

A: The internet is like the whole world, made up of very many different landscapes. It's interesting that the focus of the question, and my initial response, is on landscape rather than the sea – but why not the sea too? The sea often represents the subconscious and certainly there are vast deep seas of subconscious with regard to the net . . . the fishing net, the trawling net . . . swirling stormy seas and deep dark mysterious seas . . . The internet is all of this: dry lands, shifting sands, forests,

> deserts, swamps, mountains, valleys, urban sprawl, metropolises, villages, parks and gardens, lakes, rivers, oceans . . .
>
> CHRISTINE WILKS, new media artist[10]

The same year that the spirit of ARPA moved upon the face of the network, 20-year-old ecology activist Stephanie Mills stood up at Mills College in Oakland, California, and given a passionate commencement address which drew the attention of a nation. She warned that humanity was destined for suicide, the result of overpopulation and overuse of natural resources.[11] 'I am terribly saddened', she declared, 'by the fact that the most humane thing for me to do is to have no children at all'.[12]

As the decade turned from the 1960s to the 1970s, battles were about to be fought over two very different kinds of space. One was to save the planet, a mission which had been made even more urgent by the shock of an enormous oil spill in Santa Barbara in January 1969. This event focused the deep fear and anger of Stephanie Mills and other environmentalists in relation to the disasters that they believed lay ahead. The other battle was the fight to establish the colonization of a new and invisible territory that few people had even heard of: Arpanet.

The 1960s had been a decade of massive environmental failures. In 1967 the Torrey Canyon tanker had run aground in British waters, spilling 120,000 tons of crude oil and killing 15,000 seabirds and untold numbers of fish and marine animals. It was the world's first great oil disaster, but the peril did not fully reach American consciousness until 2 years later when there was a blow-out at Union Oil's Platform A in the Dos Cuadras Offshore Oil Field, near Santa Barbara. Nearly 100,000 barrels of crude escaped, killing huge numbers of wildlife including dolphins, elephant seals and sealions and ruining some of the West Coast's most beautiful beaches. The United States was appalled.

By then, the Western world was acutely aware that its relationship with the natural world was at risk, and it seemed as if the decline of the planet was running alongside an accelerating upsurge in new technologies. There was already a very active conservationist movement which, led by the Sierra Club founded by John Muir in 1892, had gained pace in the late 1940s. Aldo Leopold's *A Sand County Almanac*, published in 1949, had given voice to the wilderness movement. Historian Andrew G. Kirk writes that Leopold's beautiful stories of life on a run-down sand farm and his efforts to restore it 'provided a blueprint for a new land ethic and model of ecological thinking that inspired a generation of environmental advocates'.[13] Traditionally, says Kirk, members of these organizations tended to be upper middle-class or upper-class urban-based recreation groups. But in 1962 a biologist named Rachel Carson took the alert to a far wider audience when, in the same year

the first telecommunications satellite Telstar was launched by NASA, she brought environmental issues to the attention of a popular readership with *Silent Spring*, a study of synthetic pesticides which, she warned, were lethally harming the environment, especially the widespread use of DDT.

As the environmental lobby grew, so did fear of the hard sciences, the space race, the explosion of consumer products, all encompassed in a general antagonism towards technology. Kirk reports that within the conservation movement, 'a growing ambivalence towards technology for many quickly grew into full-fledged technophobia'[14] in which computers represented 'the heartless mechanised brains of oppression'.[15] He cites Theodore Roszak's complaint that computers were nothing more than 'low-grade mechanical counterfeits' of the human mind, devices propagated by the 'most morally questionable' elements of society.[16] In 1968 Roszak published *The Making of a Counter Culture*, a call to arms for the younger generation to rise up against technocracy, 'that social form in which an industrial society reaches the peak of its organizational integration'.[17] In the book he railed against what he saw as the effort to create 'a new social organism whose health depends upon its capacity to keep the technological heart beating rapidly'.[18] It is threaded with the dread of a machined future 'perhaps someday we shall inhabit a totally plastic world, clinically immaculate and wholly predictable'[19] which he believed would be inevitable in a technocratic future unless the younger generation defeated it and initiated a return to anti-scientific values.

But there were others who strove to find a mid-point between nature and technology.

Machines of loving grace

> So what I visualise is a very complex and sophisticated cybernetic technology surrounded by thick hedges of trees . . . and the rest of the nation a buffalo pasture.
>
> GARY SNYDER, poet[20]

In 1967, counterculture poet Richard Brautigan printed a broadsheet of his poem *All Watched Over by Machines of Loving Grace* and handed it to passers-by on the streets of Haight-Ashbury, in the city of San Francisco. According to Fred Turner, this poem's description of a cybernetic meadow where people, animals and computers lived together harmoniously 'absolutely shaped peoples' views of what a computer might be'.[21]

I visited Turner in 2009 at Stanford University where he directs the Program in Science, Technology and Society. Stanford University is key to the

development of information technology on the West Coast. Its founder, Leland Stanford, was an East Coast lawyer who went West and made his fortune on the railroad. He rose to become Leader of the Republican Party and Governor of California, and in 1876 bought a part of Rancho San Francisquito to develop a stock farm, which soon resulted in the birth of a small town nearby. The giant California redwood tree growing beside a nearby creek turned into the name of the town – Palo Alto (tall tree). He and his wife Jane had only one child and in 1884 Leland Jr. died of typhoid fever when the family was travelling in Italy. He was only 15 years old. According to university history, the grieving couple decided after their son's death that 'the children of California shall be our children', and they set about finding a lasting way to memorialize him. Their memorial to him would become one of the most prestigious universities in the world. It was a radical place, breaking new ground from the start by opening as co-educational at a time when most universities were all-male. It was also non-denominational and highly practical, focused upon producing 'cultured and useful citizens'. The campus was designed by Frederick Law Olmsted, who had already made his name designing New York's innovative Central Park. It is built around quadrangles reminiscent of Oxford and Cambridge but decidedly Hispanic in style, with long low buildings and shady walkways. The air is heavily scented by the eucalyptus trees imported from Australia in the 1800s and now endemic in California. It is not difficult to imagine the place as the open ranch land as it was when Muybridge took his famous photographs of trotting horses there in 1877 and proved that indeed all four of a horse's hooves are off the ground at the same time during the trot.

Stanford is also the birthplace of Silicon Valley. In 1951, when Frederick Terman was Dean of the School of Engineering, he spearheaded the development of Stanford Industrial Park, an initiative which soon attracted innovators like the young engineers William Hewlett and David Packard, founders of the Hewlett-Packard Company. Until then, Stanford University had been considered to be the Harvard of the West, but as the engineering community grew along the mid-Peninsula, it became transformed into the MIT of the West. According to Wikipedia, the name *Silicon Valley* was coined by Ralph Vaerst, a successful Central California entrepreneur. Its first published use is credited to Don Hoefler, a friend of Vaerst, who used the phrase as the title of a series of articles in the weekly trade newspaper *Electronic News*. The series, entitled 'Silicon Valley in the USA', began in the paper's issue dated 11 January 1971.[22]

As I sat with Fred Turner on a shady bench in one of Stanford's many tree-lined quadrangles, he mused about Richard Brautigan's cybernetic meadow. 'I think there was a deep hope here to fuse the natural and the technological in a way that creates a kind of benevolent cradle for making the self,' he told me. 'The west is deeply preoccupied with being the place in America

where you go to remake yourself, and this part of the West in particular holds out high hope that we will be able to find machines that can watch us with loving grace.'[23] His words reminded me of the description of the West by San Francisco writer Rebecca Solnit as a stage on which dramas are played. She calls it 'a space without boundaries, in which anything can be realized; a moral ground, out here where your shadow can stretch hundreds of feet just before sunset, where you loom large and lonely'.[24] Palo Alto itself, with its busy traffic, offices and retail areas, is hardly a space without boundaries these days, but its sights are always fixed on the unlimited potential of new imaginaries. That approach is not just particular to the mid-Peninsula, it can be found all through the state of California.

Much of the character of the region comes from its perilous geography. It experiences several earthquakes every day, most of which are inconsequential, but every now and then an enormous quake hits with disastrous results, such as the San Francisco quake of 1906 which killed over 3,000 people. And then there are the wildfires. Santa Ana winds dry out the brush on the mountains and makes them vulnerable to fires in densely populated areas such as Malibu, Santa Barbara and San Diego. Then the ensuing semi-tropical rainfall turns the burned-out land to liquid, resulting in major mudslides. Some areas of the coast are dangerous either due to those landslides, or because of perilous roads such as Highway 1 on Big Sur, or due to dangerous tides at places like Half Moon Bay where huge waves can sweep away unsuspecting beach walkers, and the occasional tsunami washes over the area. Mountain roads inland, such as those which run through the Mojave Desert and Death Valley (where the major cause of death is driver error) also take their toll. Bears, mountain lions, rattlesnakes and other wild animals patrol both the wildernesses and the foothills close to human habitation. And in recent years a new threat has arrived: swarms of Africanized honey bees which attack countryside hikers with sometimes fatal results.

The combination of glorious weather with sudden catastrophe has often been cited as the reason for the high occurrence of a risk-taking mentality in California. Technology writer Virginia Postrel, relocating to Northern California from Massachusetts in the late 1990s, was enthusiastic about the sunshine but disconcerted by the environmental dangers which accompany it, and bemused by the effect this had on the technology industries of Silicon Valley. She concluded that there were no certainties to be relied upon in California. In the language of the earthquake, so well known to citizens always on the alert for the next Big One, she pronounced, 'The future here is open and subject to upheaval. Resilience is the strategy of choice.'[25] The complex physical and emotional psychogeography of California certainly means living with two realities – a dangerous physical landscape and a seductive imagined environment. It is always about double-think founded upon the process of

imagining alternate realities; a reaction to unknown but inevitable difficulties. In the La-La Land of Hollywood and the ubergeek communities of Silicon Valley, this ability to believe two things at the same time has acted as a powerfully protective buffer in a risky environment where a brief spasm along the San Andreas Fault could hurl everything you've built into oblivion at any moment.

In their spare time, Silicon Valley workers drive to the beaches of Santa Cruz, Half Moon Bay, or Pacifica to relax and, for the intrepid only, to play in the rolling ocean. It is a 40-minute drive through bucolic green countryside to Crystal Springs Reservoir and over the mountain range to the Pacific. The sea here is often dangerous, with a powerful undertow which sucks the sand from beneath your feet, and there is an ever-present risk of undersea quakes. Notices along the beach tell you what to do if you are grabbed by a rip current or pulled into a deep backwash, along with a firm admonishment to never play tag with the waves or turn your back on them. So in the gyms and yoga studios, on the beaches and in the mountains, Californians train to stay young and fit, but they also drown in overpowering offshore currents; drive off the edges of canyons to perish in the tangled brush below and become car-bound skeletons only discovered years later; get chased by mountain lions, coyotes and killer honey bees; are bitten by rattle snakes; washed into the sea by mudslides or trapped in their homes by wild fires. And that is without the continual earthquakes: a random check of a single week in 2012 showed 371 quakes of varying magnitudes across California and Nevada.

It was here, in this tumultuous geography, that the territory of cyberspace became a (virtual) reality.

Pioneers

> The westerners were weaving stories around themselves to generate a drama in which they played a heroic role. They embraced the idea that the West was ancient in natural time – in geological and biological terms, the terms Yosemite's granite walls and sequoias displayed so well. But they wanted it to be utterly new in human history, and thus they tended to ignore or disparage the history of those who had come before them, the native people and the Spanish settlers. This newness was a vivid part of American identity, the newness of a people who saw themselves just starting out in a landscape of Edenic freshness and infinite resources, infinite possibility.
>
> REBECCA SOLNIT, author[26]

The lure of an apparently empty landscape ripe for colonization lies deep in the human psyche, and is especially embedded in the American mind. In her

biography of Edweard Muybridge, the photographer supported by Leland Stanford whose nineteenth-century nature scenes profoundly illustrate the dreamings of thousands of Americans, Rebecca Solnit's description above outlines a scenario very similar to the way some would approach the landscapes of cyberspace 150 years later. When the internet arrived, it did indeed appear, at last, to be a true manifestation of the United States' long-sought 'Edenic freshness'. And, importantly, it had not been appropriated from earlier cultures but was entirely a product of the United States. To a people already schooled in the pioneer spirit, cyberspace was genuine virgin wilderness.

However, the very notion of wilderness is problematic. The word *wild* has its origins in Old Teutonic and refers to phenomena which have not been tamed or domesticated by humans, usually wild animals and wild places. Some suggest it comes from *wold*, or forest. American environmental historian Roderick Frazier Nash, seeking to comprehend his compatriots' obsession with the idea, traces it back to the fact that the terminology we use in English today originated in Northern Europe when it was largely covered with forest and a natural connection was made between *wold* and sparse human influence. In other parts of the world, of course, the landscape of the wild takes on a very different character. Where *wild* most often refers to animals and plants living and growing in a state of nature and away from human influence, *wilderness* usually refers to the landscape they occupy, as well as to those very rare landscapes which apparently have no flora or fauna at all – *A wild or uncultivated tract of land, uninhabited, or inhabited only by wild animals*. Sometimes it refers to *a waste or desolate region of any kind, for example, open sea* and occasionally it has the more figurative meaning of *a region of a wild or desolate character, in which one wanders or loses one's way.*[27] In an attempt to unpack the weight of so much subjective and symbolic meaning Nash provides a detailed analysis of the etymology of *wilderness,* tracing it first to early Teutonic and Norse languages where *will* meant self-willed, wilful or uncontrollable. This gave rise to *wild* for being lost, unruly, disordered or confused. Later it was put together with the Old English *dëor* (animal) to denote creatures not under the control of humans. Nash gives an example from the eighth-century epic Beowulf 'where *wildëor* appeared in reference to savage and fantastic beings inhabiting a dismal region of forests, crags and cliffs'.[28] There is also a verb *wilder*, no longer used but interesting in relation to modern explorers and net surfers too. In seventeenth-century England, to *wilder* meant to *lose one's way, to go astray, stray; to be bewildered*. It could also mean an act perpetrated upon someone else *to render at a loss how to act or what to think; to perplex, bewilder*.[29] We still use *bewilder* and *bewildered*, but today they tend towards the more abstract sense of perplexity than being physically lost or astray. *Wilder* could however be a useful verb to bring back into use, especially in those cases

today when we so often *wilder* intentionally by allowing ourselves to get lost on the net or venture into new and possibly dangerous experiences. 'Wildering' cyberspace, perhaps, rather than surfing it.

Microbiologist Rene Dubos would agree with Nash's suspicion of the idea of wilderness and cautions against imagining that so-called wild places are anything other than the product of alterations made by previous cultures because, no matter how wild it looks, any landscape which has been previously hunted on, cultivated or settled bears the marks of the activities that have taken place there: 'In most places where human beings have settled, they have created out of the wilderness artificial environments that have become so familiar that they are commonly assumed to be natural although they have a cultural origin.'[30] Environmental historian William Cronon firmly states that 'Far from being the one place on earth that stands apart from humanity, (the wilderness) is quite profoundly a human creation.'[31] In other words, we should not fall into the trap of assuming that the true wild is pure and untouched by humans; in fact it is a romanticized and unworkable ideology. According to Cronon, 'everything we know about environmental history suggests that people have been manipulating the natural world on various scales for as long as we have a record of their passing.'[32] The logical outcome will be that 'if nature dies because we enter it, then the only way to save nature is to kill ourselves'.[33] The Kaplans have stressed the importance of the people who sought to overcome the wild, that 'slow procession of generations of farmers and stockmen and foresters and hunters and migrants',[34] who by their labour transformed the wilderness into places to live and work. In the last third of the twentieth century many members of the counterculture movement saw themselves as also part of that slow procession, and the settlements they built in cyberspace were cut through with the American pioneer spirit.

'Cyberspace did not appear . . . from nowhere,' wrote the London-based Islamic scholar Ziauddin Sardar in 1995. It was 'the conscious reflection of the deepest desires, aspirations, experiential yearning and spiritual angst of Western man'. He saw it as 'the American Dream writ large,' marking the dawn of a new 'American civilisation'.[35] It was also a reflection of the need for a foundational story with which to understand the new world of the internet. Historian David Nye explains that in the early days of colonization there were no technological creation stories,[36] but after the Declaration of Independence in 1776 the former colonies began to reimagine themselves as a self-created community and it was then that technology became an important part of the national narrative.[37] Two hundred years later when the frontier reopened in the form of cyberspace, that foundational narrative would weave itself back in and battles over territory were inevitable.

One of those leading the way was John Perry Barlow, born in Sublette County, a former fur-trading community in a sparsely populated area of

Wyoming, who later became a California adoptee. He might be the only countercultural internet pioneer who was also a cattle rancher, a career he combined with writing lyrics for The Grateful Dead and being an advocate for internet freedom through the Electronic Frontier Foundation. No one, writes Andrew Kirk, better captures the world of hybrid politics, technophilia, environmentalism and western regionalism than Barlow.[38] He was also responsible for coining the term 'electronic frontier' and for being the first person to migrate the term 'cyberspace' from Gibson's cyberpunk writings and apply it to virtual space. 'Imagine discovering a continent so vast that it may have no end to its dimensions,' he wrote 'Imagine a new world with more resources than all our future greed might exhaust, more opportunities than there will ever be entrepreneurs enough to exploit, and a peculiar kind of real estate that expands with development.'[39] Cyberspace, in its present condition, he believed, 'has a lot in common with the 19th Century West. It is vast, unmapped, culturally and legally ambiguous, verbally terse (unless you happen to be a court stenographer), hard to get around in, and up for grabs. Large institutions already claim to own the place, but most of the actual natives are solitary and independent, sometimes to the point of sociopathy. It is, of course, a perfect breeding ground for both outlaws and new ideas about liberty.'[40]

Passionately protective of this new territory, he was infuriated by the 1996 Communications Decency Act which embodied a first attempt to regulate pornographic material on the internet. Emailing from a fastness somewhere in Switzerland, he dashed off the lengthy 'Declaration of the Independence of Cyberspace' which seized the opportunity to declare the freedoms which seemed to be 'natural' to the internet. 'Our identities have no bodies,' he wrote, 'so, unlike you, we cannot obtain order by physical coercion. We believe that from ethics, enlightened self-interest, and the commonweal, our governance will emerge.' And 'We are creating a world that all may enter without privilege or prejudice accorded by race, economic power, military force, or station of birth,' a world where 'anyone, anywhere may express his or her beliefs, no matter how singular, without fear of being coerced into silence or conformity'. Most importantly, Barlow stressed what many at the time saw as the trump card of life in cyberspace: 'Your legal concepts of property, expression, identity, movement, and context do not apply to us. They are all based on matter, and there is no matter here.'[41]

In 1990 he partnered with Mitch Kapor, founder of the Lotus Development Corporation, and early Sun Microsystems developer John Gilmore, to co-found the Electronic Frontier Foundation. 'When our freedoms in the networked world come under attack', says the EFF website, 'the Electronic Frontier Foundation (EFF) is the first line of defense'.[42] But Barlow's activism is not just focused on cyberspace. 'Like many ranchers', writes Kirk, Barlow 'took

conservation for granted; it was a way of life'.[43] In the past he has served as the Head of the Wyoming Outdoor Council and a member of the Stock Growers Association. Today, still a hybrid of traditional cowboy culture and evangelist for technological optimism, he continues to provide an unusual bridge between the traditional conservationism of the West and what might be called urbanized post-counterculture society. But there were many other advocates for the rural way of life, such as farmer and public intellectual Wendell Berry, who remained vehemently opposed to information technology, complaining that 'I do not see that computers are bringing us one step nearer to anything that does matter to me: peace, economic justice, ecological health, political honesty, family and community stability, good work.'[44]

Counterculture

> There are two kinds of creation myths: those where life arises out of the mud, and those where life falls from the sky. In this creation myth, computers arose from the mud, and code fell from the sky.
>
> GEORGE DYSON, technology historian[45]

In the 1960s and 1970s the state of California, especially the city of San Francisco, was home to the American counterculture movement. It was a loose, unstable community of individuals and organizations with diverse interests but shared ambitions for the creation of alternative ways of life. Kirk describes their common theme as 'reconciling nature and culture toward a sustainable future',[46] a focus distributed through music, literature, design, fashion and tools. Their thought leader, if there ever was a single person, was probably Gregory Bateson, the English anthropologist who had made his home in California and who, having been born in 1904, was almost as old as the century. Fred Turner comments that Bateson's theory of *immanent mind*, published in 1972 in *Steps to an Ecology of Mind*, held enormous appeal for counterculturalists.[47] Based on cybernetics, this theory held that the world is a set of information systems in interaction with each other, as well as being systems in their own right, and that there is also a larger mind, which may or may not be God.

Bateson's was the most persuasive of many voices at that time, but there was one person who had the vision to see how they could all work together along with the organizational ability to create the networks to make it happen. His name is Stewart Brand, a man who has, according to *New York Times* journalist John Markoff, 'a Zelig-like penchant for being intimately involved in a series of key social and technological movements'.[48] And he knew when it

was time to produce a publication, a call to action, or a new community. Along with Howard Rheingold, John Perry Barlow, Cliff Figallo, Kevin Kelly and others, he fostered a sense of participation and cultural and collective memory which survives today in a distributed and evolved form. Furthermore, his place in history is now secure since Stanford University Library undertook to manage his personal archive of those years. As the most comprehensive collection of materials of the period it generates numerous studies and has become the central source of knowledge about the counterculture period. Early photos of Brand show him dressed in a variety of styles – Plains Indians fringed leather jacket, impresario's top hat, cowboy stetson, sailing cap, Beat-style beret. He is shown lecturing, listening and conversing. Sometimes in the photographs he looks very serious, at others he sports a handsome smile. Here is a man who has ideas and wants to share them; a keen listener and voracious reader. If he is interested in a person or a topic he awards them intense attention and occasional interrogation while silently assessing where they fit into his ever-evolving notion of the world picture. If he is not interested, one guesses that he is pretty unlikely to hang around.

Fred Turner told me he had often wondered to himself 'how come Stewart Brand got to speak the metaphors for everybody?' From the group which gathered around Brand, he said, came terms like 'personal computer' and 'electronic frontier'. 'This community defined these terms for the rest of us,' he remarked, adding 'Why?'[49] After much thought he had concluded that Brand has qualities similar to those of P. T. Barnum, the nineteenth-century showman and founder of the Barnum and Bailey Circus. Barnum's great skill lay in recognizing the potential in a wide array of talented people. Stewart Brand, Turner told me, 'brings together people from disparate social networks' and in the process the resultant grouping 'gives rise to a pidgin English'. The metaphors in his world, said Turner, 'were actually living inside the guys he brought together'.[50]

In the Spring of 2009, I drove north over the Golden Gate Bridge to visit Stewart Brand and talk about the early days. He lives in a houseboat along the waterfront in Sausalito, a ferry ride across the bay from San Francisco. The notorious former island prison of Alcatraz is visible from the shore of this picturesque tourist village where ferries travel busily between various small harbours around the bay. I got there a little late as it had been difficult to find the right address among the moorings and boatyards and I had driven around in circles a few times before finally coming across the nondescript gate which led to Brand's front door.

A few minutes later, as we sat together in his office, I saw that he is more striking than his photographs. He is tall and angular with a long chin, a long nose, and a piercing gaze. His once dark-blonde hair is now white, and he has

something of a hawk's eye behind his metal-rimmed spectacles. At the far end of the office ticked an antique grandfather clock, while every spare inch of the walls were lined with bookshelves. He has lived here for many years, touching the shores of the Bay but keeping the city at a distance.

He was born in 1938 in Rockford, Illinois, into a family of engineers. He studied first in New Hampshire, but by the late 1950s he had arrived on the West Coast and enrolled for a graduate degree in ecology and biology at Stanford. Although he describes himself as an ecologist by training, he has never practised, but has instead developed his own perspective on the relationships between nature, technology and business. As a result, he has become a unique and influential element in the history of new media business and technology. And like so many who move there and never go home again, he has become a devout Californian. He says, 'You've probably detected that California isn't really in the US. It's part of the Pacific Rim and so Washington is very far away and Europe is much farther than that. The transatlantic culture you see on the US East Coast is pretty much nonexistent here. This is a trans-Pacific culture. Not just Alaska and Hawaii, but Australia, Japan, China and Singapore all feel like they are in one package, so "international" here typically means looking west.'[51] And the result of that trans-Pacific mix, he believes, is much more cooperation. He calls himself 'an intellectual nomad'[52] and right from the start he set out to understand the new terrain, test its limits, and guide others through it. This vision of connecting scientific discovery to popular consciousness has come to epitomize Brand's ability to synthesize disparate viewpoints and cultures.

He is clearly proud of the fact that California's Mediterranean climate means that 'people tend to go outside and do things the Mediterranean way. There's an ocean over here and some mountains with snow up there and a fair amount of hiking trails everywhere.' Recalling the early days of computer culture, he told me that the first engineers stayed indoors with their equipment. They were, he said, 'basically fat and pale, but out here the second generation of hackers started to be all sorts of things – female, beautiful, male, adventurous, death-defying travelling and nomadic', adding, 'There is a ferocity to the landscape here.'[53]

But Stewart Brand is also an unlikely key figure in the history of cyberspace because unlike many of his fellow-travellers he has never been especially immersed in the medium. Yet it is his vision which has been responsible for seeing the subtle filament of connections between internet technology and the wild and then synthesizing them into something new and often revolutionary. And, as mentioned above, he has a tendency to be in the right place at the right time without realizing it. He puts his ability to see synergies down to his engineering family background and his training as a scientist, but there is

more to it than that. It seems that he is able to slip through social and political membranes which would deter many others, giving him a highly practical perspective on the mix of science, business and artistic pursuits that energizes him. He told me 'I understand stuff as a scientist but think about fixing things as an engineer.'[54] His journey through cyberspace came from combining an intimacy with geography and physical adventure with quick comprehension of how that translates into the virtual, and a sense of where the two connect.

The story of the Whole Earth badges is a nice example of how Brand gets things done, wrote Andrew Brown in a 2001 retrospective, 'starting with an idea that appears completely crazy, and insinuating it through the cracks in society until it becomes just a piece of the common sense on which we all stand.'[55] Brand has told the story many times. Here is one version:

> It was February 1966 and I was twenty-eight and was sitting on a gravelly roof in San Francisco's North Beach. I had taken a mild dose of LSD on an otherwise boring afternoon and sat, wrapped in a blanket, gazing at the San Francisco skyline. As I stared at the city's high-rises, I realized they were not really parallel, but diverged slightly at the top because of the curve of the earth. I started thinking that the curve of the earth must be more dramatic the higher one went. I could see that it was curved, think it, and finally feel it. I imagined going farther and farther into orbit and soon realized that the sight of the entire planet, seen at once, would be quite dramatic and would make a point that Buckminster Fuller was always ranting about: that people act as if the earth is flat, when in reality it is spherical and extremely finite, and until we learn to treat it as a finite thing, we will never get civilization right. I herded my trembling thoughts together as the winds blew and time passed. And I figured a photograph – a color photograph – would help make that happen. There it would be for all to see, the earth complete, tiny, adrift, and no one would ever perceive things the same way.[56]

But how to accomplish it?

> We could make a button! A button with the demand 'Take a photograph of the entire earth.' No, it had to be made a question. Use the great American resource of paranoia. 'Why haven't we seen a photograph of the whole Earth yet?' Ah. That was it. By the next morning, I got busy printing buttons and posters asking that question. And when they were ready, I prepared a Day-Glo sandwich board with a little sales shelf on the front, decked myself out in a white jump suit, boots, and a top hat with a crystal heart and made my debut at the University of California in Berkeley, selling

> buttons for twenty-five cents. It went perfectly. The dean's office threw me off the campus, the *San Francisco Chronicle* reported it, and other newspapers picked up the story. I soon branched out to Stanford, then to Columbia, Harvard, and MIT. I sent buttons to scientists, secretaries of state, senators, people in the Soviet Union, UN officials, and famous thinkers like Marshall McLuhan and, of course, Buckminster Fuller. Fuller wrote back, 'Well, you can only see about half the earth at any given time.' It is no accident of history that the first Earth Day, in April 1970, came so soon after color photographs of the whole earth from space were made by homesick astronauts on the Apollo 8 mission to the moon in December 1968. Those riveting Earth photos reframed everything. For the first time humanity saw itself from outside. The visible features from space were living blue ocean, living green-brown continents, dazzling polar ice and a busy atmosphere, all set like a delicate jewel in vast immensities of hard-vacuum space. Humanity's habitat looked tiny, fragile and rare. Suddenly humans had a planet to tend to. The photograph of the whole earth from space helped to generate a lot of behavior – the ecology movement, the sense of global politics, the rise of the global economy, and so on. I think all of those phenomena were, in some sense, given permission to occur by the photograph of the earth from space.[57]

Two years later, in 1968, Zelig-like Brand was present when another scene occurred which was less well-known than the Whole Earth photograph but which captured the imagination of all who witnessed it. It was the filming of Douglas Engelbart's now famous demonstration of the work of the Augment laboratory at the Stanford Research Institute. Engelbart is the quietly spoken and inspirational engineer who led the Augment project, his grand experiment to design the ultimate man-machine interface. The famous Demo took place on 9 December 1968, at a session of the Fall Joint Computer Conference held at the Convention Center in San Francisco and attended by about 1,000 computer professionals. This was the public debut of the computer mouse, just one of many innovations demonstrated that day. They also exhibited the new invention of hypertext, along with object addressing and dynamic file linking, as well as shared-screen collaboration involving two persons at different sites communicating over a network with audio and video interface. The 90-minute live public demonstration proved to be 'the mother of all demos',[58] as one attendee, Steven Levy, later wrote:

> The audience stared into the maw of cyberspace. Engelbart, with a no-hands mike, talked them through it, a calming voice from Mission Control. . . . The coup de grace came when control of the system was passed, like some digital football, to the Augmentation team at the Stanford

> Research Institute, 40 miles down the peninsula. Amazingly, nothing went wrong. Not only was the future explained, it was there, as Engelbart piloted through cyberspace at hyperspeed.[59]

The demonstration was filmed by Stewart Brand, who happened to be working as an occasional contract photographer and videographer. He told me that at the time he had no sense of significance of the event, 'But that was because I didn't know anything', he added, self-effacingly.[60] In fact, that year he was deeply immersed in his own project, assembling the first *Whole Earth Catalog*, (Figure 3.1) 'a six-page mimeographed list of books on topics such as tantric art, cybernetics, Indian teepees, and recreational equipment'.[61] That year a NASA astronaut had finally taken a picture of the whole Earth as seen from space. Known as *Earthrise*, it quickly became a rallying image for the environmental movement and, serendipitously, made a perfect jacket cover for the first issue of the Catalog.

Andrew Kirk writes that the Catalog was intended to provide 'a service that would blend the liberal social values and technological enthusiasm of the counterculture with the emerging ecological worldview he (Brand) cultivated as a Stanford University biology student'.[62] Brand had also spent several years travelling the American West, trips which included visits to Indian reservations and encounters with burgeoning numbers of intentional communities, many of whom were experimenting with 'appropriate technologies' – small-scale, labour-intensive projects driven by environmentally sound power sources and including sustainable inventions such as solar-powered lighting, cycle-driven pumps, and rocket stoves fuelled by small amounts of wood. Today, appropriate technologies have found a natural partner in the open source community and, in some cases, have also intersected with the principles of biophilic design. But in the late 1960s, they were a very new idea, and the Catalog's promise of 'access to tools' opened up an array of strange and intriguing items that one might admire but generally never have a need for.

I have my own memories of the *Whole Earth Catalog*. In the late 1960s I worked in a bookshop in Nottingham, England, and the Catalog sat on our shelves. I bought a copy, and can still remember the rough feel of the black paperback covers and the brightness of the whole earth photograph on the front. It was an extra-large publication, the kind that booksellers fuss about displaying because it simply did not fit anywhere, but it sold so fast that this was not really a problem. I remember sitting in my flat, probably on the large embroidered cushions that were popular at the time and probably with an incense stick smouldering in the fireplace, and poring over pages of unbleached paper featuring black and white advertisements, articles, reviews and plans for exotic buildings and tools I would never

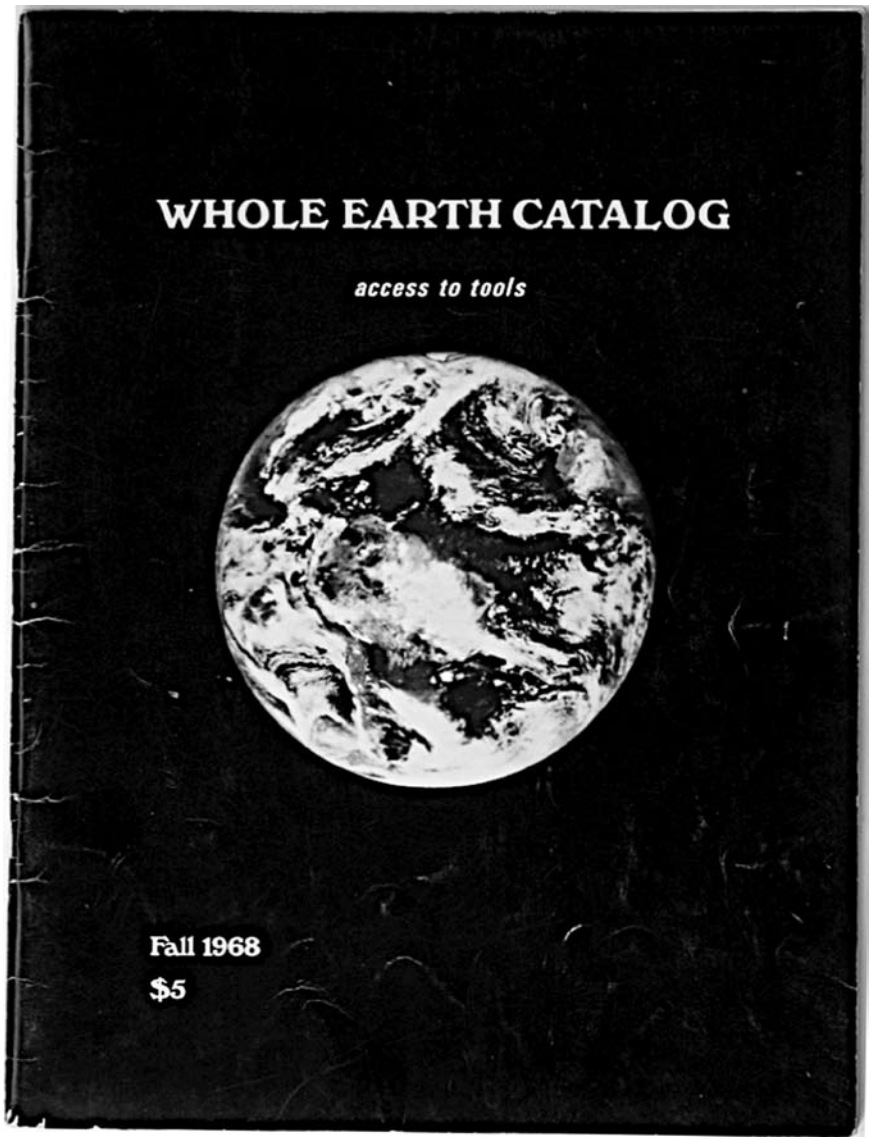

FIGURE 3.1 *Whole Earth Catalog (Stewart Brand)*

use or even understand, all of which came from a land very far away. The Catalog smelled, writes Kirk, 'of ink and earthy pulp'.[63] I remember wondering sometimes whether the items really were for sale, or whether the whole thing was some kind of invented fantasy community issuing from the minds of very stoned people living in California, a place I could barely imagine. But it was indeed real, and it formed an important bridge

between the environmental community, who largely disliked any kind of computerized technologies, and intellectual adventurers like Richard Brautigan who enjoyed imagining a future which included sophisticated and human-loving machines. The Catalog was short-lived, however. In 1972 it won the National Book Award, but Brand closed it that same year. In 1974, it was succeeded by *CoEvolution Quarterly*.

CQ, as it came to be known, ran until 1985. Where the Catalog was a compendium of practical tools and ideas, the Quarterly was aimed primarily at the educated layperson interested in ideas. It was founded, Brand later wrote, 'to see what would happen if an editor were totally unleashed'. He would, he said, 'print anything that kept me turning its pages'.[64] One of the pieces he published in 1978 was a short polemic by Stephanie Mills, the activist who in 1969 had announced her intention not to have children in the face of certain global collapse. In *CQ* she complains that the environment is a little less fun when it becomes a profession. Too often, she writes, environmentalists are being trapped in the 'ceaseless attempt to quantify, objectify, and measure intangibles like beauty and the integrity of an ecosystem'. The solution, she decides, is to understand environmentalism as a religion because it is most enjoyable when it is coupled with a sense of miraculous:

> learning to see and deeply appreciate the beauty of living creatures and the intricate adaptations that evolution has brought into being. It's a process so complex and mysterious, and kind of unbidden, that it's managed to bring into existence something as wonderful as the human mind, your mind, quite a miracle indeed. I think one of the good things you can do with environmentalism, to sort of beat off the old apocalyptic depression, is to dwell on the wonders, to really take the time to dwell on the wonders, and develop a little humility about what's been done that we couldn't begin to do ourselves in a million, billion years.[65]

Stephanie Mills held out against the internet for a long time. In June 2002 the internet journal *First Monday* interviewed her via a series of postcards from rural Michigan, where she had settled to write about bioregionalism. She still had no computer or net connection. 'Near as I can tell', she writes to *FM*'s editor Ed Valauskas on one of the postcards, 'there is little sensual pleasure to be enjoyed confronting a computer screen and keyboard'. On the subject of tools, she uses the term *technique* in the old fashioned way, as another word for techne or technology, when she writes that '*technique* alienates us from the Earth, one another and ourselves'.[66] In 2012, however, it is now possible to find her on the internet and she has her own website[67] where visitors can watch a video of her 2010 talk *On Gandhi's Path*.

Brand is now putting his formidable energy into a collaboration with computer scientist Daniel Hillis. The mission of the Long Now Foundation is 'to provide a counterpoint to today's accelerating culture and help make long-term thinking more common'. It hopes 'to creatively foster responsibility in the framework of the next 10,000 years'.[68]

By 1989, the Arpanet was nearing the end of its life and was finally decommissioned in 1990. It had been founded on the conjunctions between four nodes, three of which represented key elements of California culture, but over the years it was gradually replaced by NSFNET, a network of supercomputer internet backbones which would open up the internet to the world, and so in 1990 it was laid to rest. Leonard Kleinrock tried to preserve the very first processor by offering it to the Smithsonian Museum, but the museum was not interested. He later told the *Los Angeles Magazine* 'I offered "IMP NO.1" to the Smithsonian, but in '89 the Internet was hardly noticed by the general public, and the Smithsonian folks said "Nah."'[69] However the university did sponsor a symposium to celebrate both ARPANET's 20th anniversary and its decommissioning, and some of the venerable fathers of the internet composed poetry in its honour. 'All the world's a net!' declared Vint Cerf in his spoof Shakespearean ode to *Rosencrantz and Ethernet*,

> And all the data in it merely packets
> come to store-and-forward in the queues a while and then are
> heard no more. 'Tis a network waiting to be switched![70]

In 2011, Room 3420 Boelter Hall, where the Arpanet was born, was turned into the Kleinrock Internet Heritage Site and Archive. When I visited some months later, I found it to be an unlikely shrine. It is a plain windowless room behind an ordinary door in a university corridor, distinguishable only by a small plaque declaring it to be the Birthplace of the Internet. I was shown around by Brad Fidler, the scholar responsible for setting up the archive. And there was the original IMP, the Interface Message Processor which was so memorably misunderstood in 1968 by Senator Ted Kennedy when he sent a well-meaning but slightly confused telegram to BBN Technologies congratulating them on winning the contract to develop an 'interfaith message processor'. Well, maybe one day, but probably only in California . . .

4

An enormous, unbounded world

Cyberspace is a place. People live there. They experience all the sorts of things that they experience in a real space, there. For some, they experience more. They experience this not as isolated individuals, playing some high tech computer game; they experience it in groups, in communities, among strangers, among people they come to know, and sometimes like.

While they are in that place, cyberspace, they are also here. They are at a terminal screen, eating chips, ignoring the phone. They are downstairs on the computer, late at night, while their husbands are asleep. They are at work, or at cyber cafes, or in a computer lab. They live this life there, while here. And then at some point in the day, they jack out, and are only here. They step up from the machine, in a bit of a daze; they turn around. They have returned.

LAWRENCE LESSIG, Lawyer and Activist[1]

Space and place

> Q: If the internet were a landscape, what kind of landscape would it be?
>
> A: When I think of the World Wide Web, I imagine it as Mandelbrot described the coastline of Britain – infinite in complexity and different scales of resolution and yet also bounded. At once robust and delicate, it decays in some places even as it exponentially grows in others. It resembles my experience of the natural world in being able constantly to surprise and delight me; like the 'nature' in which I live, it is occasionally recalcitrant and frustrating. Also like 'nature,' it is increasingly a part of my internal sense of the interconnections and interrelations that define who I am.
>
> N. KATHERINE HAYLES, new media critic[2]

The Chinese-American geographer Yi-Fu Tuan tells a story about the way the Hopi Indian understands space differently from the 'static three-dimensional structure of Western man'.[3] An unnamed Hopi Indian invites anthropologist Dorothy Eggan to describe the Grand Canyon, which she does. He then asks her whether she went to the canyon when she described it, to which she replies that no, of course she didn't, an observation with which he disagrees. In fact, 'part of you was there or part of it was here,' he tells her.[4]

His perception of place is reminiscent of the net-surfer's sense of being simultaneously online and offline, both here and not-here. The idea is that Eggan is not just imagining the Grand Canyon, but that she is actually experiencing it as part of that imagining. This bears a striking resemblance to the way many users describe their experience of being online, and conjures up a similar experience to an encounter in a virtual world, a Skype video meeting or even just a simple exchange in Facebook chat.

Our life in the physical world has taught us some basic rules of thumb about where we are, but often they come as much from received culture as from objective spatiality. For example, people who live in north Queensland, Australia, and speak a remote aboriginal language called Guugu Yimithirr, talk about space in terms of compass directions. Guy Deutscher reports that they don't say 'The child is behind the tree', but instead 'The child is north of the tree.' If you ask them how they know where north is or where south is, 'they look at you in amazement, just as you would be flummoxed if I asked you how you know where in front of you is and where behind is.'[5] Similarly, Inuktitut speakers take it for granted that a shaman can travel through time and space, even to the moon.[6] This shamanistic space is sometimes called 'the subtle world' and popular physician and writer Deepak Chopra explains it like this: 'Just as the material world is connected invisibly at the quantum level, the subtle world is connected by a field of consciousness.'[7] Chopra

believes that we are moving towards a 'culture of consciousness based on connections', one which would 'overturn the whole scientific prejudice against the subtle body, invisible realities, and the primacy of consciousness in general'.[8]

Chopra's mysticism is not so distant from other theories in cybernetics and philosophy. Fred Turner notes, for example, that as early as the 1940s mathematician Norbert Wiener had argued that 'cybernetics and related systems theories offered up a vision of the world in which each of its elements could be read as connected to, and to some extend a reflection of, every other', adding that anthropologist Gregory Bateson would call it 'the pattern that connects'.[9] And in 1941, shortly before his death from cancer, the controversial linguist Benjamin Lee Whorf wrote about the notion of a 'noumenal world' which he described as 'a world of hyperspace, of higher dimensions' which had the potential to 'unite and unify'.[10] The term comes from the philosopher Kant, who identified the noumenal world as the aspatial and atemporal world of things as they are in themselves, as opposed to the phenomenal world, which is the world only as it appears to us. For Whorf, the noumenal world awaited discovery 'under its first aspect of a realm of PATTERNED RELATIONS, inconceivably manifold and yet bearing a recognizable affinity to the rich and systematic organization of LANGUAGE'.[11] The idea, said Whorf, is 'older than Plato, and at the same time as new as our most revolutionary thinkers . . . All that I have to say on the subject that may be new is of the PREMONITION IN LANGUAGE of the unknown, vaster world – that world of which the physical is but a surface or a skin, and yet which we ARE IN, and BELONG TO.'[12] Many internet users will recognize the notion of a space whose surface – in their case the machine – is no more than an entry point into an unknown, vaster ecosystem.

In Tim Berners-Lee's 1999 account of the creation of the World Wide Web, *Weaving the Web*, he describes his vision for its potential in terms of a story from North American history. His speculation that 'a single hypertext link could lead to an enormous, unbounded world'[13] echoes a key moment when the United States doubled its size by buying 828,000 square miles of territory from France in 1803. Known as the Louisiana Purchase, the project encountered considerable opposition in the Senate, who were told by Samuel White that 'this new, immense, unbounded world . . . will be the greatest curse that could at present befall us'.[14] They were afraid that the huge area would be impossible to control and that the resulting anarchy would weaken the original 13 Eastern states ceded by Britain 20 years earlier. For Berners-Lee the notion of a vast internet, wild and free, offered the chance for a new kind of society. For others, it is an occasion for adventure. 'We want the web to be like those natural powerhouses of invention, the jungle, the

primordial marsh' writes cybersecurity expert Tim Stevens.[15] Or, as writer and environmentalist Wallace Stegner wrote, wilderness is both 'an opportunity and an idea'.[16] So, too, with cyberspace. Picture this, for example.

You are immersed in a wireless cloud, navigating your way through the folders on your hard drive. It is a floating forest of branching tree directories anchored to a root folder buried somewhere deep inside the machine. Beneath you lies a creepy invisible underworld populated by spiders, bugs, crawlers, worms and microscopic viruses. As a torrent of music flows through your phone, you tweet to your friends about the latest gossip in the news river. Your message joins the stream and you are barely conscious of the fact that you are not just cruising the surface of an information superhighway, but journeying through a deeply connected world. Cyberspace is an unseen ecosystem of networks complex beyond your imagining, so deeply embedded in your consciousness that you seldom notice it. Sometimes being online can feel like a mind-meld, not just with your fellow surfers, but with the universe itself. 'I believe that in the future, social networks will be like air' blogged Charlene Li in 2008. Without that social context in our connected lives, she continued, 'we won't really feel like we are truly living and alive, just as without sufficient air, we won't really be able to breathe deeply'.[17]

So how unbounded is this enormous world? In 1997, when the internet was already 28 years old, Esther Dyson described the digital space as 'a new terrain'.[18] By the following year, according to Google, that terrain had grown to 26 million pages.[19] In 2008 it reported hitting a milestone total of '1 trillion (as in 1,000,000,000,000) unique URLs on the web at once'.[20] In 2011, the popular technology news site Mashable asked 'Just how fast is the web growing?' and answered its own question with 'In 2009, around 3.7 million new domains were registered each month. As of June 2011, it's not uncommon for 150,000 new domains to be registered in a single day'.[21] What is not known, however, is how many of those websites are active. Data mining company Netcraft monitors the number of responsive sites each month, and in August 2012 they reported a total of over 628 million websites worldwide.[22]

What does that look like? Google downloads the web continuously, it says, collecting updated page information and reprocessing the entire weblink graph several times per day:

> This graph of one trillion URLs is similar to a map made up of one trillion intersections. So multiple times every day, we do the computational equivalent of fully exploring every intersection of every road in the United States. Except it'd be a map about 50,000 times as big as the U.S., with 50,000 times as many roads and intersections.[23]

Imagine that map, but then visualize as much at least a third of it as ghost towns and empty roads. Nobody knows how much of the internet is actually 'populated', and Google's figures do not contain the dark net hidden from its crawlers and several times bigger than the known web. The dark net, sometimes called the *deep web*, *invisible web* or the *undernet*, is thought to be many orders of magnitude larger than the known internet and it is generally hidden from our view. The result, according to researcher Michael K. Bergman, can be compared to dragging a net across the surface of the ocean. 'While a great deal may be caught in the net, there is still a wealth of information that is deep, and therefore, missed'.[24] One of the more innocuous reasons for the invisibility of dark net data is that there are many information sources which cannot give up their data to search engines, no matter how fiendish their algorithms, because they are not indexed and therefore remain un-findable unless you know where to look. Sometimes the designer has deliberately hidden the site by adding a line of code telling crawlers to ignore it, but more often the resource is in the form of a searchable database like a library catalogue where the data must be accessed by a typed query. Since web crawlers searching for data are unable to do this, the content remains hidden. Other materials are concealed on purpose by peer-to-peer services such as *Freenet* who wish to enable censorship-free publishing and file-sharing. 'By only connecting to people they trust', says *Freenet*, 'users can greatly reduce their vulnerability, and yet still connect to a global network . . . this practice allows people to use Freenet even in places where it may be illegal, which makes it very difficult for governments to block it'.[25] But many people, of course, also hide content for illegal purposes including the sale of pornography, drugs and weapons, and terror activities, as well as ostensibly 'legal' political, diplomatic and military reasons.

The vastness of the internet, both visible and invisible, can trigger a powerful sense of the sublime. Historian David Nye has analysed the American technological sublime and his research is a useful reference point for thinking about immense span of cyberspace. He explains how eighteenth-century philosopher Edmund Burke 'established an absolute contrast between the beautiful, which inspired feelings of tenderness and affection, and the sublime, which grew out of an ecstasy of terror that filled the mind completely'.[26] Before Burke, the notion of the sublime was connected with alchemy, but as the ideal of scientific objectivity grew into the foreground it came to be seen as part of the Enlightenment project of defining reason.[27] As the New World was opened up, the stunning raw landscapes of America seemed made for the expression of the sublime. The Grand Canyon, for example, had been known about by Europeans since the Spanish conquistador García López de Cárdenas stumbled upon it in 1540 but it was not properly explored until 1869

when Major John Wesley Powell led the first expedition. Powell later returned with scientists, photographers and artists, and it was artist Thomas Moran's spectacular paintings which showed the canyon to the public for the first time. His atmospheric interpretations helped to transform the region 'from a hellish place into one of awesome beauty in the public's imagination'.[28] The hellishness was never completely absent, however. In a letter to his wife dated August 1873, Moran describes a painting expedition which included encounters with wolves, tarantulas and rattlesnakes – one of which bit an Indian boy travelling with them who subsequently took three days to die. But the parts of his letter which are most often quoted are those which portray the sublime grandeur of the place. 'The whole gorge for miles lay beneath us and it was by far the most awfully grand and impressive scene that I have ever yet seen,' he wrote. 'A suppressed sort of roar comes up constantly from the chasm but with that exception everything impresses you with an awful stillness.'[29]

Moran's adventures exemplified Nye's observation that 'to experience the sublime was to awaken to a new vision of a changing universe'.[30] For Nye, the sublime can be found in technological achievements such as the Golden Gate Bridge in San Francisco, the American railroad network, Apollo XI and many other objects that have 'raised astonishment'.[31] His aim is to trace the emergence of new forms of the sublime, 'considering them not as absolute categories of aesthetic experience but as contingent within social and political systems'.[32] It is conceivable, then, to find similar sentiments in the words of Besher et al. in *The Virtual Tao* when they express their own astonishment at the notion of cyberspace, which

> conjures a huge cross-section of images ranging from a person with hardware strapped to their disembodied self, miming cryptic hand-gestures known only to those who have trekked through the mysterious landscapes of virtual 1's and 0's. Or perhaps it's a fly-through of Mars' red surface, banking and turning at every vista at 1000 mph, or maybe it's a spiral of 'Escher-esque' architectural images so vast and psychedelically colorful it makes your head spin. In the world of cyberspace, the possibilities are infinite.[33]

'Any place in which a person feels stripped of guidance, lost and perplexed', writes environmental historian Roderick Nash, 'may be called a wilderness'.[34] Stephen Kellert believes that the fact that people seek places to connect to reflects an inherent human need to establish territorial control of resources during the long course of our species' evolution.[35] Yi Fu Tuan says that we learn about those territories piece by piece, from babyhood onwards,[36] and

as we go we construct a personal geographical and cosmological space with ourselves at the centre.[37] He calls this powerful relationship with the material environment 'topophilia', or the love of place. There are various schools of thought regarding the origin of the term – it has been attributed to, among others, W. H. Auden, Gaston Bachelard and Alan Watts – but Tuan made it his own when he wrote a book of the same name in 1974. Like biophilia, topophilia can be weak in its effect; 'It is not the strongest of human emotions,'[38] writes Tuan. It is triggered most noticeably when we feel strongly attracted to a particular place in a way which might be emotionally charged or deeply symbolic.

For many people, the experience of being logged into the internet, especially in an immersive game space, can elicit a compelling topophilic experience, but Tuan adds a proviso which could undermine any similarity because he believes that the experience of place must be fully sensory. He writes 'An object or place achieves concrete reality when our experience of it is total, that is, through all the senses as well as with the active and reflective mind'.[39] Ah, the senses. Can we really experience the physical senses in a virtual environment without some kind of digital augmentation to stimulate the brain? Perhaps this is where cyberspace and physical space part company. But not necessarily. At first it might seem that the apparently nonsensory and unstable environment of the internet cannot offer any kind of sensory experience, but in practice we do engage all kinds of physical and psychological sensoria when we access it. For example, when we log on, our minds might run ahead into cyberspace but our bodies always remain with us, parked in a physical place – public or private; warm or chilly; noisy or quiet; comfortable or not. We will be in a preferred position – perhaps sitting on a chair; lying in bed or on grass or on a beach; standing up; on a bus, walking down the street. The body might be hungry, thirsty, relaxed, tense, even in pain. Such factors can impinge on the way we experience our online lives. Sometimes we even choose to imagine shrugging off our physical bodies in favour of a preferred, albeit temporary, virtual version. Ten years ago I was invited to run a workshop at a retreat for people with extensive disabilities who were coming close to the end of their lives. Most were active internet users. During a break, one man confided in me with a broad smile that he loved going online because it felt the way he imagined death would be. It was an opportunity to be himself, free of the burdensome and painful body which barely worked anymore yet which had come to define his identity. Soon, death would release him into a new kind of existence, he said, but in the meantime he could achieve a preview of that liberation from the flesh by logging on.

Today, mobile locative media blend our online presence with our physical location, and as communications improve it is increasingly easy to connect to

the internet from all kinds of remote places. It is no longer necessary to be tethered to the urban. Since 2010, for example, 3G data coverage has been available on Mount Everest, making it possible for intrepid mountaineers to check into Foursquare or report their status on Facebook as they toil towards the summit.[40] Locative mobile media such as these, which allow users to share their locations either publicly or privately, are powerful illustrations of the urge to re-root the digital connection in a sense of place. In an older example, the California State Parks system was one of the first to make wifi available in around 60 of the state's 85 parks as early as 2005.[41] The project was initiated because the state has an obligation to provide services to visitors at the parks and, as Alan Friedman, CIO of the California State Parks system, said, 'We were concerned that some people, because of the demands of their lives to be connected, were having trouble getting away to our parks because they lacked connectivity.'[42] So now campers can follow the call of the wild and log on when they get there, another instance of how it is easier every day to integrate the natural world we have made inside our machines with the physical world beyond it.[43] And of course we can travel inside the machine too, as literary computing scholar Sandy Baldwin did when he took a virtual trip to Baghdad in 2009:

> Hello Baghdad. Hosts are open, packets receiving. I'm in Iraq in milliseconds. But the DoD turns me back, their firewall refusing to echo, ending my request.
>
> I tell you the net is fields of waves and radiations. It takes us in and we take it in. It is netting, apparatus of capture. The net is defined as always on, connections always open. . . . Once in the net, I can speak of datastreams and packets, of addresses and codes, of world travel.
>
> Here's how I went to Iraq the other day. I rode the net and wrote into the net. Here's what I did: I ran pathping in the command prompt that still remains below the surface of Windows, ran it from my home computer to a.dns-server.iq, the primary name server for the country of Iraq. The text included the word pathping, which is a command invoking a program of the same name, and included an internet address, which provided the destination for the pathping utility.[44]

Baldwin's focus is not on a physical journey to the city itself but on travel through the imaginative space by which he 'reaches' it. His exultant 'I rode the net and wrote into the net'[45] conjures up a setting which is both a vehicle and a text, constantly moving, constantly being written. He was exploring what cyborg anthropologist Amber Case calls the liminality of the internet. Sociologist Bruno Latour coined the term 'liminality' to mean being 'betwixt

and between' 'here and there', or one thing or another. It can be applied to, for example, the idea of a doorway. 'When you step inside a doorway, where are you? Part of you is in one room, and part of you is in the other. For that moment as you are passing through the doorway, you're neither here or there – you're in between.'[46] The same applies to technology, Case suggests: 'Where do you suppose a person is when they're talking on a cell phone?' she asks. 'It is a point betwixt and between here and there. In the same way, one does not "live" in the inbetween space of a doorway. One tends to pass through. And one does not live on the phone. One calls, talks, and hangs up.'[47] She points out that the brief moments in our daily lives when in the past we would have chatted to someone close by, for example during a wait at a bus stop, we now look at our phones because they 'contain a space – a virtual one – that is betwixt and between lived space. It can be anything – online there is an automatic production of space'.[48] Or as John Perry Barlow has written, 'what is a place if cyberspace is everywhere?'[49]

Importantly, unlike oceans or mountains, cyberspace is not the product of a period of evolution which began long before homo sapiens. We built it. It is younger than we are. We have colonized it, cultivated it and filled it with ourselves. Yet, even though our marks run through it everywhere, much of it still remains vast, wild, empty and foreign. Nevertheless, despite all the spam and commercialism there is a chance that it can still offer what historian Frederick Jackson Turner said of the New World in 1896, 'a clean slate to which idealists could bring their dreams for a better life'.[50] These new accretions of nodes and pathways of digital networks have created a terrain whose qualities have developed to the extent that as early as 1990 Mitch Kapor and John Perry Barlow could confidently observe that 'the people of the developed world have begun to cross into a landscape unlike any which humanity has experienced before.'[51] The early hackers, spending every waking hour inside the machine, took this notion further. For them, the physical world was a distinct environment. They called it 'meatspace', meaning 'where the meat lives, as opposed to the other environment, cyberspace' where, they joked, 'we already have a running meatspace implementation'[52] – the universe.

In many ways, as internet culture developed it very consciously mirrored the universe. The *Ethernet*, created in 1975 at Xerox Parc, is a good example. It was developed as a passive broadcast medium with no central control and formed the basis of the local area networks (LANs) which are still used today to connect devices relatively close to each other. A landmark technical paper[53] by Metcalfe and Boggs notes their decision to name their invention after the *historical luminiferous ether* through which electromagnetic radiations were once alleged to propagate. Ether, or aether, was believed to be the pure essence which fills the region above the terrestrial sphere, an equivalent to

the air breathed by humans and available only to the gods. In its luminiferous form, ether could be light-bearing. It was named after an elemental god in Greek mythology, *Aither*, who was the god of the bright, glowing upper air of heaven – the substance of light and one of the three *airs*. The middle air was *Aer* or *Khaos*, a colourless mist which enveloped the mortal world, and the lower air was *Erebos*, the mists of darkness, which enveloped the dark places beneath the earth and the realm of the dead. *Aither*, or *Aether*, was the upper air, the mist of light and home of the gods of heaven. It enveloped the mountain peaks, clouds, stars, sun and moon. The stars themselves were said to be formed from the concentrated fires of *aither*.[54] *Ether*, as it is now called, has long been a feature of philosophical and scientific attempts to understand the invisible element which is everywhere between us on Earth. Researcher Peter Schaefer analysed the published appearances of the word by computer scientists in the 1970s and physicists in the 1880s when 'ether was thought to be everywhere yet invisible'[55] and concluded that 'despite numerous attempts, the existence of the ether was never verified through experiments, and as the paradigm shifted, the word "ether" disappeared from theories of electromagnetism only to be picked up as a signifier for radio and television waves'.[56] He interprets its revival by Metcalfe and Boggs a hundred years later as an indication of 'a transcendental hope for universal access to communication networks'.[57]

Or we might look at the skies. Russian internet artist Ola Lialina made a study of the 'Starry Night' desktop background, the 'black, dark blue or purple image tiled through with light static or blinking particles'.[58] It was perhaps the most popular design for the very first computer desktop backgrounds and came as default on many machines. This design is deeply resonant with the restorative element the Kaplans called 'compatibility' because it speaks to our desire to feel part of the natural world by reminding us that wherever we are, globally or virtually, we can always feel grounded by looking up at the sky. When screensavers were invented, the starry night background became animated and set our screens whirling off towards a distant twinkling universe somewhere beyond cyberspace. Lialina suggests that the reason for its popularity lay in the large proportion of web designers who also happened to be science fiction fans and computer gamers. Their desire to make the web look like the futuristic backdrop of their favourite pieces was justified, she writes, not only by their taste but by the hope the new medium was offering:

> The Internet was the future, it was bringing us into new dimensions, closer to other galaxies. So the look of the internet had to be an appropriate one like in Star Crash or Galaga. It had to be like the inside of a computer or

> somewhere out there. Space wallpapers made the Internet look special. This was obviously a space with a mission that other media could never accomplish.[59]

But it would not last forever. 'Day by day the hope for an extraterrestrial web future was giving way' to other designs and the starry night background ceased to be a symbol of the future, says Lialina, and became instead a sign of the web's early years. 'Its meaning shifted to the opposite: from future to past.'[60]

In recent years a new heavenly body has taken precedence in the internet firmament: the cloud, 'that huge bank of online power that lives somewhere and everywhere'[61] writes *Guardian* journalist Bobbie Johnson. Unlike the mysterious flickering starry night, data clouds are not generally admired for their beauty. In fact, the enormous storage facilities which house all our public and private data are often seen as pretty sinister. We are living in an era, says Nicolas Nova, 'in which the word "clouds" corresponds to big, dark and energy-consuming warehouses'.[62] Of course the 'cloud' does not really exist at all. As journalist Bill Thompson reminds us, it is only a figment of our imagination. 'Every piece of data is stored on a physical hard drive or in solid state memory, every instruction is processed by a physical computer and every network interaction connects two locations in the real world'.[63] Nicholas Carr agrees:

> The metaphor of 'the cloud' is a seductive one, but it's also dangerous. It not only suggests that our new utility-computing system is detached from the physical (and political) realities of our planet, but it also lends to that system an empyrean glow. The metaphor sustains and extends the old idealistic belief in 'cyberspace' as a separate, more perfect realm in which the boundaries and constraints of the real world are erased.[64]

Carr even wrote a whimsical Zen *koan* about it: 'Not everything will move into the cloud', he intoned on his blog, 'but the cloud will move into everything'.[65]

Wireless computer networks inspired the concept of hertzian space devised by industrial design theorist Anthony Dunne. Anne Galloway explains that whereas 'cyberspace' is a metaphor that spatializes what happens in computers distributed around the world, hertzian space is actual and physical even though our senses detect only a tiny part of the electromagnetic spectrum:

> Images of footprints of satellite TV transmissions in relation to the surface of the earth, and computer models showing cellular phone propagation in relation to urban environments, reveal that hertzian space is not isotropic

> but has an 'electroclimate' defined by wavelength, frequency and field strength. Interaction with the natural and artificial landscape creates a hybrid landscape of shadows, reflections, and hot points.[66]

Artist Usman Haque has applied the concept of hertzian space in several works, most notably *Sky Ear* in 2004, which aimed to make visible the hertzian habitat above Greenwich Park in London by sampling the 'tumultuous electromagnetic space'[67] generated by mobile phone calls and texts, TV broadcasts, wireless laptops and even remote control garage door openers. The *Sky Ear* cloud was 30 metres wide, made up of 1,000 glowing helium balloons, and embedded with 37 mobile phones. Haque believes that wireless technologies have challenged our relationship to designed space 'because they encourage us to think not of static silent structures that surround us but rather of fluid dynamic fields beyond the edge of our natural perceptions, fields within which we are all consumers and contributors'.[68]

Certainly, wireless internet is, to paraphrase researcher Laura Forlano, changing the boundaries we are used to and, 'bleeding into public spaces and breaking down some traditional notions of privacy and property while re-enforcing others'.[69] Such reconfigurations of people, places and information, says Forlano, require a new conceptual framing to be built on earlier notions of digital information and physical space. For users of wired internet, whether broadband or cable, the doorway is very clear: in order to connect to the internet steps must be taken, wires must be plugged in. But for those operating in a wireless environment, the entry is less defined and being connected becomes just as easy as breathing. To paraphrase Sōtō Zen monk Shunryu Suzuki, what we call 'I' is just a swinging door which moves when we write or read into the virtual space of the internet.[70] We say 'online' or 'offline' but actually there is just one limitless connection and, with good bandwidth, digital virtuality can feel as pervasive and as invisible as air. Has the computer reopened a long-closed doorway to a place where a different kind of consciousness is in operation, and where virtuality, like air, is a property of the encompassing world; a world in which humans – like all other beings – participate? Indeed, sometimes logging on feels like landing on the island in Shakespeare's play *The Tempest*. The shipwrecked travellers are simultaneously intrigued and afraid but Caliban, for whom the isle is home, reassures them, saying:

> *Be not affeard, the Isle is full of noyses,*
> Sounds, and sweet aires, that giue delight and hurt not:
> Sometimes a thousand twangling Instruments
> Will hum about mine eares; and sometime voices[71]

Caliban's sensorium, negotiated via the mind rather than the materiality of place, is rather like the process of attunement described by architect Richard Coyne. Coyne has developed the notion of *tuning* as a 'set of practices by which people use devices, wilfully or unwittingly, to influence their interactions with each other in places.'[72] *Tuning* is about the changing environment we inhabit in our online/offline lives, the temporal and spatial adjustment constantly taking place. Coyne points out that while the synchronicity of clocks and timetables tend to look to a condition to which everything happens at once, 'tuning brings to the fore the processes by which people seek or arrive at the aligned condition, recovering when things drift, retuning and detuning'[73] and calls for 'an orientation that draws on metaphor and the imagination'.[74] This notion is reminiscent of the mobile experience of weaving in and out of signal range, momentarily alternating between connection and disconnection. In such an environment, so many things which at one time seemed to be fixed and clear, such as where you are, and perhaps even *who* you are, are increasingly mutable – and pathways become even more important.

Pathways

> Many people mistakenly think of the internet as a destination but, like zen, it is merely a pathway. As the zen masters say, 'Don't ask where the path is. You're on it.'
>
> PHILIP TOSHIO SUDO, author and guitarist[75]

According to Stephen Kellert, the process of identifying features in a landscape helps us orientate ourselves in the locality. He is thinking of physical world characteristics such as slope, aspect, sunlight and wind direction,[76] but the immaterial internet has markers too, some of which are found in its physical infrastructure. An email, for example, is broken into small packets of data which are despatched to their destination via a series of router machines in the network, then reassembled into a format which allows the message to be read. The route taken varies according to factors which may arise along the way, such as a broken connection or a faulty machine, and this responsiveness enables the network to provide a flexible reaction to obstruction and ensures that the message still arrives despite such difficulties. Then there is the invisible pathway between computer files and on the internet through shopping sites, auctions, YouTube, Flickr, Facebook, Twitter, blogs and all kinds of websites. They are like desire lines, a term used by architects to describe the preferred path taken by humans or animals when they traverse a stretch of open ground, routes which may be very ancient, initially chosen for

specific reasons such as ease of walking, safety, speed or perhaps to obtain a good view of the landscape, reasons which may have become obsolete in the intervening years. As more people follow a desire line in a physical landscape, it becomes increasingly deeply trodden and embedded, and may eventually be adopted as the route of a surfaced road. The history of some English roads, for example, can be traced back to initial expansion by the Romans 2,000 years ago and before that to Iron Age trackways and even earlier footpaths. But occasionally designers who are determined to create a path on a different route fight the evolution of a desire line. The unhappy result is a pathway trudged determinedly across lawns and straight through hedges, a footway which will be adhered to no matter how many times the way is blocked.

But as poet Gary Snyder once wrote 'there's all sorts of walking – from heading out across the desert in a straight line to a sinuous weaving through undergrowth'.[77] Ted Nelson, the inventor of hypertext, has spent a lifetime trying to create pathways through a single computer document, keeping everything on the same page however complex it gets. At 13, his daydream was to have his own international space satellite and today he still uses images of solar systems to describe his document-handling applications. He visualizes 'documents hanging in space as far as the eye can see', setting the user free 'to wander in a semi-connected structure of ideas'.[78] Most users, however, tend to follow and re-follow their own well-trodden pathways between email, Facebook, Twitter and news and shopping sites. Each of us creates a set of personal desire lines over months and years as we learn how to use the machine itself, its software applications, its online spaces and mobile spaces, often relearning the routes with each new machine or upgrade. These routes involve complex cognitive and subjective processes but we seldom articulate them to others because there is rarely a need to do so. Each self-taught user carves her own way through, with the rare exception of those who at some time were taught the 'correct' method to find a file or reach a webpage. In reality, there are very few 'correct' paths to follow, especially on the internet which has been specifically designed to offer numerous alternative routes. 'Most of us, and nearly all of my generation', writes Bill Thompson, 'are route learners in cyberspace, managing to find our way through layers of folders, network connections, URLs and social graphs by recalling links and connections'.[79] But soon, he says, 'we will have a generation capable of dealing with the complexity by building maps and managing internal models of the information spaces we all spend so much time interacting with'.[80]

There is one mode of internet travel which has already become obsolete for the most part, although the meme is still common in China, and that is the Information Superhighway. Its origin might come as something of a surprise.

Information superhighway

> actually the Earth has no road to begin with . . . but when many people pass one way, a road is made.
>
> LU XUN, author[81]

Korean artist Nam June Paik was born in Seoul in 1932. He met composers John Cage and Karlheinz Stockhausen while studying and practising art in Germany in the late 1950s, and was an early member of the emerging Fluxus movement, an international network of transdisciplinary artists, composers and designers renowned for cross-media experimentation. In Paik's case this meant making art with television sets and, later, video. Moving to live in New York in 1964 provided the ideal opportunity for him to engage with screen-based media at their most intense not just in the cities but along the new interstate highway system which was fast opening up the country, inviting Americans to 'see the U.S.A. in your Chevrolet'. In 1974, the Rockefeller Foundation hired Paik as a consultant to provide a vision document for its Art Program. The result, inspired by both the interstate system and the then infant internet, predicted that

> The building of new Electronic Super Highways will become an even huger enterprise. Assuming we connect New York with Los Angeles by means of an electronic telecommunication network that operates in strong transmission ranges, as well as with continental satellites, wave guides, bundled coaxial cable, and later also via laser beam fiber optics the expenditure would be about the same as for a moon landing, except that the benefits in term of by-products would be greater.[82]

In the same document the artist also coined the term 'broadband communication network'. This is how creation stories are made or, in this case, re-made. Re-made, because very few people today credit a Korean video artist with the origination of one of the most powerful internet memes. Most imagine that it first appeared in a speech by the then Vice-President Al Gore, but in fact, neither was the sole originator. Rather, the term is a blend of the two: Paik's 'Electronic Super Highway' with Gore's 'Information Highway', producing 'Information Superhighway'.

Just before Christmas, in December 1993, Al Gore gave an address to the National Press Club. It provided the influential journalists collected there with the seed of a meme which would come to dominate discourse about the internet for several years to follow. Explaining new legislation to open up opportunities for the telecommunications industries, Gore drew a picture

of the time when transport networks were vitally important for commerce. But today, he explained, 'commerce rolls not just on asphalt highways but along *information highways*. And tens of millions of American families and businesses now use computers and find that the 2-lane information pathways built for telephone service are no longer adequate.' He continued:

> One helpful way is to think of the National Information Infrastructure as a network of highways – much like the Interstates begun in the '50s.
>
> These are highways carrying information rather than people or goods. And I'm not talking about just one eight-lane turnpike. I mean a collection of Interstates and feeder roads made up of different materials in the same way that roads can be concrete or macadam – or gravel.[83]

In 1995, two years later and 19 years after his prescient vision document, Nam June Paik exhibited an artwork entitled *Electronic Superhighway: Continental U.S., Alaska, Hawaii*. It was a 49-channel closed circuit video installation, 40 feet long and created in the outline shape of the USA with the state boundaries delineated in neon. It can now be seen at The Smithsonian American Art Museum where the catalogue describes how 'neon outlines the monitors, recalling the multicolored maps and glowing enticements of motels and restaurants that beckoned Americans to the open road. The different colors remind us that individual states still have distinct identities and cultures, even in today's information age'.[84] It could almost be a neon incarnation of William Gibson's cyberspace, with its 'lines of light ranged in the nonspace of the mind, clusters and constellations of data. Like city lights, receding . . .'[85]

Until his death in 2006 Nam June Paik forcefully defended his origination of the term but the truth is that he was an originator but only within an artistic culture whose influence was limited compared with that of Al Gore, a politician who had the ear of the national and international press. Plus, Paik's idea came too early for mass adoption, whereas Gore gave his speech at a time when opinion-makers were looking for a foundational story for the internet. So the popular tale of the birth of the information superhighway is a good story, but it is not the true story. However, stories just need to fill gaps in our understanding, and a meme must have its moment. Paik's came too early, but Gore's was exactly right. At a time when the uncertain phenomenon of the internet seemed to threaten many established business practices it was frequently interpreted as a rough and un-navigable wilderness. And Al Gore offered a guiding hand. Americans were well-accustomed to pioneer imagery, and they knew exactly what it meant to cut new routes across hostile territory. And they knew all about cars and trucks. So when Gore announced

that soon there would be not just narrow paths leading into the darkness, but recognizable highways through the internet, he was offering some badly needed reassurance and for a while the information superhighway was the most recognizable yet non-existent feature of cyberspace. As we saw earlier, however, it was eventually decided that the metaphor did not stand up to scrutiny.

In 2001 cybergeographers Martin Dodge and Rob Kitchin proposed that the spatial relations of the Web should be structured so that it corresponds more closely to metaphorical geographic space in a more 'cognitively accessible'[86] form. But since the turn of the millennium the notion of what might be considered 'cognitively accessible' has changed quite considerably. Replacing breadcrumb pathways with search has been perhaps the least intuitive skill users have had to learn, because it marks a clear departure from the way we are used to finding and organizing objects in the physical world. The file and folder arrangement which seemed to transfer so well to virtual space and looked so pleasantly similar to your office filing cabinet has been rendered obsolete by, for example, Gmail's labels and tags. And you do not even really need to use them, you can simply search. For everything.

And soon Google-type search will not just be confined to the virtual world. The increasingly widespread use of sophisticated radio frequency identification tag technologies (RFIDs) which connect data objects together in an 'internet of things' means that in many industrial processes and warehouses, physical objects are already moving each other around largely independently of human beings. Yes, this is the fridge that knows when you are running out of milk. Science fiction author Bruce Sterling, the inventor of the theoretical *spime* (trackable through space and time) RFID object, predicts that in the future 'when I get up in the morning I won't need to search for my socks, I can just Google them'.[87] Pew Internet Research reports that on any given day in early 2012, more than half of the adults using the internet use a search engine (59%); a figure which is double the 30 per cent of internet users who were using search engines on a typical day in 2004.[88] Today we are less likely to navigate cyberspace as if it were linear terrain or an airspace to be traversed and more likely to dive right inside the entangled bank of data to find the information we need. And the more we search, the more the data grows. The act of search itself, according to writer John Battelle, 'will be the spade that turns the Internet's soil'.[89]

Just as we no longer need to follow a linear route when searching for information, so global positioning satellite (GPS) systems which allow us to navigate in real space and cyberspace at the same time are transforming our understanding of what it means to know where you are. I remember my confusion the first time I used a GPS navigation system in my car. When

I initially learned to drive it took me a long time to get used to the mirrors because I found them very disorientating. The front and rear windscreens and side windows showed me direct views of my surroundings, but the mirrors provided a completely different perspective on the same terrain. Now GPS offers a third view of the same place but this time with new information about aspects of the surrounding landscape which are often not visible through the windows or mirrors. On the Spring day in 2007 when I took my first GPS-guided drive down the M1 motorway from Leicester to London, a trip of roughly a hundred miles, I could not shake off the strong sense that I was cruising not through physical space but through cyberspace. As I passed through my surroundings, snatching glimpses of the screen as it listed villages and towns hidden behind the roadside sound barriers and identified the names of rivers that the road was passing over but I could not see, I was reminded of HotSauce,[90] an application developed by Apple in the mid 1990s which provided a 3D visualization enabling the user to 'fly through' a website or the files and folders of their computer. HotSauce was never released in a final version and Wikipedia notes that 'most users saw no point' in navigating websites in a 3D space.[91] But now I felt like I was 'flying through' a physical equivalent.

'What these devices promise, like the opening of the Western frontier, and like the automobile and the open road, is a greater freedom' writes Ari N. Shulman in a long and richly detailed essay about GPS. But, he continues, this freedom 'is of a very strange new sort'. His concern is that the GPS actually intervenes 'between the person and the vehicle and between the vehicle and the world' with the effect that, by adding a mediator between our own actions and the physical world, 'it shrinks us back into ourselves'. A hoped-for transcendental travel experience turns into yet another unsatisfactory journey, a failure once more of our self-contrive dogma 'about how to "really see a place"' which 'supposes that a place is some vital essence independent of us'.[92] Indeed, there is often a disjuncture between our fantasy of mediated place, and the actuality of it. It is never quite what we expect. For example, contemporary mobile media 'seems to have been born as if through parthenogenesis'[93] as digital media artist Martin Rieser points out, as if it has been generated by some kind of independent self-determined reproduction. Locative technology promises an indulgence of what Richard Coyne has called 'our taste for the technological sublime'[94] but sometimes its very mystery keeps that experience just very slightly out of reach.

It also enables an expansion of the mundane. Geotagging, the practice of adding location-based data to digital media such as photographs, tweets, blog posts and RSS feeds, is transforming the way we orient ourselves in the physical world. It is fast becoming ubiquitous as mobile technologies become ever smarter and more widespread and it becomes increasingly

easy to capture location information. Suddenly, our locations have become public property, not least because many applications have GPS switched on by default, or because we don't know how to use them properly. And not only are our whereabouts public, they could also be being fed into maps we know nothing about because even though it is a non-existent place, cyberspace certainly has a lot of maps.

Maps

> Cyberspace isn't on any map, but I know that it must exist, because it is spoken of every day.
>
> JONATHAN G. S. KOPPELL, Associate Professor of Politics, Yale University[95]

'The challenge of mapping cyberspace is in some ways more formidable than that faced by sea captains in the past', wrote geographer G. C. Staple.[96] As we have seen, the sense of being firmly rooted in a single static place with a controlled view of one's surroundings is almost antithesis to the online locative sensibility. Rather, as Dodge and Kitchin write, 'people live in an experiential continuum, running from the materiality of geographic space through to the virtuality of cyberspace'.[97] Their 2001 book *Mapping Cyberspace* was the first full-length exploration of how the internet can be mapped from many different perspectives. They discuss information maps, spatial maps, maps of media and social spaces, cognitive maps, imaginative and historical maps – all based on the abstract territory of the internet. Since then, online mapping has exploded in popularity with the advent of Google Earth in 2005 and Google Street View in 2007, followed by a burst of geo-social apps for mobile and web media such as Foursquare and Gowalla (now defunct), both launched in 2009, which allow users to post their locations and connect with friends. The impetus behind these kinds of practices is to share information about the user's immediate experience, and since being outside in nature is a powerful experience it is unsurprising that many use geo-social apps to share beautiful views and striking outdoor encounters with others. Josh Williams, the founder of Gowalla, exemplifies this passion for communicating biophilic experiences in the story of how his company came about:

> Nearly three years ago I sat on a beach at Lake Tahoe and watched as a large low-flying cloud hung above the lake, creating the backdrop for a beautiful weekend of solitude. As much as I enjoyed the time alone to clear my thoughts, I was overwhelmed with the desire to share this experience with someone. I pulled out my iPhone and snapped a pic. Then I texted it

> to my dad. It was an oddly modern form of postcard. A way to briefly say 'I wish you were here.'[98]

Towards the end of 2011 Gowalla was absorbed by Facebook, which with 500 million mobile users in 2010 was the second largest company in what *Jess3 Labs* called the 'geosocial universe'. The largest at the time was Skype, with 590 million mobile users.[99]

In 2001, Dodge and Kitchin had argued that 'geography continues to matter, despite recent rhetoric claiming the "death of distance"',[100] a term coined by economist Frances Cairncross which claimed that new communications technologies were rapidly obliterating distance as a relevant factor in how we conduct our business and personal lives. But 12 years on from their book, distance does indeed seem to be taking second stage in favour of the geosocial universe. What is new, writes mobile interface theorist Jason Farman, 'is the advancements made by emerging GIS programs such as Google Earth that allow for spatial debate of maps within maps, new levels of interactivity and user agency with maps, and the ability for non-professionals to engage in these activities'.[101] What is more, he adds, these maps are not even fixed or culturally defined, and we can write in them too. He explains how Google Earth situates viewers from roughly the same distance to Earth as some of the Apollo 8 whole-earth photographs – about 16,000 miles – and then zooms in on (or 'flys to' in Google Earth terminology) the user's region.[102] Simply launching the program on your computer screen triggers a breathtaking image of the blue planet swinging into view, cross-marked by bright yellow country borders. Farman argues that 'Google Earth's charting of the globe onto an interactive, web-based GIS is inherently connected to the desire to map out a new territory: the digital empire.'[103] He points out that connecting information flows to a geographic map is a way of visualizing McLuhan's 'global village' and replicating the Apollo Whole Earth photographs fought for by Stewart Brand over 40 years ago, but by doing so 'Google has taken the steps to chart out visually the territory that it has sought to command: an interconnected global village'[104] or, as we might describe it today, an ecosystem.

Ecosystem

> These (screenshots of Windows Vista) are not glimpses of hackers' paradises or techie wonderlands. They are the opposite, showing landscapes beyond technology's reach, offering not the streaming green cryptograms of 'The Matrix' but wilderness vistas free of civilization, promising not ones and zeros but pristine water and sky. Windows was once thought of as a

> virtual 'desktop'; now it opens onto untrammelled nature. Escape from technology through technology. That, at least, is the fantasy.
>
> EDWARD ROTHSTEIN in *The New York Times* reviewing Windows Vista[105]

An ecosystem is a complex set of networked relationships between organisms and their environment. In 1975, chemist James Lovelock and his microbiologist colleague Lynne Margulis published a hypothesis that the global ecosystem might be understood as *Gaia*, 'the biosphere and all of those parts of the Earth with which it actively interacts to form the hypothetical new entity with properties that could not be predicted from the sum of its parts'.[106] Some believe, controversially, that Gaia is itself a self-sustaining living being which maintains a balance of life on the Earth independent of any one species, including humans.

Gaian or not, an ecosystem hosts a community of different species and non-living elements, many of which have symbiotic relationships held together by powerful bonds which produce a strong sense of 'locational familiarity'.[107] It is possible that the internet has given rise to a similar sense of community, an interweaving of interdependent physical and interpersonal networks whose locational familiarity is based around their online lives. In 1999, *New York Times* journalist George Johnson interviewed Dr. Bernardo Huberman, an internet ecologist at the Xerox PARC Internet Ecologies Area (now, it seems, sadly extinct). They talked about the way that the internet has become an independent living laboratory, a place to study mass human behaviour with a precision and on a scale never possible before. 'No central authority has cultivated the Web as a beautiful garden,' said Huberman. 'It grows on its own like an ecosystem.'[108]

Researcher Adriane Lapointe, however, warns that such characterization could be a kind of benign 'greenwash', guilty of rebranding cyberspace as

> a living environment-cum-organism deserving of conservation and care – a notion particularly consistent with the idea of cyber ecosystem health. Cyber ecosystem is an easy phrase to like: it's green, non-threatening, and agnostic about responsibility: we can all be part of it. It rolls off the tongue as easily as the redundant 'safe' does before 'haven', and therein lies the rub. However thoughtfully they may be used at the outset, terms like this can rapidly become catch phrases which pad out sentences, express broad generalities, or simply mean something specific to the speaker but vague to everyone else.[109]

In 2006 Microsoft released the Vista operating system described above by Rothstein as a view onto 'untrammelled nature'.[110] Along with its Aero graphical

user interface which turned the desktop into a fluid glass-like environment featuring stunning high resolution images of natural landscapes in intense colour, Vista offered the promise of a new kind of ecosystem; a deliberate attempt to convince us that Microsoft was finally throwing open the Windows and allowing screen-burned users out into the fresh air to wander free through the pastures of cyberspace and frolic in Aero's transparent mists. The rich imagery of Vista addressed a deep biophilic truth: that when we log on to join the stream, we bring with us a subconscious desire for cyberspace to be just like the (never-was) Edenic countryside of our youth, a verdant Elysian Fields of virtual harmony. (In fact, the nature connections go even deeper than the design which was finally released, because in an earlier stage of development, Vista had been code-named Longhorn after a breed of cattle noted for its ease of calving and long lactation period. Make of that what you will!) But it turned out that Vista's smooth romantic landscapes were just one more fantasy. In reality, the organic, holistic, evolving eco-system of Web 2.0 connectedness is less like a prettied-up travel brochure and more akin to a messy brackish swamp seething with mutations. Cyberspace may be supported by machines, but it is not *like* a machine or at least, it is not like any machines that we yet know. Rather, it is a soggy mutating interstitial space perfect for growing and breeding; it is a space for living, a new kind of habitat, a new kind of home.

Home

> I live at barlow@eff.org. That is where I live. That is my home. If you want to find me, that's the only place you're liable to be able to do it, unless you happen to be looking at me at that moment – physically.
>
> JOHN PERRY BARLOW, writer, activist, former cattle rancher[111]

A habitat is a natural environment which provides the right conditions for living for a given life-form; or in simpler terms, the most suitable home. According to Judith Heerwagen and Gordon Orians, the selection of a habitat is a crucial choice for most organisms, including humans, one which is often initially guided by impulses which are almost subliminally intuitive in that good habitats can be expected to evoke strong positive responses, while poor ones evoke weak or negative responses.[112] It was Orians who formulated the well-known 'savannah hypothesis' described here by E. O. Wilson:

> the ancestral environment contained three key features. First, the savanna by itself, with nothing more added, offered an abundance of animal and

> plant food to which the omnivorous hominids were well adapted, as well as the clear view needed to detect animals and rival bands at long distances. Second, some topographic relief was desirable. Cliffs, hillocks, and ridges were the vantage points from which to make a still more distant surveillance, while their overhangs and caves served as natural shelters at night. During longer marches, the scattered clumps of trees provided auxiliary retreats sheltering bodies of drinking water. Finally, lakes and rivers offered fish, mollusks, and new kinds of edible plants.[113]

The idea is that when people are given a free choice, they move to open tree-studded land on prominences overlooking water. Wilson is careful to point out, however, that this tendency 'is no longer dictated by the hard necessities of hunter-gatherer life. It has become largely aesthetic, a spur to art and landscaping. Those who exercise the greatest degree of free choice, the rich and powerful, congregate on high land above lakes and rivers and along ocean bluffs'.[114] In other words, such choices come from a very deep and ancient evolutionary root, but the fact that we now live in a technologized urban age with a much wider choice of habitats makes little difference to those deeply imprinted preferences. Heerwagen and Orians think it unlikely that our response patterns have been modified by comparatively recent conditions, suggesting instead that environments 'should be viewed from the perspective of an animal that has *modified* them according to preferences inherited from its distant past'.[115] In other words, high-tech design is frequently over-ridden or modified by a much more deeply embedded atavistic notion of what makes us feel at ease.

And as soon as we feel comfortable in cyberspace, many of us want to build some kind of base to express ourselves. This might take the form of setting up a personal profile, designing a simple homepage, or the complex process of creating a virtual home in a game world. Norwegian critic Bjorn Sorensson pointed out in 1996, well before the advent of Facebook and Second Life, that 'the prevalence of the home/house is visible everywhere on the web, most commonly in the form of allusions to *rooms* within the 'house/home'.[116] He notes that the room metaphor is popular within personal homepages 'perhaps in order to give it a more intimate appearance (Mike's Room, David's Den, and for the more adventurous – Betty's Boudoir, Honey's Bedroom, etc.)'. Some years ago I conducted a similar informal survey of homes in the text-based world of LambdaMOO for my book *Hello World: Travels in virtuality* and found that many MOO homes are adventurous in terms of location (from an elephant's eyelash to a facsimile of the universe and everything in between) and in their descriptions (exotic textual landscapes regularly updated and sometimes with programmed seasons, weathers and times of day), but an

equal if not larger number are astoundingly dull. Given the opportunity to imagine anything at all, many inhabitants of virtual worlds choose a cosy and conventional sitting-room or bedroom, and as a result cyberspace is home to numerous virtual roaring log-fires, silken bed sheets, large sofas and multi-coloured scatter cushions. One LambdaMOO resident who goes by the pseudonym 'Puff' told me that he thought most people fall into one of two categories: those who create something to suit themselves 'they end up with something comfortable or idyllic or the like' and those who create something to express themselves 'they end up with something bizarre and sometimes even wonderful'. Another, called Xeric, liked to create mirrors of his offline life. He told me that he has made several complete virtual models of real life places where he has lived.[117] Like Yib's gardens discussed earlier, such virtual 'homes' have all the hallmarks of the compatibility setting described by the Kaplans, comfortably tailored to personal preferences.

For several decades it was possible to build a home in cyberspace using just code and text but, more recently, improved sound and graphics capabilities have made it easier to create multimedia homes in graphical worlds like Second Life, in games like The Sims, and in a vast range of massively multiplayer online role-playing games (MMORPGs). Many role-play game worlds such as World of Warcraft and hundreds of others include sophisticated interior spaces of all kinds, and some of them are for sale or rent. You can, for example, purchase a homestead in Second Life from an estate agent like *Reach Isles*, a 'virtual world land development and management company focusing on luxury living in Second Life'.[118] Its properties are 'for those who prefer living on private islands without the lag and congestion of the Second Life mainland, at affordable prices with a flexible tier structure'.[119] The homestead of *Kahaulani–SOUTH,* for example, features private beaches, palm trees and a small but select home on the edge of blue tropical waters. (Figure 4.1) It is, say *Reach Isles*, 'a great place for a home if you value things like natural beauty, privacy, and space'.[120] Furthermore, 'the island has all 4 sides open to the virtual ocean – no other sims will EVER touch its borders'.[121] The rent for this hideaway? 4,450 Linden dollars per week, which converts to approximately $17 US.

However, often the term 'home' as it is used in a computer context does not refer to a location, either real or virtual, but to a concept, and it is tempting to speculate that the notion of a 'home page' may draw upon the American obsession with home and homecoming in general. It is difficult to ascertain a first use of 'home' but it is likely to come from the 'home directory', or $home, of the Unix operating system devised by Ken Thompson, Dennis Ritchie and their colleagues in 1969. Then in the late 1980s a graphical user interface system called NeXt was developed on top of Unix. It used a very early browser-style application equivalent to the Finder on Mac OS X

FIGURE 4.1 *Kahaulani-South (Reach Isles, Inc. http://reachisles.com)*

or Windows Explorer on Windows and featuring some of the first pictorial icons. Among them was an icon for the home directory[122] – a coloured image of a pretty chalet-style cottage with pebbledash walls, exposed beams and a large tree in the front garden.

This image of 'home' looks strangely anachronistic in such a state-of-the-art technical setting, although one might suggest that it is a forerunner of the electronic, or tele, cottage beloved of home-workers. Patrice Flichy tells the story of former US Army colonel Dave Hughes who in 1980 created a bulletin board called the 'Old Colorado City Electronic Cottage' and used it to orchestrate a campaign against taxes on home industries. Flichy comments that Hughes' approach fitted into the old American tradition, 'often called Jeffersonian, that considers that political action is situated above all at the local, rural community level'.[123] Interestingly, although it is the default in Western browsers, the 'home' button is not universal across all cultures, and in a number of other countries the term 'main page' is used rather than 'home page'. In Mandarin, for example, 'main page' translates as 主页 or *Zhu Ye,* and in Arabic it is written like this الصفحة الرئيسية.

For some, cyberspace provides the home to which they have no access in real life. Palestinian film-maker Sobhi al-Zobaidi has written about the ways in which the internet offers hospitality to Palestinians as dispossessed people with a unique relation to both space and memory.[124] It allows them to 'move in multiple directions simultaneously, bypassing the laws and logic of spatiotemporality', and to go to places that are otherwise unreachable

due to externally imposed restrictions. Most important of all, it provides a place for community and collective remembrance because, writes al-Zobaidi, 'Nowhere in Israel or the Arab world are Palestinians allowed to build museums, monuments or public displays bearing collective characteristics of our catastrophe'.[125] Before the internet, he adds, 'it was not possible for Palestinians in Palestine to have direct contact with Palestinians in Lebanon or Syria'.[126] This is, perhaps, an example of the way in which, according to Marshall McLuhan, 'the human family now exists under conditions of a "global village"'.[127]

For sociologist and cybernetic culture theoretician Manuel Castells, the opportunity for people to use the internet to communicate with each other instantly across large distances has generated a new technological paradigm he called 'the space of flows'.[128] In this mode we experience new social forms of time and space which are very different from those we knew in the pre-internet world. For example, a blogger called Deepa, member of the social tribe, posts a comment to a query by Shel Israel as to whether social media is becoming a vast wasteland. Deepa does not think so. 'In a global neighbourhood', she writes, 'my blog is my living room and I invite people into it. Twitter is (for me at least) akin to putting my head out of a window and listening in/joining in the conversations.' It is, she says, similar to talking over a hedge.[129] Today, chatting to each other over the hedge across the world are more than 2 billion other internet users[130] of whom at least 170 million are on Twitter.[131]

We have been living in the space of flows for quite some time. It has been possible to talk across the network ever since Leonard Kleinrock greeted his colleagues with the first 'lo' in 1969, but perhaps the best-known early online community was established in 1985 by Stewart Brand and Larry Brilliant. The Well was an offshoot of Brand's Whole Earth Catalog. Its name stood for Whole Earth 'Lectronic Link and, like the Catalog, it was firmly rooted in Californian counter-culture. As historian Andrew Kirk has observed 'No other aspect of the counterculture, in fact, captured the spirit of the age better than the simple desire to strike out to a new frontier and provide one's own shelter'.[132] Matthew McClure and Cliff Figallo were appointed to facilitate the conversations. Both had been members of the 1970s collective The Farm, a radical intentional community in Tennessee, and they soon established a Farm-inspired ethos of collaboration, counterpoint and irreverence based around a single disclaimer 'You Own Your Own Words'. This phrase was devised by Stewart Brand in an attempt to attract interesting people into online conversation while at the same time giving them responsibility for their own words and ideas. Members wrote to each other online via a bulletin board system but many also met weekly in the Well offices in Sausalito, across

the bay from San Francisco. McClure said that 'the kind of ecology that we wanted to build on The Well was intelligent people with diverse interests who were sufficiently outgoing and extroverted that they would be naturals in the medium'.[133] Fred Turner describes it as 'a community held together by talk, the textual mirror of a physically dispersed tribe that felt itself linked by a shared invisible energy'.[134] For John Perry Barlow, it was 'an example of the latest thing in frontier villages, the computer bulletin board'.[135] In this kind of small town, he wrote, 'Main Street is a central minicomputer to which (in the case of the WELL) as many as 64 microcomputers may be connected at one time by phone lines and little blinking boxes called modems'.[136] For a while the Well belonged to *Salon* magazine but in September 2012 it was sold to a group of members anxious to preserve its important historical value as 'the primordial ooze where the online community movement was born'.[137] After so many years, much of the tribe has dispersed, but in 2012 Howard Rheingold brought the community to life again in a piece for *The Atlantic*:

> I can't remember how many WELL parties, chili cook-offs, trips to the circus, and other events – somewhat repellingly called 'fleshmeets' at the time – I attended. My baby daughter and my 80-year-old mother joined me on many of those occasions. I danced at three weddings of WELLbeings, as we called ourselves, attended four funerals, brought food and companionship to the bedside of a dying WELLbeing on one occasion. WELL people babysat for my daughter, and I watched their children.[138]

Could the new space of the internet be providing some kind of remedy for the fracturing brought about by the loss of the wild which took place in the years following the Second World War? During that time, Americans became increasingly estranged from the land and by the 1970s the sense of separation had become acute. In 1980 geographer Frederick W. Turner wrote of his realization that many people shared his own ignorance of the land and of how 'a feeling of American loneliness began to insist upon itself, a crucial, profound estrangement of the inhabitants from their habitat'.[139] 'It was', he continued, 'as if those who had inherited the fruits of exploration and conquest had been left a troubled bequest, as if there were some unplacated, unmet spirit of place dividing them from an authentic and comforting possession here'.[140] Loneliness for the lost wild afflicts not just the descendants of the invading colonizers, but also the invaded people themselves. In *Wild Hunger* Bruce Wilshire quotes from a member of the Omaha Tribe who describes how in his youth the country was very beautiful, with many forms of life which were 'after their manner, walking, flying, leaping, running, playing all about . . . But now . . . sometimes I wake in the night, and I feel as though I should suffocate

from the pressure of this awful . . . loneliness.'[141] It seemed as if ordinary people were becoming divorced from their culture and traditions.

Fred Turner provides an interesting analysis of a community in need of a home in a 1999 essay on a phenomenon he calls 'the shifting boundaries of the network society'. Discussing Douglas Coupland's 1995 novel *Microserfs*, the story of an early start-up company making 'virtual Lego' in Silicon Valley, he describes how the young workers in the company are completely bereft of any sense of home. These topics are also taken up by novelist and coder Ellen Ullman in the very readable *The Bug* and *Close to the Machine*. In *Microserfs*, a programmer called Karla expresses the problem like this:

> You have to remember that most of us who've moved to Silicon Valley, we don't have the traditional identity-donating structures like other places in the world have: religion, politics, cohesive family structure, roots, a sense of history or other prescribed belief systems that take the onus off individuals having to figure out who they are. You're on your own here. It's a big task, but just look at the flood of ideas that emerges from the plastic![142]

Turner interprets her estrangement this way:

> In Karla's comments, we sense the presence of some of the principles that inform the rhetoric of the electronic frontier: solitude, individualism, the need for inventiveness and even the hint of a sense of mission. But we can also see that those principles have emerged out of the destruction of other patterns of individual and social cohesion, patterns such as the rhythms of the life cycle and the demands of a social and geographical locale. Days and nights have disappeared into orgies of coding. Old age is no longer a source of authority, but a mark of unemployability. One can do computer work in a variety of locations and in fact, to stay employed one must be willing to move around. As a result, one contributes little to local social organizations and one belongs nowhere. No religion, no politics, no family, no history, no obligations to a particular place – like a contemporary version of the Nebraska Territory, the social landscape of the computer industry is a wide-open plain and its inhabitants are on their own.[143]

The internet gave rise to fears that it could only intensify people's isolation, but a 2009 survey by Pew Internet found the opposite, concluding that 'Americans are not as isolated as has been previously reported. 'We find', they wrote, 'that the extent of social isolation has hardly changed since 1985, contrary to concerns that the prevalence of severe isolation has tripled since then'.[144] They found that the internet had no effect on community participation, reporting

that 'internet users are as likely as anyone else to visit with their neighbors in person'; nor did it pull people away from public places. Rather, it is associated with engagement in places such as parks, cafes and restaurants, the kinds of locales where research shows that people are likely to encounter a wider array of people and diverse points of view. 'Indeed, internet access has become a common component of people's experiences within many public spaces. For instance, of those Americans who have been in a library within the past month, 38% logged on to the internet while they were there, 18% have done so in a café or coffee shop'.[145] They conclude that 'people shape technology far more than the other way around. For this reason, our survey results suggest that people's lives are likely to be enhanced by participation with new communication technologies, rather than by fearing that their use of new technology will send them into a spiral of isolation'.[146]

Indeed, recent research into the popularity of writing and reading status updates on social network sites like Facebook and Twitter suggests that status updates are good for our mental health. From as early as 9 months old, human children begin trying to draw others' attention to aspects of the environment that they find important, and research using functional magnetic resonance imaging of participants talking about their beliefs and opinions has demonstrated that opportunities to share personal information generate very positive social rewards. Harvard psychology researchers Diana I. Tamir and Jason P. Mitchell found that 30–40 per cent of everyday speech is used to relay information to others about one's private experiences or personal relationships. They also reported that recent surveys of internet use indicate that upwards of 80 per cent of posts to social media sites like Twitter and Facebook consist simply of announcements about one's own immediate experiences. Tamir and Mitchell concluded that humans have an intrinsic drive to disclose thoughts to others.[147] In other words, the act of providing status updates makes us feel good. And anecdotally, it is very likely that responding to them also has a positive effect.

Ecosystem, habitat, home and community were brought together very potently in James Cameron's 2009 feature film *Avatar*. It sets a traditional combat adventure story on the green and sensual planet of Pandora, where the indigenous Na'vi people live in enormous spreading trees, known as hometrees. The human invaders have no interest in the Na'vi since their only reason for being there is to exploit the planet's mineral resources, in particular a very large deposit of rare *unobtainium* recently discovered directly beneath one of the hometrees which must therefore be felled and uprooted so that the mineral can be extracted. The hero is Jake Sully, a paraplegic war veteran whose role is to link with a genetically bred human-Na'vi hybrid body, his 'avatar', and infiltrate the Na'vi community. When he logs into it, the new body

provides him with a working set of legs and a much larger if somewhat stranger physique. But inhabiting it also elicits a growing environmental awareness as he comes to understand the interconnectedness of the relationship between the Na'vi and their intensely beautiful home world, rich with life and diversity. Biologists on the team discover that every part of Pandora is alive, connected by an electrochemical communication between the roots of the trees. All of the life-forms – flora, fauna and the Na'vi themselves – can upload and download data to the global network which is Pandora.

Cameron tapped deeply into the biophilic zeitgeist with *Avatar*, synthesizing a Gaia-style interconnected ecosystem with Jesuit Teilhard de Chardin's vision of the noosphere, a cosmic convergence of mind and planet, then mixing them up with the doctrine of hylozoism in which all matter is alive, and adding in the politics of sustainability and exploitation. It is unusual for a mass market science fiction blockbuster to attract serious discussion from the environmental community, but the UK magazine *Resurgence* (strapline: at the heart of earth, art and spirit) published a special e-book about the film in which the director is applauded for 'bridging the interest of those who are looking for a profound message and those who are looking for entertainment'.[148] Cameron knows that his movie is well-timed in the light both of global concern and the increased interest in green lifestyles. He told a reporter that *Avatar* 'says less about the movie's ability to change people's minds than about the movie's ability to key into what people are thinking at the subconscious level'.[149] In the closing scenes, Sully helps save the Na'vi and is rewarded when, gathered together inside the hometree, they harness their collective energy in order to make his avatar body permanent. Now one of them, he is able to stay on Pandora and live in the hometree forever. A green dream for worn-out tech warriors.

Biophilic design

> The language of landscape is our native language.
>
> ANNE WHISTON SPIRN, landscape architect[150]

In the 1980s the Kaplans identified some of the ways in which we access nature for restorative purposes. By the end of the twentieth century efforts were underway to elicit the same kinds of restorative qualities by deliberately bringing biophilic elements into the built environment in a new discipline called *biophilic design*. It was an attempt to translate an understanding of the inherent human affinity to affiliate with nature systems and processes into the design of the built environment, and its applications can increasingly be

found in urban architecture and planning.[151] Biophilic design is both a response to the imperatives of sustainability and a reaction to the increasing exclusion of nature from urban landscapes, an exclusion which gets in the way of what many researchers believe to be an innate human need for biophilic contact. The discipline was spearheaded by Stephen Kellert, who co-edited two important collections of essays, *The Biophilia Hypothesis* with E. O. Wilson in 1993 and *Biophilic Design* with Judith H. Heerwagen and Martin L. Mador in 2008. These books documented the incremental rise of biophilic research from Wilson's original epiphany in Suriname through a series of debates and refinements to some very detailed and often futuristic visions for putting the ideas into practice. Today, their influence can be found in the work of numerous architects and designers around the world as they continue to experiment with ways of bringing biophilia into our everyday lives.

Stephen Kellert believes that biophilia was biologically encoded[152] deep in our past at a time when sensitivity to sensory signals was crucial to our survival and when, in order to stay safe, we needed to be able to read the messages conveyed by changes of light, sound, odour, wind, weather, water, vegetation, animals and landscapes. Later, as the human population stabilized and there was time to develop increased intellect and strengthened physical dominance, the pressing need for high levels of biophilic sensitivity dropped away. For thousands of years it has remained with us as a 'weak' biological tendency but in recent centuries the coming of industrial society has increasingly failed to sustain it and as a result it has begun to decline into latency. Anxiety about the failure of biophilia to develop as a conscious part of our daily lives lies behind many environmentalist concerns. Its absence is said to cause a gap between humans and nature that writer Richard Louv has called *nature-deficit disorder*,[153] an impaired relationship with nature which he believes must be renewed and remedied by transformative human reconnection with the natural world. I will return to this issue in the final chapter.

Kellert has set down a framework in which biophilic design has two basic dimensions. The first dimension is *organic or naturalistic*[154] and is characterized by shapes and forms that reflect an affinity with nature in one of three ways. The first affinity involves *direct* contact with nature which requires no human input to sustain itself, such as daylight, plants, animals, natural habitats and ecosystems. This is probably the kind of contact that most of us are thinking of when we talk about *getting out into nature* and it can be compared to the ways in which people explore cyberspace as if it is evolving as an independent world. The second, *indirect experience*, includes the kind of contact that requires human input, such as when we water plants or care for animals and can be likened to the deliberate creation and nurture of assorted

virtual aspects and entities. The third, and the most interesting in relation to cyberspace, is what Kellert calls *symbolic or vicarious* experience. This involves 'no actual contact with real nature, but rather the representation of the natural world through image, picture, video, metaphor and more'[155] and is reminiscent of activities in virtual worlds and online communities. The second dimension is *place-based or vernacular* design and it relates to buildings and landscapes that connect to the culture and ecology of a locality or geographic area.[156] Its focus is on the spirit of place, a concept which, as we have seen, also has powerful connotations in cyberspace.

Beyond the dimensions described above, there are six biophilic design elements which between them have over 70 attributes. A number of these attributes correspond closely to groups of cyberspace metaphors such as plants, animals, landscapes, ecosystems, habitats and place. A good deal of cyberspace is actually about the absence of place, what Kellert calls *placelessness*, which he sees as a 'corrosive separation of the built environment from its biocultural context'.[157] But as we have seen, the advent of virtual space has brought about a different kind of *placelessness* which in fact is an essential element of virtual experience, and one which does not so much negate physical space as replace it with an equally potent sense of presence. In fact, it is probably most closely aligned to Kellert's 'spirit of place'.[158] He uses this term for the way that some locations come to represent cherished aspects of individual and collective identity. Over time we become committed to caring for them and to seeing them as part of our culture, and sometimes the imaginal becomes dominant in the process. For example, Peter Bishop, writing about an entirely different imaginative space, says of the non-existent land of Shangri-La that 'places are produced by a dialogue between cultural fantasy-making and geographical landscape'.[159] In the case of the internet, however, the spirit of place is often focused around a celebration of placelessness, a condition which as we have seen is a problem for Kellert, who recommends that it should be avoided wherever possible. But cyberspace is different, and placelessness is integral to its identity. It is, say geographers Martin Dodge and Rob Kitchin, 'dematerialised, dynamic, and devoid of the laws of physics; spaces in which the mind can explore free of the body; spaces that are in every way socially constructed, produced and abstract'.[160]

When I set out to write this book I wanted to know why I and so many other internet users seem to have constructed cyberspace as if it were a place of nature. E. O. Wilson's hypothesis that we are guided by a deeply atavistic, possibly even genetic, drive to get close to life and life-like processes seemed to provide the beginning of an answer, and the research conducted by the Kaplans and others explained the kinds of effects that can be triggered by

biophilic sensitivity. Psychologist Peter Kahn believes that we should build on the way that biophilia research has unified diverse fields of knowledge: 'Our minds and bodies came of age hundreds of thousands of years ago, and thrived through patterns of interactions with the natural world,' he writes. 'We cannot jettison all of these interaction patterns and still thrive as a species.'[161]

But we should not assume that the biophilic impulse provides a reliable yardstick against which we can measure ourselves. Rather, it is likely that biophilia takes on different shapes and shades. Conservationists Gary Paul Nabhan and Sara St. Antoine believe it must have changed as it evolved during the hundreds of thousands of years we spent as hunter-gatherers, and that today it is likely to be expressed 'only when the appropriate environmental triggers are present in a certain cultural/environmental context.'[162] In other words, we may experience fewer triggers for biophilic responses today than in the distant past simply because they are less necessary for survival now that we no longer live in the wild. E. O. Wilson agrees. He told a PBS interviewer in 2008:

> the vast majority of people don't ever see a snake in nature. And they're sure not being hunted by cave lions and oversized crocodiles, although they were universally through most of the history of the species. So that part of it [biophilia] is far less true. Also far less true is the chance to unfold more completely a sense of belonging to a habitat, particularly savanna, although that continues to resonate in our making choices for habitation, having city parks, and the like.[163]

Nevertheless, he thinks that a sense of biophilia still resonates strongly today. Research shows that, although it might be a fragile sensibility, biophilia does appear to be essential to human health, productivity and well-being. It might even be possible that in recent decades our forays into the new territories of cyberspace have reawakened and stimulated the biophilic tendency. Could it be that here, in a strange new land where unfamiliar signals must be sensed and interpreted, the ancient biophilic vocabulary is being expressed once again? If so, it would be expected that not just plants but organisms too would feature within its mythology, and indeed they do.

5

Organisms

Wild nature is inextricably in the weave of self and culture
GARY SNYDER, Poet[1]

Bestiary

> In the past, nature in the wild has been usually regarded as alien and cruel.
>
> RENE DUBOS, microbiologist[2]

The animals of cyberspace are to be found in many diverse forms. Microscopic, cyborgian, nano and virtual creatures roam the networks, and humans themselves flux and mutate. Together they make up a curious bestiary. Traditionally, a *bestiary* is a compendium of beasts, both real and mythical. In the Medieval period it was often used to generate inspiring stories told to largely illiterate Christian congregations in order to improve the minds of ordinary people 'in such a way that the soul will at least perceive physically things which it has difficulty grasping mentally: that what they have difficulty comprehending with their ears, they will perceive with their eyes'.[3] Animals are a significant element of the biophilic environment. According to Stephen Kellert, the presence of animal forms in design often provokes satisfaction, pleasure, stimulation and emotional interest, and they are frequently represented in building interiors 'through the use of ornament, decoration, art, and in stylized and highly metaphorical disguise'.[4] They also play a powerful role in our vocabularies. Cecil Brown, an anthropologist at Northern Illinois University who has studied folk taxonomies in 188 languages, has found that people recognize the same basic categories repeatedly, including fish, birds, snakes, mammals, 'wugs' (worms and insects), trees, vines, herbs and bushes.[5] Another research project has shown that humans are even capable of intuiting whether foreign language names refer to birds or fish.[6] For philosopher Paul Shepard, such zoomorphic modes of perception allow us to embody and experience aspects of wildness within ourselves.[7] He believes that images of animals in early cave art, such as the astounding drawings found in caves in Chauvet, France, and thought to be over 30,000 years old could have helped to internalize key images shared by a group. They may, he thinks, characterize 'a root of biophilia, that is in us still, the tug of attention to animals as the curved mirror of ourselves'.[8]

But animals can also be a dangerous threat. Roger Ulrich, the scientist who conducted research into ways in which stress could be alleviated by biophilic experiences, has also examined the opposite kind of engagement, biophobia. If positive encounters with nature can have a calming effect, it should also be true that negative experiences will result in anxiety. A number of studies have shown this to be likely, and the reason apparently comes from one of two sources: either it stems from genetic adaptation such as revulsion for rotting meat and other dangerous substances, or from cultural sources which have created an accumulated history of vicarious acquisition. This complicated term

describes a simple mechanism. Ulrich gives the example of an early human in a hunting and gathering group who is bitten by a poisonous snake. If that individual survives, she will have learned to avoid that type of snake in the future, but if she dies, her lesson dies with her. However, the rest of the group who witnessed the attack will have learned vicariously from her experience and may also pass on that learning to others[9] with the result that they will benefit from the knowledge even after she herself has perished. Furthermore, recent experiments in vicarious acquisition have shown that we are more likely to believe someone else's testimony over our own existing knowledge.[10] The current thinking is that humans probably have a partly genetic predisposition to biophobia, which is to say that we respond fearfully to certain living things (most notably spiders, snakes and bugs) and also to some natural situations which might contain hidden dangers and be difficult to escape from. So just as we are drawn towards some animals and some kinds of places, we are repelled by others, and often for sound survival reasons. Over time this process of vicarious acquisition of information about which species are dangerous leads to a state of *biological preparedness*, and Kellert believes that a critical adaptive function of oral folklore, mythology or other culturally transmitted information might be to vicariously condition adaptive fear/avoidance responses.[11]

Seen through a phobic lens, the enormous unbounded world of the internet becomes a jungle prowled by feral and dangerous creatures out to destroy the unwary surfer by theft, predation or defamation. Every computer is at risk, from malware, viruses and other destructive predators, many of them so automated that one is no longer fighting the humans who devised them but the cold-hearted machine itself. We are already familiar with the term *technophobia* meaning fear of technology, or most often these days, fear of the computer. This emotion is often thought to be irrational, but perhaps there is a logic behind it through the biophobic phenomenon of vicarious acquisition, in which a similar *preparedness* has been placed in the technophobic's mind by stories and cultural conditioning. So if biophobia is fear of the natural world, then *technobiophobia* could be used for a tendency to *fear* certain life and life-like processes *as they appear in technology.* This fear is most noticeable in anxieties about phenomena which seem to replicate real human vulnerabilities, such as attacks by viruses and worms, but for the most part biological metaphors appear randomly. Indeed, compared to landscapes of the digital frontier, virtual homesteads and gardens or internet terrains, there seems to be no coherent narrative to be found across the various forms of cyber-animalia. There are no apparent synergies, for example, between the Chinese Grass-Mud-Horse, the twisted tail of a Dutch monkey, and the evil machinations of the ILOVEYOU virus. There is no tidy Noah's Ark here, just a chaotic bestiary of metaphors and imaginings. As for the body in cyberspace, much has been written and

there is no space here to review that ground, so instead I will look at examples of ways in which creature metaphors have shaped the way we think about the online environment. I have divided my collection into three parts: fauna (mostly bugs); humans (meat) and imagined (dreams and predictions). Some of them are very dangerous while others are just, well, cute.

Animalia

> Since animals roam free in the world, how natural that in fairy tales these animals are able to guide the hero in his search which takes him into distant places.
>
> BRUNO BETTELHEIM, psychologist[12]

In China, two imaginary animals have been fighting it out over the issue of internet censorship. The battle began in December 2007 after the pro-democracy movement Charter 08 released an online petition calling for an end to the Communist Party's monopoly on power. Shortly afterward, government censors began a campaign which, in less than 3 months, shut down more than 1,900 websites and 250 blogs – not only overtly pornographic sites, but also online discussion forums, instant-message groups and even cellphone text messages in which political and other sensitive issues were broached.[13] In response, the protestors applied a method they had used before. They adopted terms which could not easily be censored from the internet. In this case, they invented two mythical creatures, the grass-mud horse and the river crab, which have since achieved international notoriety. Anne Henochowicz explains:

> Grass-mud horse, which sounds nearly the same in Chinese as 'f*** your mother' (cào nǐ mā), was created as a way to get around and poke fun at government censorship of vulgar content. The idea caught fire after netizens made a video depicting the grass-mud horse at war with and eventually defeating the river crab (河蟹 héxiè), a homonym for the propaganda catchword 'harmony' (和谐 héxié). Netizens continually expanded the lore of the grass-mud horse by creating catchy songs and fake nature documentaries on YouTube and other video sharing sites.
>
> The phrase is especially meaningful on a political level because the Communist Party is often described as 'the mother' of the people – 'f*** your mother' can also suggest 'f*** the Party.' The grass-mud horse is one of many mythical creatures created by netizens in response to increasingly strict censorship measures.

> The term has since developed an additional meaning: a 'grass-mud horse' is someone who is web-savvy and critical of government attempts at censorship. As one Chinese blogger explained, '"Grass-Mud Horse" represents information and opinions that cannot be accepted by the mainstream discourse, and "The Song of the Grass Mud Horse" has become a metaphor of the power struggle over Internet expression.'[14]

The grass-mud horse is still popular at every level of Chinese culture. You can buy a grass-mud horse doll, or watch artist Ai Weiwei on YouTube singing the grass-mud horse song (somewhat uncertainly, it must be said) to a recorded children's chorus.[15] By drawing on the ancient tradition of using mythological animals to tell allegorical moral tales, the Chinese online community has found a way to undermine internet censorship while the grass-mud-horse and the river crab have taken their places as perhaps the strangest creatures in cyberspace.

The most dangerous creatures, however, are to be found among the numerous species of computer viruses. In a world which leans towards freedom and openness, viruses are a reminder that we must also protect ourselves. 'The discourse of computer worms and viruses', writes Finnish new media archaeologist Jussi Parikka, 'is held in tension between elements that underline the need for top-down control, hygiene and digital cleanliness and the forces that draw digital culture toward flexibility and self-organising meshworks'.[16] In 2000 the Pew Internet and American Life Project reported that 54 per cent of internet users worried about computer viruses.[17] It is interesting to note, however, that the survey was undertaken just after one of the most devastating virus attacks up to that time. A fortnight before it began, on 4th May 2000, millions of people across the world had received a friendly message in their inboxes. ILOVEYOU, ran the subject line. Within hours, systems in every country were crippled by the invasive ILOVEYOU computer virus as it overwrote existing system files with copies of itself and sourced the victim's contacts list to forward itself to even more hapless recipients. Its origin has never been finally confirmed but most likely it was released by Philippino student Onel de Guzman, angry that his thesis proposal had been rejected by his university. The proposal outlined a plan to commercialize a 'trojan horse' programme designed to steal passwords, an idea which the assessor understandably turned down on the basis that such activity is illegal. The impact of the ILOVEYOU virus was so devastating that many major servers across the globe had to be shut down, but it was not an isolated case, simply one example of the thousands of attacks in progress at any moment in time.

A computer virus is a small program written to alter the way a computer operates without the permission or knowledge of the user. To be classed as a virus, a program must be able to execute itself, in other words to start

independently, and it should also be able to self-replicate, usually by replacing other files with a copy of itself. This sounds like biology, but it is not, at least, not yet, although in the opinion of evolutionary dynamicist Martin Nowak computer viruses do represent a form of evolution.[18] And indeed, the discourse of computer viruses teems with metaphorical life. 'CPUs are referred to as brains; system networks are environments; computers get infected and sick; and these diseases are countered with vaccines' says Parikka.[19]

In the trade, computer viruses are divided into two groups – those which are known to exist and have little likelihood of spreading, often preserved in collections and known as 'Zoo' viruses, and those which exist 'In the Wild'. According to researcher Sarah Gordon, the first known use of the term was by Dave Chess, of IBM's T. J. Watson Research facility in 1990/91, to describe real-world virus incidents.[20] As systems were set up to establish methodologies for identification, the collection of new viruses soon came to resemble the methods of medical virology. Any virus that was reported by two or more researchers was considered to be spreading in the wild, and the most frequently reported gained the most attention. Some viruses are especially difficult to deal with because they are *polymorphic*, meaning that they can imitate other types of code by a kind of shape-shifting. Some are parasitic and invade other systems such as telephone networks.

Recently, the rise of social media sharing has increased the risk of infection. According to industry analyst Fal Sarkar, social media encourages the spread of viruses: 'Just as biological viruses tend to spread faster as individuals are brought closer together by a shrinking world, so too computer viruses are finding a vehicle to spread via Web 2.0 social networks.'[21] In the early years, systems were more separate from each other; a virus found on a Bulletin Board might never travel beyond that server. But in our networked world, they can go anywhere and infect an almost unlimited range of hosts. To test this possibility, in 2010 British scientist Mark Gasson had a chip inserted into his hand which could open security doors and activate his mobile phone. Nothing unusual there. Such chips are commonly used to tag pets and other animals. But this chip was deliberately infected with a computer virus, meaning that in theory the virus could be passed from inside his body to, say, the software of a door lock, and when another individual bearing the same chip used the lock, the infection could be passed across and into the chip inside that person's body.[22]

Gasson's chip has not yet reached the stage of true integration, but it is only a matter of time before advances in biological computing provide viruses with a host of new reproductive opportunities. Progress is already being made with research to create living cells designed to act as computer parts. Scientists at Imperial College London have successfully demonstrated that they can build some of the basic components for digital devices out of bacteria and DNA, which could pave the way for a new generation of biological computing

devices.[23] And University of Washington scientists have built a transistor that uses not electrons, but *protons* – sub-atomic particles. In a bid to create devices that can communicate directly with certain biological functions that involve protons – eventually even *control* them – they are experimenting with chitin from crab shells, a material which could one day be woven into human neural circuits connected to computers.[24] It is inevitable that viruses, both programmable and biological, will not be far behind.

The idea that the computer itself may be an evolving biological organism, sometimes known as 'connectionism', is discussed by Sherry Turkle in *Life on the Screen* where she writes that connectionism, designed on the template of biology, 'opened the way for new ideas of nature as a computer and of the computer as a part of nature. And it thus suggested that traditional distinctions between the natural and the artificial, the real and the simulated, might dissolve.[25] According to network scientist Professor Albert-László Barabási highly interconnected networks, including the World Wide Web, are the result of self-organizing processes governed by simple but generic laws.[26] Even supermarket giant Walmart bases its marketing strategy on the notion that the internet is an organism. Their Labs division includes a Social Genome research group working from the premise that 'In a sense, the social world – all the millions and billions of tweets, Facebook messages, blog postings, YouTube videos, and more – is a living organism itself, constantly pulsating and evolving'.[27] The Social Genome, they say, is 'the genome of this organism, distilling it to the most essential aspects'.[28] Is the internet becoming a self-organized system with microbial properties? Stewart Brand thinks so. He describes it as a 'biological system that deals with both self and non-self.'[29] And philosopher Andy Clark is adamant that 'The line between biological self and technological world was, in fact, never very firm.'[30]

After viruses, the computer worm, 'an insidious and usually illegal computer program that is designed to replicate itself over a network for the purpose of causing harm and/or destruction'[31] is probably the next most feared. Worms are programs that replicate themselves from system to system without the use of a host file. Usually the worm releases a document that already has the 'worm' macro inside it, then the entire document travels from one computer to the next. The very first computer worm is generally thought to be the fictional 'tapeworm' in John Brunner's 1975 science fiction novel *The Shockwave Rider*, in which the US government retains control of the country by controlling access to information via complex levels of permissions and security layers. The programming upon which this national intelligence network lies is threaded with 'worms' which constantly review and filter the data, ensuring that access to it is tightly monitored and controlled. This worm, or 'tapeworm' as Brunner calls it, marks the first use of the term and has thus obtained for *The Shockwave Rider* a place in hacker history. *The Hacker's Dictionary*

records Robert T. Morris's Great Worm of 1988, a 'benign' worm that got out of control and hogged hundreds of mainframe computers across the United States, infiltrating over 6,000 networks around the planet. It was named as a play on the fearsome dragons in Tolkien's Middle Earth trilogy, Scatha and Glaurung, who were powerful enough to lay waste to whole regions.[32]

The origin of the term 'bug' in computing is also well-documented. It is said to have come from the celebrated computer scientist Rear Admiral Grace Hopper, inventor of COBOL. According to *The Hacker's Dictionary*, which has an extensive entry on the subject, the story goes that in 1947 a technician solved a glitch in the Harvard Mark II machine by pulling an insect out from between the contacts of one of its relays. Hopper subsequently promulgated the term 'bug' in its hackish sense as a joke about the incident although, as she was careful to admit, she had not been there when it happened. For many years the logbook associated with the incident and the actual bug in question (a moth) sat in a display case at the Naval Surface Warfare Center (NSWC). A photograph of the logbook and the moth taped into it, can be found on the Naval History and Heritage website.[33] *The Hacker's Dictionary* not only provides a great deal of detail on this episode but, in a burst of humour, traces the term back to Shakespeare and Johnson, noting that

> Actually, use of 'bug' in the general sense of a disruptive event goes back to Shakespeare! (Henry VI, part III – Act V, Scene II: King Edward: 'So, lie thou there. Die thou; and die our fear; For Warwick was a bug that fear'd us all.') In the first edition of Samuel Johnson's dictionary one meaning of 'bug' is 'A frightful object; a walking spectre'; this is traced to 'bugbear', a Welsh term for a variety of mythological monster which (to complete the circle) has recently been reintroduced into the popular lexicon through fantasy role-playing games.[34]

Bugs tend to be isolated phenomena but the very nature of the network is to support complex and self-reproducing entities. 'The Net is an emblem of multiples' says Kevin Kelly. 'Out of it comes swarm being – distributed being – spreading the self over the entire web so that no part can say, "I am the I."'[35] Cyberanthropologist Amber Case is also interested in swarm behaviours. She sees synergies between the ways in which humans 'dance' around shared hyperlinks on Twitter and Facebook and the Bee Dance, a type of behaviour performed by bees when locating pollen in distant fields and used to notify other hive members of the location of the honey in the hive. Each dance pattern contains instructions on how to move in order to reach each resource. 'In the digital realm', writes Case, 'the bee dance takes the form of a hyperlink shared between one person to many others'.[36]

Of course, the bee not only dances. It also swarms. Kelly's 1994 book *Out of Control* is seen by many as the definitive analysis of the way swarms and networks behave in technology. Kelly, who is himself a beekeeper, writes 'A hive possesses an intelligence that none of its parts does, just as a beehive functions as if it were a single sentient organism, so does an electronic hive, made up of millions of buzzing, dim-witted personal computers, behave like a single organism.'[37] The result is an emergent self-governing intelligence: the Net, because 'out of networked parts – whether of insects, neurons, or chips – come learning, evolution, and life.'[38]

> The tiny bees in a hive are more or less unaware of their colony, but their collective hive mind transcends their small bee minds. As we wire ourselves up into a hivish network, many things will emerge that we, as mere neurons in the network, don't expect, don't understand, can't control, or don't even perceive. That's the price for any emergent hive mind.[39]

For Howard Rheingold, such swarming means 'smart mobs', groups of people 'who are able to act in concert even if they don't know each other'.[40] The tools they use to do this are mobile devices which can both communicate and compute, such as smartphones and tablets. Smart mobs are, he says, 'an unpredictable but at least partially describable emergent property,'[41] a product of our increasingly connected society. Rheingold's book *Smart Mobs* was published in 2002, well before the Web 2.0 meme seemed to make his theory a tangible reality. More recently, Jussi Parikka has taken the investigation further in two books – *Digital Contagions* (2007) and *Insect Media* (2010). He sees swarms both as 'shortcuts to thinking about the molecular',[42] and as important translators between the biological and the technical sciences.

This partnership is in evidence at Kobe University in Japan, where scientists have used a swarm of living crabs to actually make a computer. (Not the same crabs who provide chitin for the experiments at the University of Washington described above – these crabs certainly seem to get around). Working on the basis that the group will naturally work together to find the best way through a maze-like path, they released 40 soldier crabs into a specially created channel, watched their behaviour, and then used that knowledge to design a circuit of logic gates. The hope was that by applying the technique of biomimicry – imitating natural processes to solve human and machine problems – they would discover unconventional models of computing.[43] As Parikka says, 'learning' from biology has been a continuous theme in the history of computing. 'The conscious coupling done in laboratories and computer science departments has not only been about metaphorics', he writes, 'but also about capturing the potentials and affects living entities express'.[44]

Kevin Kelly believes we are moving inexorably towards 'a swarmy distributed net of autonomous units and heterogeneous parts.'[45] He does not see this as a problem because the swarm brings the opportunity for more individuality, and more humanity, than we have ever had before. 'In the process of connecting everything to everything, computers elevate the power of the small player. They make room for the different, and they reward small innovations.'[46] Because they have taken on the flexibility, adaptability and self-connecting governance of organic systems, he writes, 'we become more human, not less so, when we use them'.[47]

'There's no doubt,' writes Guardian journalist John Naughton, 'that our emerging information environment is more complex – in terms of numbers of participants, the density of interactions between them, and the pace of change – than anything that has gone before'.[48] And this new reality cannot be avoided, he stresses. 'It must be addressed.'[49]

Spiders also swarm, but in cyberspace they are better known for their crawling behaviour and of course for the webs they weave. Indeed, the spider itself is often seen as powerful. *Lycos* was an early search engine devised at Carnegie Mellon University and released in July 1994. It was named after the *lycosa kochii*, or wolf spider. 'The name was deemed most appropriate since the wolf spider is active at night and catches its prey by pursuit rather than by creating a web and waiting. The Lycos search engine essentially emulates its metaphorical reference by skipping from server to server gathering documents as it goes.'[50] And in the early days, spiders (sometimes called 'crawlers') were described as 'the Web-walking part of a search engine'.[51] 'Far from being a hub with spokes,' writes journalist Chris Anderson, 'the Internet is more like a spider's web, with many ways of getting from point A to point B.'[52] One might imagine that the creator of the World Wide Web, Tim Berners-Lee, got the inspiration for its name from watching a spider at work and observing its dogged persistence in maintaining so many connections – a kind of technological Robert the Bruce moment, perhaps. But the real story is quite different. In fact the concept went through a number of iterations beginning with the idea of a 'Tangle' because 'in an extreme view', he wrote, 'the world can be seen as only connections, nothing else'. But as a system Tangle proved too complicated, and it was only when he decided to use hypertext as the connector that the concept began to gel. 'Imagine', he wrote, 'making a large three-dimensional model, with people represented by little spheres, and strings between people who have something in common at work'.[53] His first idea was to call the collection of hyperlinks a 'Mesh', but rejected it because the word sounded too much like *mess*. In 1990, after discarding various permutations he settled on a name which came from mathematics and was used to denote collections of nodes and links in which any node can

be linked to any other. His friends warned against it, commenting that even the acronym WWW was a mouthful to pronounce, but he went ahead with it anyway, and the World Wide Web was named.[54]

The notion of an actual spider's web may not have been foremost in Berners-Lee's mind at the start, but it proved a potent image in the many debates which would follow as the world tried to understand the new space. For many, it seemed to tap into an existing zeitgeist of how the universe might be. In 1995, the year after the web went global, the Buddhist magazine *Shambhala Sun* published an article by science fiction writer Alexander Besher proclaiming 'We are standing in the vast "Web of Indra" of interactive reality.'[55] The metaphor of Indra's Net is often used to illustrate interconnectedness. Writer Alan Watts described it like this:

> Imagine a multidimensional spider's web in the early morning covered with dew drops. And every dew drop contains the reflection of all the other dew drops. And, in each reflected dew drop, the reflections of all the other dew drops in that reflection. And so ad infinitum. That is the Buddhist conception of the universe in an image.[56]

The web is also a powerful image in shamanistic cultures. In 1996, Native American Jolene Rickard remarked in an article on the CyberPowWow website: 'Wasn't it the Hopi that warned of a time when the world would be circled by a spider's web of wire lines?'[57] Artists, too, have been inspired by it. Critic Derrick de Kerckhove wrote about 'webness', a term coined by the jurors of the Art on the Web category for the 1995 Ars Electronica Prize, which, he claimed 'points to a character that is quite specific to the properties of the World Wide Web. A linked web is structured like a liquid crystal, always reconfiguring itself without losing its molecular identity.'[58]

As we have seen, watery metaphors are the source of much soft fascination online. Indeed, it appears that the most common metaphor for cyberspace is the sea. When asked 'If the internet were a landscape, what kind of landscape would it be?' Joanna Howard replied 'For me it would be undersea, explored by snorkelling, with bright darting fish, waving weed, dark rocks with caves and hidden creatures. Beams of sunlight coming down diffused by the water, never sure what things really are, except the beautiful fish.'[59]

But what of the beings that live in that ocean? For the most part, underwater creatures appear as part of the ocean-like internet rather than as programming phenomena. For example, the sounds of hardware handshaking initiated by dial-up modems evoked all kinds of submarine noises and signals which now lie forgotten in our silent broadband world. Once, every modem had a slightly different musicality. *The Hacker's Dictionary* notes, for example, that as dial-up

connections have been superseded by wireless and cable 'we are starting to forget the evocative sound of modems connecting to the network, but there is one particular watery sound which is no longer heard – the distinctive whale song of 1980s Trailblazer PEP modems'.[60]

But silence does not mean that connection has changed; hardware handshaking still happens just as much or even more than in the days when it was audible. The only reason we could hear it in the old modems was that it was sent via the kind of content phone lines that were designed to transmit audible voice frequencies. But today's systems shift the frequency up to faster speeds and frequencies. Computer scientist Mario Gongora says 'It is as if we were moving from whales' talk to dolphin, then bats' talk and now real-machine talk which is so fast we cannot hear it. But the "talking" is all happening there just the same.'[61]

The idea of watery cyberspace can produce evocative and beautiful images. In 2001, computer science researcher Young Hyun was captivated by one particular tank at the Monterey Bay Aquarium.

> I particularly remember a stunning exhibit of jellyfish, which were illuminated with UV light to show their incredibly delicate organic structures, gently pulsing in tanks of inky black water. Jellyfish are some of the strangest, alien, and yet most beautiful, living creatures . . . I began to wonder, perhaps the backbone networks of the Internet look like jellyfish?[62]

Until recently there have been few winged creatures in the cyberbestiary. 'Blackbird' was a developer tool promoted by Microsoft in 1995[63] and 'Fire Eagle' is a shared location information store developed by Yahoo and launched in 2008. 'Mockingbird' software intercepts and responds to communications between users and hosts.[64] But since the advent of the Twitter microblogging application in 2006, the bird has been in the ascendant. The origins of Twitter's name, however, lie not in the wild but the city. Twitter co-founder Jack Dorsey had been thinking for several years about the constant stream of information shared by urban despatch riders, taxis, emergency vehicles and other groups who need to be constantly aware of each others' locations and status. What was missing from that stream, thought Dorsey, were the statuses of ordinary people. The first application he developed to rectify that was called Status, later changed to Twitch to reflect the frequent buzzing alerts of a phone as new status updates arrived, but, Dorsey told *The L. A. Times*, 'twitch' is not a good product name because it doesn't bring up the right imagery.[65] So he and his team looked in the dictionary and found 'twitter', defined as 'a short burst of inconsequential information', and 'chirps from birds'. 'And that's exactly what the product was,' said Dorsey. 'Bird chirps sound meaningless to us, but meaning

is applied by other birds. The same is true of Twitter: a lot of messages can be seen as completely useless and meaningless, but it's entirely dependent on the recipient. So we just fell in love with the word.' His business partner Biz Stone agrees, adding that he likes to think of Twitter as a flock of birds.[66]

Images of animals are everywhere online, and not just as still pictures, screensavers and wallpapers but also in animations, videos and games. Apple's operating systems are all named after big cats – lion, snow leopard, leopard, tiger, panther, jaguar, puma, cheetah and most recently mountain lion. According to E. O. Wilson, 'we are human in good part because of the particular way we affiliate with other organisms'[67] and we can see that affiliation happening on the internet. You can take care of livestock in *Farmville*; feed your virtual *Tamagotchi* pet, or choose a *Nintendog* puppy 'All shapes, sizes, and breeds of puppy are waiting for you at the kennel, each with different features. What kind of puppy would you like to take home?' asks the website.[68] With SimAnimals on the Nintendo Wii you can 'Engage with wild animals' or 'Explore the vast forest and make it your own'.[69] You can check out the latest cute kitten pictures online during a coffee break and, perhaps in more private moments, pose as an animal character in search of a little furry romance.

Perhaps the best-known small animal connected with the computer is the hand-operated point-and-click device that controls the movement of the cursor on the screen, the mouse. The first computer mouse was made of wood and designed by Douglas Engelbart and his team at the Augmented Intelligence Lab at SRI in 1964. John Markoff reports that what today is called the cursor was at one time called a 'CAT'. 'In hindsight', he says, 'it seems obvious that the CAT would chase the tailed mouse on the desktop'.[70] The original three-button mouse was refined first in Bill English's lab at Xerox Parc and then later at Apple in a project overseen by Steve Jobs and completed in 1980 as a high-speed rapid prototyping exercise with only one button. The mouse was an outwardly subtle but highly complicated technology. One early problem was that, due to graphics incompatibilities, it sometimes left annoying single pixel 'mouse-droppings' behind it as it moved across the screen in MS-DOS systems.[71] There was a similar issue with 'drunk mouse syndrome' also known as 'mouse on drugs', in which the cursor is out of sync with the mouse and moves in random directions across the screen. This can sometimes be fixed by unplugging the mouse and plugging it back in again, but *The Hacker's Dictionary* also reports that at Xerox PARC in the 1970s most people kept a can of copier cleaner (isopropyl alcohol) at their desks.

> When the steel ball on the mouse had picked up enough cruft to be unreliable, the mouse was doused in cleaner, which restored it for a while. However, this operation left a fine residue that accelerated the

> accumulation of cruft, so the dousings became more and more frequent. Finally, the mouse was declared 'alcoholic' and sent to the clinic to be dried out in a CFC ultrasonic bath.[72]

In the 1990s the mouse was the cause of an angry debate between English and Polish technical writers who were translating computer manuals from English to Polish. Scott Herron reports that the group split into two factions: 'those who wanted to directly translate the original English term "mouse click", and those who refused to have anything to do with a mouse that clicks because as everyone knows, mice don't click, they squeak.'[73] Another popular rodent in the hacker's lexicon is the gopher, an important feature of early internet computing. The function of the gopher protocol is document search and retrieval, and it is widely thought to have been named both after the burrowing animal common in the Americas, and the 'gofer' – an assistant who 'goes for' items, otherwise known as a runner. A third derivation could come from the fact that the gopher is the mascot of the University of Minnesota, where the gopher system was invented.

Perhaps the feature with the widest range of interpretations is the @ sign used in email addresses, for example, j.smith@theinternet.com. This typographic character has a long history with origins in many languages including Arabic, Norman French, Greek and Italian. It also appeared in early typewriters and teleprinters which is probably why it was included in the original ASCII set devised in 1963. It was first used for email in 1971 by programmer Ray Tomlinson when he was developing a time-share system called TENEX. Over the years, it has come to possess a bestiary all of its own, as Scott Herron describes in *A Natural History of the @ Sign*.[74] Herron goes into great detail and there is no space here for more than just a few examples. He tells us that many Finnish terms for @ are connected with cats, and that not content with naming the sign for what it looks like, Finnish names it for what it sounds like. In addition to 'kissanhnta [cat's tail], 'miau,' 'miumau,' and 'miuku' are all 'miau merkki' [meow marks] in Finnish. In Poland, it is sometimes called 'kotek' [little cat], and in Sweden 'kattfot' [cat-foot] and 'kattsvans' [cat's tail]. Then there is the monkey. Herron writes 'The imaginations of Dutch speaking people seem to have worked overtime to come up with names for this little symbol. The original name was 'een a met een slinger' [an a with a swing], but was soon more popularly called either 'apestaart' or the diminutive 'apestaartje' [(little) monkey's tail] or 'slingeraap' [swinging monkey]. Other names attested: 'a-krol' or 'a-krul,' [curly a], 'slinger-atje' [little swing a], 'apeklootje' [little monkey's testicle]. The Finns also see the @ as monkey's tail, as do the Germans, Afrikaans, Swedes and Slovenes. For the Poles and the Russians it is simply a monkey. Snails are popular in English,

French, Italian and Korean. In Hebrew, it is most often either a 'shablul' or 'shablool'[snail] or a ' shtrudl' [strudel, that is, the pastry]. 'In both cases, it's something that is rolled up.' Other animals associated with the @ sign are the elephant (Danish, Swedish); dog (Russian); mouse (Finnish, Mandarin); pig (Danish, Norwegian, Polish); herring (Czech, Slovak). Hungarians call it a worm, and Thais call it a wiggling worm.[75]

The internet does not just bring us metaphors; it also connects us with real creatures. For example, the proliferation of webcams streaming live feeds has allowed us to bring wild animals directly onto our screens. From a breeding pair of peregrine falcons making their nest on a ledge near the top of the city centre Newton Building at Nottingham Trent University[76] in the UK, to elephants gathering at a watering-hole in Tembe National Park, South Africa,[77] we can unobtrusively observe the wild from a safe distance. The BBC's immensely successful *Springwatch* and *Autumnwatch* series[78] are built upon a network of webcams which are discussed on TV every evening and can be watched live online for 20 hours a day during the filming season.

Webcams are good for nests, watering holes, zoos and other static locations, but GPS tracking is a better choice for animals on the move, and the more their activities are absorbed into the network, the more potential there is for engagement and empathy. For example, the Cook County Coyote Project is a comprehensive study of coyotes in Chicago metropolitan areas. The team captures the animals, attaches a radio collar or, in the case of pups, inserts a tracking chip under the skin, and monitors their movements in order to understand how they live in urban areas as well as interact with other wildlife and domestic animals.[79] In 11 years they located collared coyotes more than 40,000 times, and in 2008 alone they radio-collared over 250 coyotes, making it the largest urban study of coyotes in the world.[80] Their website is highly informative, but blogger Alexander Trevi has offered some ideas about how they could take it to a whole new level. 'It's not uncommon', he writes, 'for a lot of people to have their only extended contact with the wilderness mediated virtually'.[81] He thinks they should be capitalizing on their data by sharing it. 'Set up an API to give mobile software developers a way to access those radio pings, and there might be apps to track the coyotes' urban ramblings. Google Coyote®. And yes, we're betting that it will have an audience.'[82] And, he continues, 'develop it into an iPhone app, and you have the makings of an urban safari fad'.[83]

Trevi is right. There is indeed an audience for ideas like Google Coyote®. In 2012 an interactive documentary developed from tracking data won a Cyber Lion Award at the 59th Cannes Lions International Festival of Creativity. *Bear 71* is the true story of a female grizzly bear living in Banff National Park, Canada. She was captured and fitted with a radio collar, then tracked and

FIGURE 5.1 *Bear 71 (Bear 71 ©2012 National Film Board of Canada. All rights reserved.)*

logged for 8 years by wildlife and conservation officers who monitored the data in a process that, say the film-makers, reflected 'the way we have come to see the world around us through Tron and Matrix-like filters, qualifying and quantifying everything, rather than experiencing and interacting'.[84] Hundreds of cameras hidden in the trails frequented by the bears and triggered by animals and humans passing by recorded thousands of hours of footage and provided images which were later harvested by Leanne Allison of the National Film Board of Canada Film Studio and digital design company Jam3 and integrated with the tracking data and maps of the area to produce an intriguing work which can be viewed as a film or interacted with using the viewer's own webcam and mouse.

These projects tap into our desire to get as close to nature as we can. We want to be reminded, not in an informational way but by feeling it in the gut, that we are still part of the animal community. Perhaps we seek a window into the subtle world described by artists Emma Bush and Mary Loveday Edwards:

> It can happen suddenly, unexpectedly, and most frequently in the half-light of glimpses, that we catch sight of another visible order which intersects with ours and has nothing to do with it. Suddenly and disconcertingly we see between two frames. We come upon a part of the visible which wasn't

> destined for us. Perhaps it was destined for night birds, reindeer, ferrets, eels, whales . . .[85]

Or an encounter like that described by ecologist and philosopher David Abram when he was resting on a rock after climbing a steep mountainside in the Himalayas. He was idly rolling a silver coin across his knuckles when he realized that the glinting metal had attracted the attention of a condor, and it was flying towards him:

> As the great size of the bird became apparent, I felt my skin begin to crawl and come alive, like a swarm of bees all in motion, and a humming grew loud in my ears. The coin continued rolling along my fingers. The creature loomed larger, and larger still, until, suddenly, it was there – an immense silhouette hovering just above my head, huge wing-feathers rustling ever so slightly as they mastered the breeze. My fingers were frozen, unable to move; the coin dropped out of my hand. And then I felt myself stripped naked by an alien gaze infinitely more lucid and precise than my own. I do not know for how long I was transfixed, only that I felt the air streaming past naked knees and heard the wind whispering in my feathers long after the Visitor had departed.[86]

E. O. Wilson's epiphany of recognition in the forest in Suriname was about the realization of how estranged we are from the animal kingdom and how powerfully we long to join it. When we stare into our screens to watch distant creatures going about their daily lives, do we dream of connection? Are we hoping for the moment when the falcon or elephant or gazelle or bear meets our remote gaze and stares right back? Such a longing is not dissimilar from the desire to meet an entity from beyond our planet. Kevin Kelly told me he would like to see a search for Internet intelligence similar to SETI, the project which searches for alien intelligence. 'We should', he said, 'apply the same kind of tools and search for an emerging intelligence on the Internet, basically making eye contact with otherness on it'.[87]

In the meantime, cyberspace is giving us the opportunity to make contact with the otherness in ourselves.

Humans

> We're at a great moment of historical mutation, whoever we are.
>
> DONNA HARAWAY, critic[88]

In 1996 John Perry Barlow described cyberspace as highly abstract, saying that 'Ours is a world that is both everywhere and nowhere, but it is not where bodies live'.[89] In fact, our bodies are much more present than we had anticipated. David Abram has warned of the danger of human-made technologies 'that only reflect us back to ourselves'[90] and cautions that we allow technology to shut ourselves off from the natural world.[91] But my research has shown that far from shutting ourselves off from nature, we are rediscovering it in cyberspace. Indeed, that reflection is turning out to be more complex and far-reaching than anyone could have imagined and it has been happening since the earliest days of the internet. In fact, it was 1968, a year before the internet was connected, that computer scientist JCR Licklider visited Doug Engelbart's laboratory at the Stanford Research Institute, Menlo Park, and was astonished to encounter the world's first real-time live collaborative virtual environment. He saw a group of people sitting in a circle, each with a screen in front of them. The screens were all logged into the same single computer and, through them, so were the users. When one person typed into his screen, the same text appeared on everyone else's. Licklider was very excited. He immediately grasped the potential of extending the system so that rather than all sitting around the same table using different screens to access a single computer, they could be much more distant from each other. 'There has to be some way' he wrote, 'of facilitating communication among people without bringing them together in one place.'[92]

Engelbart's Augmentation Research Center was focused on finding ways to augment the human intellect and improve the intellectual effectiveness of the individual human being, and their networking system excited Licklider because he had been working on that very problem for years. In the 1950s as the demand for computing power grew, it had became clear that computers needed to be connected together in order to attain the processing power required to do all the calculations they were increasingly being expected to tackle. This process, called time-sharing, required networks not just of machines but also of people. Soon, individuals who had previously worked only in widely distributed small teams were being required to interface not just with their keyboards but with their remote colleagues. Their brains were needed in the network. In 1960 Licklider had published an influential paper which outlined the ways in which men and computers might not just collaborate, but even become symbiotic. To illustrate his point, he described the fig tree and its companion insect *Blastophaga grossorun.*

> The larva of the insect lives in the ovary of the fig tree, and there it gets its food. The tree and the insect are thus heavily interdependent: the tree cannot reproduce without the insect; the insect cannot eat without the

> tree; together, they constitute not only a viable but a productive and thriving partnership. This cooperative 'living together in intimate association, or even close union, of two dissimilar organisms' is called symbiosis.[93]

He saw 'man-computer symbiosis' as a subclass of man-machine systems, and hoped that 'in not too many years, human brains and computing machines will be coupled together very tightly, and that the resulting partnership will think as no human brain has ever thought and process data in a way not approached by the information-handling machines we know today'.[94] Licklider envisaged this organic relationship as the bedrock of what he called an Intergalactic Computer Network,[95] a notion which many believe to be the forerunner of the internet, not least because at the time he was working for the ARPA, the military-funded research group which would design and build the Arpanet. What he saw in Engelbart's lab convinced him that man-computer symbiosis was finally underway. 'In a few years', he later wrote in an article for *Science and Technology*, 'men will be able to communicate more effectively through a machine than face to face. That is a rather startling thing'.[96]

Today, Kevin Kelly's predictions are equally startling. 'We are headed toward a singular destiny,' he writes. 'One vast computer composed of billions of chips and billions of brains, enveloping the planet in a single sphere of intelligence.'[97] The end product will be a merged entity he calls 'One Machine'. And, take note, each of us is already contributing to it:

> Each time a person clicks on a search result or creates a link to a Web page, the Machine is being programmed. Each new link wires up a subroutine, creates a loop, and unleashes a cascade of impulses. As waves of links surge around the world, they resemble the thought patterns of a very large brain. Indeed, a hyperlink is much like a synapse in the brain. Both work by making associations between nodes. Each unit of thinking in the brain – an idea, for example – grows by gaining links to other thoughts. The greater the number of synapses connecting to an idea, the stronger it becomes. Similarly, the more heavily linked a Web node is, the greater its value to the Machine. Moreover, the number of hyperlinks in the World Wide Web is approaching that of synapses in the human brain. But the Machine contains a million times more transistors than you have neurons in your head. And, unlike your brain, it's growing at a rate that outpaces Moore's law. By 2040, the planetary computer will attain as much processing power as all 7 billion human brains on Earth.[98]

For computer scientist Vernor Vinge, however, there is an even more dramatic future ahead for the brain, one which is reminiscent of Licklider's

man-machine symbiosis. He predicts the coming of the *singularity*, a tipping point which futurist Ray Kurzweil describes as 'a future period during which the pace of technological change will be so rapid, its impact so deep, that human life will be irreversibly transformed'.[99] The Singularity will, writes Kurzweil, 'represent the culmination of the merger of our biological thinking and existence with our technology, resulting in a world that is still human but that transcends our biological roots'.[100] Furthermore, there will be no distinction 'between human and machine or between physical and virtual reality'.[101] He has a precise date for when that moment will occur and it is not too far away – 2045. Will it happen? Paul Allen, a co-founder of *Microsoft* and now leading the *Allen Institute for Brain Science*, believes it is unlikely to happen in this century, at least. In his view, proponents of the singularity have failed to understand the complexity and high level of human cognition required to achieve it. Progress, he says, 'is deeply affected by the ways in which our brains absorb and process new information, and by the creativity of researchers in dreaming up new theories'.[102] But he is clearly not ruling it out for ever.

Some researchers have approached the issue from a different perspective and asked not is the internet like a brain, but is the brain like the internet? Larry Swanson and Richard Thompson from the University of Southern California isolated a small section of a rat's brain in the nucleus accumbens – a brain region long associated with pleasure and reward. They found that, contrary to the traditional nineteenth-century view that the brain operates from a top-down model, it actually appears to be a 'vastly interconnected network much like the Internet'.[103] Indeed, the Mandarin word for computer is 电脑 or 'Diànnǎo' – 'electric brain'. Ever since Norbert Wiener devised the notion of cybernetics in 1948, the synergy between brain and computer has been the focus of much speculation. But there is a difference between likening the brain to a computer and vice versa, and suggesting that the machine, or the system, actually is a brain. Marshall McLuhan thought that 'by putting our physical bodies inside our extended nervous systems, by means of electric media' we are setting up a dynamic by which 'all previous technologies that are mere extensions of hands and feet and teeth and bodily heat-controls – all such extensions of our bodies, including cities – will be translated into information systems.'[104] Forty years later, Tim O'Reilly took McLuhan's prediction one step closer when he suggested that hyperlinking enables a process of organic growth similar to the formation of synapses in the brain: 'As users add new content, and new sites, it is bound in to the structure of the web by other users discovering the content and linking to it,' he wrote, 'Much as synapses form in the brain, with associations becoming stronger through repetition or intensity, the web of connections grows organically as an output

of the collective activity of all web users.'[105] O'Reilly is not saying that the web actually is a brain, however, simply that he thinks it resembles one.

The brain is by far the most significant element of the body parts which make up the partial anatomy generated by the collective imaginary of internet metaphors. But in this strange imaginary cyberbody, certain areas are significant while others disappear completely. The backbone, for example, is a key metaphor in the discourse of internet engineering. 'Just like the human backbone carries signals to many smaller nerves in the body, a network backbone carries data to smaller lines of transmission,' says *The Hacker's Dictionary*. 'There is not a single internet backbone, as if the net were a single skeleton, but numerous backbones, like a Borgian mass of bodies connected in a network.'[106] The first backbone was a T1 line created by the National Science Foundation in 1987. Today there are many backbones, mostly carried on fibre optic lines. The internet also has a 'heartbeat' made up of a series of signals indicating circuit or synchronization events; the oscillation frequency of the computer's clock crystal, or even 'a signal emitted at regular intervals by software to demonstrate that it is still alive. Sometimes hardware is designed to reboot the machine if it stops hearing a heartbeat'.[107]

Beyond the head and torso, the cyberspace body begins to look even more peculiar. It has no arms or legs, but it is able to 'handshake', a vital function which keeps machines and programs synchronized as they move through a series of protocols. And the hand has fingers. John Markoff, writing about Stanford Artificial Intelligence Laboratory (SAIL), tells the story of how, in 1971, computer scientist Les Earnest 'made a lasting contribution to the role of community in the early Arpanet by inventing the idea of electronic "presence"'. 'In a world where work went on around the clock, it was often hard to locate people with unpredictable schedules,' Markoff explains. And since Earnest 'liked talking to people face-to-face' he decided to create a program that put a human name on each computer user. Then he added a bit of information that would make it possible to determine if a particular user was sitting in front of his terminal. He called his command 'finger';[108] it would not only find someone on the system, but show information about them such as how long they had been logged on, and how long they have been idle on the system. This clumsy choice of terminology sounded rather odd when inserted in a sentence, for example 'I'm going to finger Tom to see if he's around' but it was so useful that it was widely-adopted across UNIX systems.

The Frankenstein-like 'cyberbody' has a life cycle in which it is born (goes 'live'), sometimes mutates, gets ill or diseased, decays and finally dies. And in the computer world, to be 'live', in the sense of real-world data or software, involves some vulnerability. 'Live data is more fragile and must

not be corrupted, or bad things will happen.'[109] The concern with liveness is reflected in the French translations of ROM and RAM. RAM (random access memory) is the short-term memory of computers, used to access recently occurring material. In French, it is often translated to 'la memoire vivre' (living memory) whereas ROM (read-only memory), which is less volatile and retains its contents without power, is called in French 'la memoire morte' (dead memory). For a machine to be completely dead means, of course, that it is nonfunctional, but it may simply succumb to catatonia, described by *The Hacker's Dictionary* as 'a condition of suspended animation in which something is so wedged or hung that it makes no response. If you are typing on a terminal and suddenly the computer doesn't even echo the letters back to the screen as you type, let alone do what you're asking it to do, then the computer is suffering from catatonia'.[110] Zombification is also a danger, when control of a computer is hijacked by a criminal attacker who then uses it to flood the web with malware. And one of the most unpleasant 'diseases' encountered by a computer system is when it 'rots' or 'decays'. *The Hacker's Dictionary* calls 'bit rot' a 'hypothetical disease, the existence of which has been deduced from the observation that unused programs or features will often stop working after sufficient time has passed, even if 'nothing has changed'. The process sounds very like a kind of Alzheimer's disease. Bits decay as if they were radioactive, it says, and as time passes 'the contents of a file or the code in a program will become increasingly garbled'.[111] The term 'bit rot' comes from the idea of particle decay, as found in nuclear physics. *The Dictionary* adds the intriguing note that 'The notion long favored among hackers that cosmic rays are among the causes of [bit rot] turns out to be a myth.'[112] 'Bloat' is another term that has been widely used for many years. 'Bloatware' is software that 'provides minimal functionality while requiring a disproportionate amount of diskspace and memory' leading to 'server bloat' and 'code bloat'. Another sickness is 'core cancer', a process that exhibits a slow but inexorable resource and, 'like a cancer, it kills by crowding out productive 'tissue'.

And then there are zombies, originally a UNIX term for a malfunctioning process but these days more usually found in the form of the zombie computer. In common parlance, a zombie is a dead body which has been reanimated and brought back to life. It is generally mindless and under the control of an external agency such as a wizard or other powerful entity. A zombie computer is a machine connected to the internet which has been infiltrated and taken over by invasive software such as a Trojan horse or computer virus and become externally controlled for nefarious purposes such as sending out spam or denial of service attacks. In recent years zombie mobile phone programs have begun to appear, such as the release into the wild in 2009

of the Sexy Space text message worm, aka SymbOS.Exy.C, the world's first botnet capable SMS worm designed to target Nokia smartphones. And in 2009 BBC journalist Maggie Shiels reported that the estimated number of PCs hijacked then zombified by cyber-criminals were then estimated at around 12 million across the world. The majority of these were in the United States, with the next largest number being in China.[113]

Could these diverse phenomena add up to a form of evolution? After all, wrote Besher, Engebretson and Bollerot in 1995, 'technology has sprung up from nature just as we have.'[114] Technology historian George Dyson appears to think it possible. He grew up around the Institute for Advanced Study in Princeton where his father Freeman worked, but as soon as he left high school in the 1960s he departed for the forests of British Columbia where he chose to work on boats and with other technologies but kept his distance from computers. They were too much of a reminder of a childhood spent playing with surplus electronic equipment.[115] But in the end he could not resist the call to return to them. 'If you spend time alone in the wilderness, you get very attuned to living things,' he told Kevin Kelly in an interview for Wired. 'I learned to spot the trails left by life.'[116] And when he looked at the digital universe, he noticed similarities. 'I saw the tracks of organisms coming to life. I eventually came out of the Canadian rain forest to study this stuff because it was as wild as anything in the woods.'[117] According to Dyson, digital organisms are 'strings of code that replicate and evolve over time' and may not necessarily be 'any more alive than a phone book'.[118] 'When you click on a link', says Dyson, 'you are replicating the string of code that it links to. Replication of code sequences isn't life, any more than replication of nucleotide sequences is, but we know that it sometimes leads to life.'[119] Kelly asks 'What other kinds of digital organisms can we see?' and Dyson's reply adds a new kind of species to the cyber-bestiary – megafauna: 'Besides obvious ones like computer viruses, we have large, slow-moving megafauna like operating systems and now millions of fast-moving apps, almost like microbes. Recently we've seen enormous conglomerations of code creeping up on us, these giant, multicellular, metazoan-level code-organisms like Facebook or Amazon. All these species form a digital universe.'[120] Facebook and Amazon as enormous organisms. Is it conceivable? As the notion of the corporation evolves into the twenty-first century, it could even be a plausible idea. Certainly material for a science fiction movie, if nothing more.

Kelly also has his own theory, the *Technium*, which he calls *The Seventh Kingdom*. Biologists divide the living world into six groups, or kingdoms: archaea, protists, eubacteria, fungi, plants and animals. Kelly has added a seventh, The Technium, which 'branches off from the mind of the human animal, just as the deepest roots of the human branch off of the bacteria.

Outward from this root flow primitive species of technology like hammers, wheels, screws, and refined metal, as well as domesticated crops. Over time the technium has evolved the most complex rarefied species like quantum computers, genetic engineering, jet planes, and the world wide web.'[121] But his conclusion that 'life and technology trace back to a common stock'[122] is disputed by critics such as ecologist Jerry A. Coyne who remarks that 'Sadly, evolution doesn't work this way.'[123] 'True', writes Coyne in the *New York Times*, 'evolution shows some trends – species are on average more complex now than at the beginning of life – but does that mean that there is a consistent evolutionary impulse toward complexity, with natural selection always favoring the more complex over the less? Not at all.'[124]

Actually, we have become symbionts, says Katherine Hayles, Professor of Literature at Duke University and author of *How We Became Posthuman*. Just as a lichen is the marriage of a fungus and an algae, we now live in full partnership with digital technology, which we rely on for the infrastructure of our lives. 'If every computer were to crash tomorrow, it would be catastrophic,' she says. 'Millions or billions of people would die. That's the condition of being a symbiont.' Hayles is among those who see this dependence as not necessarily bad, but simply as an inevitable part of advancing civilization. 'From Thoreau on, we have had this dream we can withdraw from our technologies and live closer to the natural world, and yet that's not the cultural trajectory that we have followed,' she says. 'You could say when humans started to walk upright, we lost touch with the natural world.'[125]

For Andy Clark, Professor of Philosophy and Chair in Logic and Metaphysics at the University of Edinburgh, the next step is to acknowledge that humans are 'natural-born cyborgs'.[126] A cyborg is a human being whose physical abilities have been enhanced by electronic, mechanical or robotic elements. We are used to seeing cyborgs in science fiction, such as the Borg in *Star Trek* or the *Six Million Dollar Man*, but medical advances are fast catching up with fiction, a fact which could be seen most acutely in the 2012 Paralympic Games where many competitors were enhanced by prosthetics. Perhaps the most famous of these is Oscar Pistorius, known as The Blade Runner because of his prosthetic blades. According to Andy Miah, Director of the Creative Futures Institute at the University of the West of Scotland, 'Pistorius symbolizes the rise of the cyborg and the demise of the natural human.'[127] In Clark's view, we have always been cyborgs because we externalize our cognitive processes by outsourcing their content and transmission to platforms like writing, print and digital. In the future, writes Clark, 'we shall be cyborgs not in the merely superficial sense of combining flesh and wires but in the more profound sense of being human–technology symbionts: thinking and reasoning systems whose minds and selves are spread across biological

brain and nonbiological circuitry.'[128] However, there is a problem with the notion of the cyborg, he warns, because it 'conjures images of human-machine hybrids and the physical merging of flesh and electronic circuitry'.[129] He believes it should be understood differently. 'My goal is to hijack that image and to reshape it, revealing it as a disguised vision of (oddly) our own biological nature.'[130]

Architect Pliny Fisk III has a different approach, however. He has devised an interesting neuropsychological strategy which might help solve the problem of losing touch with the natural world by re-engaging the human brain with what he calls 'nature's brain.'[131] Fisk's expertise is in practical green architecture and as the founder and director of The Center for Maximum Potential Building Systems in Austin, Texas, he has won many awards for sustainable building projects. He comes from a culture which is traditionally suspicious of cyborg enthusiasts like Clark. But there is a bridge between the two, because Fisk believes that there is a productive connection between the way we use digital technologies and the way the brain is set up to respond to biophilic stimuli. He wants to incorporate our technological habits into the way we inhabit our buildings because 'while sustainable buildings continue to respond directly to the environment, they may also satisfy the human brain's natural need for stimulation by involving nature's cycles on a miniaturised scale proven to elicit brain response'.[132] He appears to have got the idea from observing the pleasures we get from the instant gratification of using our mobile phones and likening them to the impulses which drive biophilic response. He calls it 'designing for a biophilic neocortex'.[133]

Andy Clark claims that he does not really 'use' his brain. 'There is no user quite so ephemeral. Rather, the operation of the brain makes me who and what I am. So too with these new waves of sensitive, interactive technologies. As our worlds become smarter and get to know us better and better, it becomes harder and harder to say where the world stops and the person begins.'[134] If this is the case, is it possible for Fisk to create designs which make it harder to say where the *building* stops and the person begins? Would that be a true symbiosis between architecture and the brain?

What Fisk proposes rests on the notion that we have inherited a biophilic sensitivity to material lifecycle events such as encounters with water, energy, food and materials. This process is served by the neocortex, which is always seeking new stimulation. But the range of rewards it used to bring – hunting and preparing sustenance, disposing of the remains, building shelters, adjusting to the rhythms of time and the seasons – has been much reduced by our highly effective architectural methods, and so the neocortex has energy to spare. It is no surprise, then, that in the twenty-first century what Fisk calls the 'stimulation hunger' of the neocortex is 'satiated at least partially

by participation in the world of electronic information technology, which takes us into a make-believe realm unconnected to much of the actual physical world around us.'[135] His solution is to make the biophilic lifecycle more evident through design that engages the neocortex once more by designing buildings that reconnect us with the natural world not just through how they look and feel, but also by how they behave. For example, the Advanced Green Builder Demonstration building, completed in Austin in 1996, contained features which explicitly exposed the ecosystem of the house – solar heating, water-recycling and so on – and which required haptic management such as testing water levels simply by touching the cool water tank, or ensuring efficient waste water processing by trimming back any flowers which impede the workings of the reed bed.[136]

'Our concept extends biophilia's principles to suggest that buildings might be designed to *mimic* and *illuminate* these life-cycle events – even seem to speed them, electronically and otherwise –', he writes, 'causing humans to experience resource flows and cycles, understand resource dependencies at an evolutionary level, and adapt behaviour accordingly'.[137] He equates his goal to 'what Ray Kurzweil would call "singularity" or Gregory Bateson might today refer to as an "ecology of being"'.[138] The idea, he says, 'has vast planetary implications'[139] and it can be achieved not by eschewing digital technologies but by bringing them into the process. This is a biophilic arena where Andy Clark's cyborg vision of our biological nature could make a powerful contribution. Fisk enjoins us to proactively engage with what he calls the *greening of the brain*. 'These approaches must not simply lead us;' he says. 'We can lead them into a patterned information world that is connected to our evolution. And in the process, we may include the planetary partners that ultimately determine our survival.'[140]

In the final chapter we will follow Pliny Fisk III's lead towards practicalities. How can we become more alert to our own sensitivities and design our technological lives with the biophilic cortex in mind? But first, an example of the way in which this process may already have happened, here is a story about the greening of the brain in action.

The greening of the brain

Q: If the internet were a landscape, what kind of landscape would it be?

A: Hmm. I say jungle – so much undiscovered, no sense of order, no way to take it all in at once – you just have to walk it. Plenty of danger, plenty of beauty, enough to keep me interested.

OWEN TOOTH[141]

In the course of my research I uncovered an interesting story which links Douglas Engelbart, a celebrated computer pioneer with a childhood passion for swinging on creepers near the creek where he grew up in rural Oregon, with Tim O'Reilly, a well-known technical publisher and open source activist who spent many hours of his youth clambering through giant tangles of vines at the end of his street in San Francisco.

Born in 1925, Engelbart is credited with the invention of the computer mouse, the hyperlink, shared-screen teleconferencing, and other technologies still in use today, and he was a key member of the team which activated the Arpanet. But there is a lesser known story which might provide a subjective insight into his genius, and which links him to a very different way of understanding the hyperlinks which connect the World Wide Web. In 2009 I visited him in his office at the Stanford Research Institute (SRI). Waiting in the reception area, I had time to gaze into the glass display case containing his prototypes for the first computer mouse alongside a photograph of Engelbart receiving the highly-coveted National Medal of Technology from President Bill Clinton in 2000.

His office is a pleasant and compact inner sanctum. It had been difficult to obtain a meeting with him but mutual friends had introduced us and I was very grateful for the chance to visit. At the age of 84 he looked frail but he pulled a table into place for us all to sit around – his wife, his secretary and me. As we settled down to talk, the man who is well-known for his modesty was bemused as to why I wanted to hear about his relationship with nature. After all, most people come to talk about his engineering achievements. But I was there because I wanted to find out whether nature had inspired his thinking at any point, either consciously or perhaps even subconsciously. He gave me a kind, rather patient, smile, so I plunged in and asked about his childhood. He told me he was born in 1925 in Portland, Oregon, and lived in a suburban neighbourhood until his family moved further out of town when he was 9. 'It was a beautiful place on a winding road. You came across the creek on a little bridge and the creek went straight onto our property. It was just idyllic for a little kid.' But his father died and his mother got a job in Portland which involved walking a mile and a half to the bus stop every day, so Doug had to learn how to help care for his smaller siblings. 'But we didn't feel like we were suffering. Part of the reason for that was living out in that beautiful countryside.'[142] It was there, in a nearby ravine with a creek running through it, that he played a game which, from a cognitive perspective, may have helped him think through problems in a way which would later prove very useful in his engineering career. He would draw threads from old burlap sacks, re-twist them in multiple strands, then knot the resulting rope into a swing to carry him back and forth across the stream below. Thirty years later he invented

the hyperlink, which has a very similar function, that is to say it is a twist of code swinging data from one point to another. For those unfamiliar with the term 'hyperlink', it is the digital text on a web page, traditionally blue and often italicized or underlined, that you click on to go to another part of the page or to a new page. The next time you click on a link, pause to remember that it was invented by the man who as a child spent many hours making ropes to swing him from one side of a creek to another. After all, as Doug Engelbart told me that day, the hyperlink is all about 'being able to find any given object in another document and just go there'.[143]

In the late 1960s when Engelbart and his colleagues were developing the mouse, the hyperlink, and other key inventions at SRI Augmentation Research Laboratory in Menlo Park, Tim O'Reilly was growing up just a few miles away in San Francisco. I interviewed O'Reilly at the 2009 ETech conference in San Jose shortly after the meeting with Engelbart and I was unaware at the time that I would discover an interesting synergy between the two men. I had arranged to speak with O'Reilly because I had noticed his tendency to weave nature metaphors into his talks about technology and I wanted to find out what had influenced him in this way. As we sat in a corner of the press room with only a short time before he had to be on stage again, I asked him, as I had asked Engelbart, about his childhood relationship with the natural world. I learned that when he was barely a few weeks old, Tim O'Reilly's parents moved the family to the United States from Ireland. They regularly returned to visit, however, and the sensory imprint of his grandmother's garden in Killarney stays with him: 'I have wonderful memories of my grandmother's backyard, of crawling through a tunnel that went through stinging nettles into the brambly back, where there were gooseberries.'[144] At home in San Francisco, he continued his vegetal explorations in the back lot of OK Chevrolet, a used car company at the intersection of 17th and Taraval. 'There was a huge overhang of this weedy thing called mattress vine,[145] which hung down about 20 feet. You could literally climb it, and we dug little caves in it.'[146] He enjoyed it so much that he now cultivates mattress vine on his own land. 'I've actually found some of this stuff, which is generally regarded as an invasive weed, and planted it on my property for my kids and grandchildren where they can climb up it.'[147] He still sometimes scales it himself too. Tim O'Reilly is the man who spearheaded the notion we now know as Web 2.0, an idea which came out of his FOO camp in 2003. By then the challenge had evolved from the problem of how to move from one document to another to how to navigate the tangled web spawned by Engelbart's original single hyperlink. The answer would lie not in the cerebral intensity of engineering invention, but in a new conceptual approach to the growing lifeworld of the internet, in a mindset which accommodated the social as much as the technical. The web

had turned into a digital mattress vine, and O'Reilly was among the first group of people who understood how to navigate it.

These two biographical snippets represent iconic stages in the way we have learned to negotiate the new kind of habitat created by the hyperlink. And it is perhaps no surprise that they occurred over 30 years apart, because different times demand different kinds of people. Douglas Engelbart is an individualist who was both driven by a vision of computer-augmented intelligence and in need of a highly competent group of engineers and programmers to help him get there. But he was not of a particularly collaborative mindset, and neither were his colleagues. As Lee Felsenstein, co-founder of the Homebrew Computer Club once told me, 'programmers live their lives in the dark',[148] and communication between them is not always straightforward. Because of this, in 1967 Engelbart engaged the part-time services of transpersonal psychologist Jim Fadiman and gave him two responsibilities. First, he was to meet privately with Engelbart and listen to him explain his thinking. Although Fadiman had no scientific knowledge he used his skills in interpersonal behaviour to guide Engelbart towards recognition of when he was on the right track towards an important insight, and when he was moving away from it. Second, Fadiman was to sit in on team meetings and observe the group as Engelbart explained what he needed them to do, then intervene if he perceived a problem. This was not always an easy responsibility. He told me 'I would say, "Doug, I know one hundred thousand per cent that nobody understood what you just said."'[149] Fadiman describes the group as the first community ever linked together by a computer: 'One might say the web naturally evolved from Doug's thinking because they had the web right there inside the room.' Team relationships were often tense and communication could be difficult because, Fadiman said, 'they were not only developing a language with which to work, but they were using that language to develop the language'.[150] This is a group of 20 people, he went on, 'most of them brilliant social isolates, all working on the same mainframe. And if any single one of the monitors crashed, everybody crashed, so everyone was dependent on everyone else, and everyone else was accidentally destroying everyone else's work all the time.[151]

Yet ironically and despite all the difficulties, this hothouse of what Fadiman calls 'supersmart people' who could barely communicate with each other, managed to invent the indispensable tools which would revolutionize the way we communicate and connect today. Their fumbling in the interpersonal dark of programming produced some of the most vital and necessary components of both the internet and the web.

Three decades later, Tim O'Reilly would survey the result of that conception and ponder upon what it had become. A complex interwoven ecology had

arisen and spread around the world connecting languages, cultures and, above all, people. The landscape has gone from a single swing across a creek on a gunny sack rope to a wild mass of tangled undergrowth, a tangle not just of links but of the people connected by the links. Any progress to be made within that new ecosystem was crucially dependent upon an open and sustainable collaborative environment. In contrast to the intense individuality of Douglas Engelbart's Augmented Intelligence laboratory, Tim O'Reilly operates in a highly social milieu. As an active blogger and Tweeter, as well as being the brain behind a wide range of O'Reilly conferences on diverse subjects and of course the company itself, he comes across not as a lone inventor struggling to communicate a solitary and obscure vision, but as one of a number of poly-intellectual minds in the technology community. Unlike Engelbart, O'Reilly did not personally invent either software or hardware, but he seems to have an almost instinctive understanding of the complex ecology of function and design which has evolved from those first hyperlinks. The web has become a hugely complex network encompassing the entire planet and involving trillions of connections; it is no longer simply a case of swinging from one point to the next, but of navigating around a fast-growing dataworld. And one of the first people to take the necessary perceptual leap towards understanding the chaos was Tim O'Reilly.

Could the cognitive reason lie in the conceptual framework he developed during his childhood scrambling through his grandmother's brambly back garden in Killarney, and later through the mattress vine at OK Chevrolet? Our conceptions of physical space begin in very early childhood, and metaphors, whether or not they are consciously expressed, contribute to the way in which we understand it. In 1991, psychologist Rachel Sebba of the Israel Institute of Technology investigated environmental preferences in adults' recollections of being outdoors and found that almost all those who took part identified the outdoors as being of critical emotional significance during their childhoods.[152] According to Stephen Kellert, 'early childhood experiences of nature constitute a treasured emotional legacy that they draw on for personal creativity'.[153] He cites pioneering psychologist Edith Cobb's view that many highly gifted persons cite the memory of particular childhood environments as an emotional basis for their creative production. These childhood experiences, she believed, enabled them 'to renew the power and impulse to create at its very source'.[154] In O'Reilly's case, a childhood fascination with negotiating complex botanical environments may have facilitated the conceptual shift he made in understanding how the internet had evolved from a very small collection of hyperlinks to a seemingly boundless ecology of many millions of connections. In 2005 he published a lengthy essay explaining the concept of Web 2.0 in which he made it clear that 'hyperlinking is the foundation

of the web' and stressed that as new content appears it is bound in to the structure of the web. 'Much as synapses form in the brain, with associations becoming stronger through repetition or intensity, the web of connections grows organically as an output of the collective activity of all web users.'[155]

Howard Rheingold made a similar point in an essay entitled *The Shape of the Universe*, where he described the synergies between trees, cognition and code. 'Our nervous systems are shaped like trees, and so are rivers, capillaries, data structures, probability worlds, solution-spaces, chess games, and chain reactions.' Tree-shaped data structures offer an effective and orderly way to store and retrieve large amounts of binary information because 'trees in which each branchpoint leads to exactly two branches is the direct visual analog of a binary code, because you can get from the trunk to any one of the leaves by making either one of two decisions at each branchpoint'.[156]

There is one tree, of course, whose fruit is so deeply embedded in computer consciousness that we can hardly imagine technology without that glowing edible shape. Legend has it that the name of Apple Computers was thought up by the late Steve Jobs in 1976 as he drove with Steve Wozniak along Highway 85 between Palo Alto and Los Altos. Owen Linzmayer reported that Wozniak told the story like this: 'Steve was still half involved with a group of friends who ran the commune-type All-One Farm in Oregon. And he would go up and work there for a few months before returning to the Bay Area. He had just come back from one of his trips and we were driving along and he said "I've got a great name: Apple Computer." Maybe he worked in apple trees. I didn't even ask.'[157] Jobs' idea was oddly reminiscent of the Beatles' company Apple Corps, founded in 1968 and surely known to him. In later years, the similarity would provoke a series of law suits. Author John Barry claims in his book *Technobabble* that Jobs was a fructarian at the time, but this assertion, although amusing, is not substantiated.[158] Whatever the source of Jobs' idea, it was rendered into a logo in 1976 by Ronald Gerald Wayne, chief draftsman at Atari, the video game company. The image Wayne created was a pen-and-ink drawing of Sir Isaac Newton leaning against an apple tree with a portion of the text that the poet William Wordsworth wrote for Isaac Newton's memorial statue: 'Newton . . . a mind forever voyaging through strange seas of Thought . . . alone.' The ornate banner winding around the frame says 'Apple Computer Co.', and there above the scientist's head is the fruit, poised and about to fall. Jobs, however, found the logo too cerebral and difficult to reproduce. Within a year Wayne's poetic image was replaced by a simple rainbow coloured apple with a bite out of its side. Even this design is not without its mystical associations. According to academic Sadie Plant, the 'missing byte' is a homage to the British mathematician Alan Turing who committed suicide in 1954 by eating an apple poisoned with cyanide.[159] The

connection with Newton would resurface in 1992 with the Apple Newton Message Pad, a prescient design which was one of the first Personal Digital Assistants (PDA). Apple also gave rise to the term 'applet', a web-page Java program, and inevitably to copy-cat names of which the best known is Apricot, a British computer manufacturer originally called 'Applied Computer Techniques' (ACT) (later acquired by Mitsubishi) which changed its name to Apricot Computers in 1984 then changed it back again in 1990.

Beyond Apple, I have found few terms relating to fruit. The jokily-named Raspberry Pi is a small low-cost computer for kids which went on the market in February 2012 at a cost of £22 a piece and quickly soared in popularity. Developed by a charity set up for the purpose in Cambridge, UK, it was designed by a team of teachers, academics and computer enthusiasts with the intention of inspiring children to learn computing. And there is the Blackberry smartphone, made by Canadian company RIM and a major competitor to Apple's iPhone for a while, but the origin of its name is much more prosaic. It is said to have come from a marketing conversation in which someone pointed out that the keys of the new RIM phone looked like tiny seeds, leading the team to consider a fruit-related name. At the time the only model of the phone available was black, and the word 'blackberry' was deemed to have a positive ring to it, so it was chosen. A rather dull process compared to apple growing in an Oregonian collective farm.

Science fiction author Bruce Sterling seems to have been correct when he observed that 'This dark electric netherworld has become a vast flowering electronic landscape.'[160] Are we participating in the evolution of a new kind of ecosystem? If so, how can we get the best from it? Tim Berners-Lee is adamant that 'the Web is more a social creation than a technical one. I designed it for a social effect', he said, '– to help people work together – and not as a technical toy. The ultimate goal of the Web is to support and improve our weblike existence in the world.'[161] In the final chapter we look at practical ways to do just that.

6

Living deliberately

If from the top of a long cold barren hill I hear the distant whistle of a thrush which seems to come up from some warm woody shelter beyond the edge of the hill, this sound coming faint over the rocks with a mingled feeling of strangeness and joy, the idea of the place about me, and the imaginary one beyond will all be combined together in such a manner in my mind as to become inseparable.

WILLIAM HAZLITT, Writer[1]

Walden

> Just as we go into a redwood grove and get that cathedral-like feeling, I think that as the Internet continues to complexify and become larger, it will also become a spiritual place where people will retreat to feel something bigger than themselves.
>
> KEVIN KELLY, writer[2]

How can we put the biophilic life into practice in the digital age? The internet has connected us to each other; can it connect us back to the natural world too? In this final chapter we look at practical solutions to support and improve our weblike existence both online and offline.

The American classic *Walden*, written by nineteenth-century transcendental philosopher Henry David Thoreau, has become a reference point for those seeking a way to 'live deliberately', fronting 'only the essential facts of life', as he put it.[3] Is there anything in *Walden* that might be useful to us today? Thoreau's well-known observation that 'the mass of men lead lives of quiet desperation'[4] describes a condition that historian Leo Marx has called a 'cultural malady' in which the author's fellow townsmen 'perform the daily round without joy or anger or genuine exercise of will'.[5] He was not opposed to industrial commerce – indeed his family owned a pencil-making business for which he worked for most of his life – but from a philosophical standpoint he was deeply concerned about what he saw as the deadening effect of a mechanistic outlook. In 1845, he moved into a cabin beside a small lake near the town of Concord, Massachusetts, and remained there for 26 months. His subsequent meditation, *Walden; Or, life in the woods*, was published 9 years later and is still regarded as a crucial element of American national identity. His plan was to live alone in a house he built himself, a mile away from any neighbour, and to earn his living by manual labour. But the reality proved rather different. By his own admission, he was hardly isolated. He regularly walked into Concord to dine, read the papers, visit the post office and have his laundry washed and mended. He did indeed build his own cabin, although the archaeologists who later found huge numbers of bent nails in the soil around it concluded that the construction process must have been tough going. And he experimented with cultivating a field of beans, a project which was an economic failure but which allowed him to fulfil his intention of understanding the agricultural process: 'I was determined to know beans'[6] he wrote in the ecstatic voice of many novice farmers.

In *The Machine in the Garden* (1964), historian Leo Marx set out to understand this urge to idealize the rural. He saw it as 'an inchoate longing for a more 'natural' environment'[7] which results in Americans neglecting

their cities and fleeing to the suburbs at the expense of investment in the quality of urban life. In Thoreau he found an author who, although he has since become the well-spring of much sentimentalism about the pastoral, was himself 'a tough, unillusioned empiricist',[8] concerned not so much with abstract hypothesizing as with direct observation and experience.

Evidence of Thoreau's practicality can be found in his ambivalent attitude to the Fitchburg Railroad which runs near to his cabin. Its existence is seldom far from the narrative of *Walden*: sometimes the whistle of trains sounds like the scream of a hawk, sometimes like the beat of a partridge; on other occasions the track is simply part of a scene, as when its rails shine in the spring sunlight while the author listens to the arriving songs of larks and peewees; at other moments he expresses his scepticism about our growing dependency on the train, noting that 'we do not ride on the railroad, it rides upon us.'[9] He watches the modern world develop around his cabin with a mixture of pleasure and disparagement. Why connect Maine to Texas by telegraph if, as he remarks, the two 'may have nothing to communicate'[10] anyway? But by the end of Thoreau's experiment, Marx suggests, the author seems to almost sidestep the intentions of the original project and comes to believe that the realization of the golden age 'has nothing to do with the environment, with social institutions or material reality' and that therefore, after all, 'the writer's physical location is of no great moment'.[11] This comment, by the way, is quoted far less frequently than his more bucolic observations. The book ends, Marx concludes, with Thoreau removing the pastoral hope from history, 'where it is manifestly unrealizable',[12] and relocating it 'in literature, in his own consciousness, in his craft, in Walden'.[13] In other words, Marx interprets Thoreau as saying that the golden age of the pastoral life has never been anything other than a fantasy. Perhaps, indeed, it is a virtual world. But this interpretation of *Walden*'s ambivalent undertones is seldom aired, and instead its lyrical nature writing has long been used in rallying cries against the incursions of technology.

Today, Thoreau is still seen as a hero by those seeking to escape the machine. For instance, William Powers' 2010 book *Hamlet's BlackBerry: A practical philosophy for building a good life in the digital age* features a chapter called 'The Walden Zone: Thoreau on making the home a refuge'.[14] However, this framing of the book implies a connection which probably was not there in the original. Indeed Thoreau does not even use the word 'refuge', and the idea of the home as a refuge may not have been what he was thinking of at all. But Powers pushes on with the notion, suggesting that the 'Walden Zone' might be a room in your house where no technology is allowed.[15] To try it out, he instituted a weekly Internet Sabbath in his own home, turning off the family internet connection from late on a Friday until Monday morning. We should, he told CBS interviewer Jeffrey Brown in a typical example of the

FIGURE 6.1 *Walden_USC (Image from Walden, a Game, ©2008–2013 USC Game Innovation Lab.)*

ways in which an idealized *Walden* is reshaped to address modern life, 'do what Thoreau did, which is learn to have a little disconnectedness within the connected world, not run away'.[16]

Powers tried to import a customized version of Thoreauvian practice into his own home, but at the University of Southern California (USC) Tracy Fullerton and her team are working to bring the *Walden* experience into the computer itself (Figure 6.1).

In this case, they are inspired by Thoreau's intentions: 'I went to the woods because I wished to live deliberately', he wrote, 'to front only the essential facts of life, and see if I could not learn what it had to teach'.[17] At USC, Fullerton's team are creating a videogame which simulates his experiment by 'allowing players to walk in his virtual footsteps, attend to the tasks of living a self-reliant existence, discover in the beauty of a virtual landscape the ideas and writings of this unique philosopher, and cultivate through the gameplay their own thoughts and responses to the concepts discovered there'. It is set in a real-time 3D environment which replicates the geography of Walden Pond and the surrounding woods, where the designers aim to 'reinforce the messages of Walden' by embodying the actual experiment in a game which encourages the player to exercise reflection and insight.[18]

I first heard about the USC project via a tweet from someone who posted its URL along with a plaintive cry of 'No! No! No!'. Certainly, some nature lovers will be horrified by the idea of a *Walden* videogame, but it is worth

remembering that the fame of *Walden* has come not from visiting the physical place but rather from the imagining (virtuality) of it. And the book itself was of course created and distributed by technology first via hand-writing, perhaps with the very pencils made by Thoreau's family, then by fixed-type print, and most recently in electronic form, since it has been available as a free download from Project Gutenberg for several years.[19]

The story of *Walden* has become a biophilic fantasy for many people. But philosopher Gaston Bachelard might have said that there is nothing wrong with that. In *Air and Dream*s, he argues against the impulse to translate the imaginary into the real since 'a stable and completely realized image clips the wings of the imagination'.[20] Thanks to the imaginary, it is possible to 'absent oneself, to launch out toward a new life'.[21] It is also, it seems, an element of restorative practice.

Restorative practice

In Chapter 2, I discussed the Kaplans' theory of attention restoration (ART). After their work was completed and all the data analysed, the researchers experienced something of a surprise. Their results showed that we find satisfaction in a natural environment because its aesthetic qualities include a feeling of mystery and a sense of organization through its patterns and rhythms, and because it can provide the pleasure and sense of comfort which aid recovery from mental fatigue.[22] They identified four specific contributions to the recovery of mental effectiveness: (1) clearing the head so that residual clutter can be discarded, (2) recovering the capacity for directed attention which is so vital to our cognitive functioning, (3) providing cognitive quiet, especially that produced by soft fascination when it allows us to process long-standing 'cognitive residue' and finally (4) offering an opportunity to engage with the 'examined life' in the form of time to reflect, reassess and review one's priorities.[23]

It was this last element that came as a surprise to the Kaplans. It turns out that it is an aspect of the restorative experience they would never have suspected 'had it not emerged so clearly in our data'.[24] They described the kind of space which supports personal reflection as like the sacred grove which appears in many religions: a quiet forest clearing where sunlight pierces the tall trees and the only sounds are birdsong and the whispering of leaves in the gentle breeze. By coincidence or not, this could be a description of Walden Pond as we like to imagine it, with the noise of the railroad and the bustle of the nearby town edited out. It is, in fact, the perfect place to practise mindfulness.

FIGURE 6.2 *Joy of Tech (Joy of Tech comic by Nitrozac and Snaggy, © 2012 Geek Culture.)*

As we saw earlier, many West Coast technology companies have already embraced the practice of mindfulness and other techniques such as yoga and tai chi (Figure 6.2). Their staff are not always appreciative, however. In 2012 a Facebook employee complained about a yoga teacher who openly disapproved of the employee using her cellphone while in the *ardha chandrasna*, or half-moon pose, in class. The teacher, Alice Van Ness, was subsequently fired by the agency which employed her to provide the service to Facebook for 'saying no to a Facebook employee',[25] but she has found that the consequent publicity was great for business and brought many new clients attracted by her instruction to turn off their cellphones during a yoga session. The fact is that people want that sacred grove, even though it is not always easy to find. Steve Jobs meditated regularly for most of his adult life but was seldom calmed by it, and yet his Zen sensibility was crucial to his technological vision and can be seen throughout Apple's design personality (with the exception, perhaps, of that skeuomorphic calendar).

In *The Distraction Addiction* Alex Soojung-Kim Pang reminds us that 'we want our technologies to extend our minds, and augment our abilities, not break up our minds'.[26] Fortunately, 'the ability to get such control is within our reach', he says. 'Rather than be forced into a state of perpetual distraction, with all the unhappiness and discontent such a state offers, we can approach information technologies in a way that is mindful and nearly effortless, and that contributes to our ability to focus, be creative, and be happy.'[27] A long-time meditation practitioner himself, Pang interviewed a number of Buddhist monks and nuns who combine a life online with meditation and retreat. Several are forest monks living in remote places where they spend a considerable amount of time on the internet. 'Like the early Christian desert fathers', explains Pang, 'forest monks seek an especially pure, ascetic way of life; none of the luxuries of monasteries, towns, or other people for them. They sleep four hours a night, meditate for eight, and follow the 227 rules that guide every aspect of monastic life.' Some also spend a lot of time on the internet. For example, Bhikkhu Samahita lives in Cypress Hermitage, a small whitewashed house 4,200 feet above sea level in the mountains of central Sri Lanka, where he alternates between meditative solitude and surfing the web on his laptop for four or five hours a day from a room with spectacular views of the surrounding forest. But after interviewing Samahita and several other monks, Pang found himself rather frustrated at their inability to answer his questions about distraction. 'Can a person who spends four or five hours a day online really NEVER mindlessly surf the Web?' he asked each in turn.[28] It seemed, he thought, that they did not understand the question, but eventually he realized the problem. As they saw it, the responsibility for distraction lies not in the technology, but in the user. A puzzled Samahita finally grasped what Pang was asking him and explained that whether distraction has its roots internally, in memories or flashbacks for example, or externally, in the world as a whole, or computers, or TV, 'it has to be dealt with accordingly'.[29] 'All distractions are the same', Samahita said. 'It doesn't matter where they come from.'[30]

Buddhist nun Damchoe Wangmo, one of 5,000 students at the Namdroling Monastery in south-west India, echoes this view. She spends a lot of time online, writing a blog and running an online community for prospective students. In her view it is wrong 'to assume that "distraction comes from outside influences rather than inner mental conditions . . . If you start with a distracted mind, the ping of your cellphone and buzz of the Web will tug at that distraction, but they don't cause it. Distraction doesn't come from the outside world to affect a mind that's untroubled. The normal, everyday mind generates plenty of its own distractions"'.[31] In Buddhist lore this is known as the monkey mind, the clattering cacophony of dozens of monkeys jumping

around in your head clamouring for attention. 'It's useless to fight with the monkeys or to try to banish them from your mind because, as we all know, that which you resist persists' writes author B. J. Gallagher. 'Instead, Buddha said, if you will spend some time each day in quiet meditation – simply calm your mind by focusing on your breathing or a simple mantra – you can, over time, tame the monkeys.'[32]

Pang concluded that despite all our complaints about being victims of technology, the responsibility of managing our own distraction lies squarely with us. 'You are the inheritor of a contemplative legacy that you can use to retake control of your technologies, tame the monkey mind, and redesign your extended minds,' he writes. 'Connection is inevitable, distraction is a choice.'[33] His interest in the problem of distraction is echoed in many quarters along with the more general problem of how we might make peace with our technologies. As we settle into a pervasive digital world, events like the *Wisdom 2.0* conference, held annually in San Francisco, are becoming increasingly popular. *Wisdom 2.0* addresses what the organizers call 'The great challenge of our age: to not only live connected to one another through technology, but to do so in ways that are beneficial to our own well-being, effective in our work, and useful to the world.'[34] *The Huffington Post* addresses the same set of anxieties in a regular section called *GPS for The Soul*. On a random visit I found articles on the benefits of meditation,[35] a piece on how to create a '1-minute Mini-Escape',[36] and a slideshow of places where readers have found peace (bursting sunsets, mystical forests and luscious landscapes).[37] The techno-spirituality which was once popular only among counterculture subscribers to *Shambhala Sun* is now gaining many new followers as it offers traditional solutions to new problems such as directed attention fatigue.

Another topic which has been gradually gaining ground is the notion of slowness inspired, perhaps, by the slow food movement. Fast is not always best, say the proponents of slow. In 2009, *The Wall Street Journal* ran a piece by John Freeman in which he complained 'The boundlessness of the Internet always runs into the hard fact of our animal nature, our physical limits, the dimensions of our cognitive present, the overheated capacity of our minds.'[38] 'We need to uncouple our idea of progress from speed', he proposes, pointing out that 'We are connected, yes, but we were before, only by gossamer threads that worked more slowly.'[39] So, 'Don't send'[40] he begs, parodying the usual email command.

Sociologist Nathan Jurgenson sees the problem differently. Unlike Freeman, who was born in a pre-digital world, his is the voice of a generation who grew up with the internet and all its devices. 'While eating, defecating, or resting in our beds', he writes, 'we are rubbing on our glowing rectangles, seemingly lost within the infostream'.[41] He decries what he calls 'digital dualism' – 'the

habit of viewing the online and offline as largely distinct'.[42] Jurgenson's dislike for 'digital dualism' is not new, as can be seen from numerous quotations in this book which emphasize a digital/physical symbiosis, but his approach is refreshing. He too is a fan of slowness, seeing it as part of the broad ecology of the digital. In a blog post called *The IRL Fetish* (IRL is an old-fashioned internet word meaning In Real Life), he deftly erases the boundaries between online and offline – 'Social media is more than something we log into; it is something we carry within us'[43] – while at the same time reassuring the reader that although in the future we may never be able to fully log off, 'this in no way implies the loss of the face-to-face, the slow, the analog, the deep introspection, the long walks, or the subtle appreciation of life sans screen.'[44]

It is this blending of the virtual and the real that Jurgenson's generation see not as an ecstatic upload of the mind, as early netheads did, but as a practical lived reality which is 'the result of the constant interpenetration of the online and offline'.[45] We have been taught, he writes, 'to mistakenly view online as meaning not offline'. But 'the notion of the offline as real and authentic is a recent invention, corresponding with the rise of the online. If we can fix this false separation and view the digital and physical as enmeshed, we will understand that what we do while connected is inseparable from what we do when disconnected.'[46] The notion of such a 'mesh' is popular elsewhere. As we saw earlier, Tim Berners-Lee considered it as a name for what would eventually become the World Wide Web, while for ecocritic Timothy Morton it is a key element of our ecological future, 'a vast sprawling mesh of interconnection without a definite center or edge'.[47]

The ability to adapt and collaborate will be important too. The *Institute for the Future* predicts that over the next decade a fusion of globalization and connectedness will make us increasingly adaptive. 'People in search of well-being', they say, 'will pragmatically integrate practices from multiple traditions'.[48] And we will achieve that partly by moving 'from do-it-yourself to doing-it-together' as we work to rebalance our lives. With that in mind, let us turn our attention to practicalities. How can we, to use Thoreau's term, live deliberately in this connected world?

Practicalities

> A tree gives us comfort not because its branches and leaves are formed in perfect and predictable order, but because it is unique within a larger, unseen pattern – like us.
>
> RICHARD LOUV, author[49]

When I began this research journey in 2004, I set out to collect examples of metaphors and images of the natural world which are commonly found in computer culture, programming and design; to find out why they are there, and to see what can be learned from them about the intersections between human beings, cyberspace and nature. It was a long and complicated voyage of discovery involving much stumbling between disciplines as I searched for synergies. I studied scientific research on the restorative effects of biophilic environments, looking at the ways in which this research is being tested and implemented through biophilic design practice, and matching what I learned against what I already knew about digital life. I was often bewildered by the mass of evidence until I finally realized that the story had been right in front of me the whole time.

It is in front of you too. It can be found in the images on our machines, in the spaces we cultivate in our online communities, and in the language we use every day of our digital lives. It began the moment we created Arpanet and it offered up cyberspace. We instinctively moved into that alien and shape-shifting territory as if it were just another survival challenge, but the experience prompted a resurgence of biophilia, that ancient call to life, and nourished it into growing a new spur, a hybrid through which nature and technology become symbionts rather than opponents. Technobiophilia is a clumsy word, probably not quite the right one, but for now it helps to spell out what is happening so that we can understand it better.

The question is, how can we build upon this new insight? How can we harness and develop our technobiophilic instincts in order to live well in the digital world? Below, I offer some suggestions for how we might put the biophilic tendency into conscious practice as part of our online lives. They are drawn from recent scientific research and from simple observations of the way we already behave, but they are untested and intended only as a tentative beginning to be modified and improved upon.

Let us remind ourselves of the restorative settings developed by the Kaplans and discussed in Chapter 2. Remember that they are designed to make us aware of *nearby nature* through small suggestions of the natural world which, although seemingly insignificant and often out of physical reach, can play a powerful role in human well-being. Nearby nature can be found, for example, in the images and sounds with which you choose to personalize your technologies; in the objects that remind you of the natural world such as plants, window views, beautiful craft objects, and in regular practices such as meditation, walking or gardening. Once again, the four restorative settings are:

1. *Being away*: a chance to escape to a place which is completely different from our everyday.

2. *Extent*: the promise of a continuation of the world beyond what is immediately perceived
3. *Soft fascination*: calling up the capacity for involuntary attention in order to get some respite from directed attention.
4. *Compatibility*: ensuring that our environments resonate with our personal inclinations and preferences.

Even the briefest applications of one of these settings is likely to be beneficial. Try consciously inserting them between the micro attention shifts described by Howard Rheingold. Customize them to your personal preferences and use them as a starting point for your experiments. I have divided my suggestions into three groups: Indoors, Outdoors and Online.

Indoors

1. Pay attention to the view from your window

I wrote most of this book at home in a cottage in the English Midlands, sitting in front of a window overlooking a small courtyard containing potted plants. I had arranged the plants so they looked good when you were in the courtyard, but my window looked out onto only part of it, so most of the time I could not even see the beautiful greenery I had curated. The view from my desk featured only a single white clematis bush; clematis is a deciduous climber which booms gloriously for a few months and for the rest of the year looks like a drooping clump of dead sticks, and I was so deep in my work that I did not even notice the paucity of my view. It was only towards the very end of my research that it suddenly dawned on me that all the plants I had spent money and time on were at the other end of the courtyard and invisible from my window. Feeling rather foolish, I realized that not only would a simple rearrangement of the pots bring colour and greenery into my view all day long, but they would also be a working application of biophilic design. I moved them right away and now as I write I can raise my eyes and enjoy brilliant red geraniums, multi-coloured mesembryanthemums opening to the sun and a succession of other beautiful and renewing greenery. So here is the first issue to consider – what kind of view do you have from the places where you work and relax?

2. *Ornament your picture windows*

One aspect of my window view which was already biophilic was the fact that I was living in an old country cottage where the mullioned windows of the sitting room had eight panes apiece (Figure 6.3). According to architectural designer Kent Bloomer, the large picture windows we so enjoy and which reinforce that sense of bringing the outdoors indoors are actually provoking a damaging level of cognitive dissonance. This is because, he explains, 'we possess a psychological boundary around our bodies (and by extension around our houses) that divides, or separates, our sense of a personal, possessed interior space from an exterior extra-personal space.'[50] This boundary is vitally important to our experience of the world because it conditions our perceptions of the environment; it appears at places of entry and exit, providing visual information about 'social rank, safety, cultural belief and the occupants' relationship to nature'. Passing through the boundary indicates the near-possibility of touching and that haptic experience is, says Bloomer, 'fundamentally critical in establishing a firm connection, a "contact" with the natural environment. Yet', he goes on, using italics for emphasis, '*touching is precisely what is negated by the pure picture window!*'[51]

FIGURE 6.3 *Cottage window (Sue Thomas ©2013)*

His solution is to make the boundary more obvious, not less, by investing in 'the liminal transitional space of the window' and using different tactile ornamentations to emphasize the threshold. By touching them, or being able to imagine touching them, 'you may heighten your sensual association with the world outside'.[52] Examples of such interventions include thicker or tinted glass, mullions connecting small panes, old-fashioned bottle-glass, leaded and stained glass, or even just patterned curtains or blinds. You can also buy large transfers of life-sized flowers and shrubs to stick onto picture windows, and various kinds of sun-catchers and mobiles to hang in front of them. All of these can establish a 'visible and touchable moment of mediation between inside and outside'.[53] If that sounds a little far-fetched, consider this: Bloomer ends by pointing out that the 'naked' picture window 'provides a sanitized vision and might even promote a false feeling of fulfilment predicated upon an *illusion* of experiencing and being connected to the natural environment'.[54] His proposition does not seem to have been scientifically tested, and it rather contradicts the research into window and screen views discussed earlier, but it is an interesting thesis and worthy of some experimentation.

3. *Use indoor plants to your advantage*

As any interior designer knows, many of the visual and tactile benefits of plants can be obtained by displaying them indoors and close by. Interior landscaping company *Ambius*, for example, advises on the application of biophilic design to work environments and sees interior plants as an important way to obtain measurable sustainable benefits. If your workplace makes it possible, for example if you have a home office or work in a corporate building, it might not be difficult to apply their suggestion of adding a mixture of different plant species and sizes to your workplace. They recommend assorted arrangements, and in several small arrangements rather than one big one.[55]

Are some plants better than others? The question of which plants to include in your technological workspace was addressed in 1989 by a joint research project between NASA and the Associated Landscape Contractors of America (ALCA).[56] Their results, which have been widely quoted, conclude that the plants which are most effective in removing formaldehyde, benzene and carbon monoxide from the air are as follows:

- Bamboo Palm – Chamaedorea Seifritzii
- Chinese Evergreen – Aglaonema Modestum
- English Ivy – Hedera Helix
- Gerbera Daisy – Gerbera Jamesonii

- The Dracaena family, especially Janet Craig, Marginata, Massangeana and Warneckii
- Mother-in-Law's Tongue – Sansevieria Laurentii
- Pot Mum – Chrysantheium morifolium
- Peace Lily – Spathiphyllum

These plants were selected not for their beauty, tactile qualities or aromatics, but for their abilities to clean our office air. However, they are a useful list to take with you when you visit the garden centre, and a good point with which to begin the search for plants to add to your digital environment. If they feel good to the touch, look gorgeous and smell wonderful, that is even better.

4. Connect with animals

Does your dog sit disconsolately beneath your feet as you type? If you have a pet, the animal world is right there with you but do you really appreciate it, or do you spend more time looking at cute kittens online than stroking your own cat, playing with your puppy, or cleaning out the rabbit? The human/animal connection is at the heart of biophilia. Researchers Katcher and Wilkins worked with groups of children where they found that an intense interest in animals 'was common across the board',[57] even down to whether the children were cruel to them or took care of them. 'Children who throw stones at birds and children who feed birds are both responding to what may be an innate tendency to focus their attention on living things,' they wrote. Working with a group of boys aged 9 to 15 who had a range of attention-deficit and hyperactive disorders and lived in a residential home, they noted powerful positive effects among the children who participated in a nature education which included access to a collection of small animals they called the 'zoo'. After 6 months' exposure to the zoo the researchers found positive improvements in the children's behaviour and interpersonal relationships. They concluded that 'If biophilia exists, then it most probably exists as a disposition to attend to the form and motion of living things and, for animals at least, incorporate them into the social environment.'[58] And of course the positives extend to adults too. As we saw earlier with Roger Ulrich's work on the benefits of placing aquariums in dental waiting rooms, there are measurable physiological consequences of paying attention to animals. Perhaps it is not such a bad idea to take your dog to work, as some Silicon Valley companies (Google and Tagged among them[59]) allow their employees to do.

5. *Consider biophilic computer kit*

We have already seen the cypress wood mobile phone, but beyond it there seem to have been very few attempts to produce computer hardware influenced by biophilic design. The Swedish company Swedx makes (Figure 6.4) wooden keyboards, mice and monitors, and in 2012 the US company iZen launched a range of bamboo keyboards, iPhone cases and other accessories. Urban Factory, based in France, produces a bamboo mouse-pad, keyboard and USB stick. In 2012 New York-based Robbie Tilton designed a keyboard made with organic materials:

> Natural Keyboard is a wireless computer keyboard designed to be sustainable and is built of organic materials. The body and keys are 100% wood and the frame is covered in imitation moss. The textures serve as a tactile sensation while visually defying the standard aesthetic for modern technology products. In concept – the frame must be watered nightly to allow the keyboard to fully bloom.[60]

It is not yet in production – quite possibly the ambition outweighs the practicalities – but it is worth watching just in case. Nevertheless, the current lack of these kinds of products offers not just an enormous business opportunity for those so minded, but also inspiration for individual users. Why not modify your existing plastic stuff by adding home-designed biophilic features? A Kent Bloomer-inspired ornament around the 'window' of your screen, perhaps?

FIGURE 6.4 *XM1AS1 USB optical mouse, Ash Wood (Swedx)*

Outdoors

1. Go outside

In his best-selling book *Last Child in the Woods*, author Richard Louv coined the term 'nature-deficit disorder' to describe 'the growing gap between children and nature'.[61] But nature-deficit is also a problem for adults, and in 2012 he followed up with *The Nature Principle: Reconnecting with life in a virtual age*[62] which holds that 'a reconnection to the natural world is fundamental to human health, well-being, spirit, and survival.'[63] Louv does not take an anti-technology stance, although he does admit to being concerned that 'Our culture's faith in technological immersion seems to have no limits, and we drift ever deeper into a sea of circuitry.'[64] But he makes some very useful suggestions for harnessing social media and other technologies to support projects like family nature clubs, where neighbourhood families come together to design monthly adventure schedules and in at least one case even design their own smartphone app. Louv focuses on North American participants, but the groups he met are very similar to the British Geeks in the Peaks campers we met in the first chapter. And such clubs do not have to be family-led; he encountered plenty of all-adult groups too. There is no space here to cover everything Louv discusses but *The Nature Principle* is recommended as a book which is informative, practical and not dismissive of our love of technology. In many ways, his message can be summed up quite simply. It is just: go outside. And his concern is reflected in the geek community. Kate Freeman of technology magazine *Mashable* listed going outdoors as one of her recommended New Year resolutions for 2013, advising 'Get outside. As much as we love our gadgets, getting fresh air and human interaction should be a high priority. Don't stay glued to your laptop or tablet all the time.'[65]

Incidentally, biophilia research often focuses exclusively on green places, but watery places are also highly rated as restorative environments. Seasides and lakes, for example, are well-established locations for convalescence and general well-being, yet they seem to have received little attention from researchers investigating restorative environments. As Mathew White and his colleagues noted in 2010 'Whereas aquatic features (rivers, lakes, coasts) are frequently present in visual stimuli representing natural environments, they are rarely incorporated in stimuli portraying built environments.'[66] One exception can be found at The Blue Gym project based at the European Centre for Environment and Human Health in Cornwall in the United Kingdom, and the place where White himself conducts his research. The team aims to capture evidence about how natural water environments (including the coast, rivers, lakes and inland waterways) can be utilized to promote human health and

well-being. As we have seen earlier, watery metaphors abound in internet culture. The synergies are well worth exploring.

2. *Create an outdoor office*

Author Howard Rheingold, leading chronicler of the digital revolution, has a reputation for being thoroughly wired, but since the coming of wifi much of his online time occurs simultaneously both in cyberspace and in his garden. 'Most people know me from cyberspace and assume that I live there,' he told me. 'I do spend many hours a day online, but what they don't know is that my body is sitting outside, with my bare feet in contact with the earth. I don't know that I could live in any other way.'[67] At his home in Mill Valley, just north of the Golden Gate Bridge, his outdoor office is a spacious wooden chair between a hydrangea bush and a sprawling plum tree, and when the weather is not warm enough to work outside, he writes about online community in a study overlooking the garden with a door leading directly into it. Every afternoon he takes his dogs for a walk up nearby Mount Tamalpais or to the adjoining John Muir Park, and if you visit at that time you will quite likely be invited to join him to walk and talk. It is all about creating the right combination of online and offline life.

But going outside does not always mean energetically tramping up mountains, and we do not all live in the balmy climate of California. Nevertheless, it might still be possible to work outdoors for part of the year. In a previous home, I built a covered area just outside my back door, big enough for a table and chairs, and with climbing plants twining around the supports. It was open to the air but protected from the rain and provided a comfortable green environment where I could work late into the night if I wished. In my current house, a rural English cottage, I have just a simple bench and small table in the courtyard. They are uncovered and provide shade for only half the day, but I have surrounded them with pots of scented herbs and, this summer, a profusion of intensely coloured red nasturtiums and orange Black-eyed Susie climbers have entangled themselves into the furniture. When I take my laptop out there to work, I also bring along a woven rug and some cushions for the bench. At night, I light candles and write by the glow of the screen. This idyll is of course always subject to the British weather but I try to work outside as much as I can.

So my suggestion is to experiment with creating your own outdoor office in your garden or conservatory, on your balcony, or any other outdoor space to which you have access. If your wireless signal reaches it, fantastic, but if it does not, just tailor your outdoor digital life to offline applications, games, e-book readers and so on. Pay some attention to creating a design which is

green, sensory and tactile. Go barefoot if you can. Use those micro restorative moments to touch the environment around you, tending the plants, rubbing their aromatic leaves between your fingers, picking off dead flowers. And pay attention to the wildlife, to the birds and insects going about their business around you. Have you ever taken the time, while labouring on that boring report, to watch a spider weave a web? Raised your head and gazed for a moment at the clouds scudding by above you? Indoors or outdoors, your office does not have to be sterile and businesslike. It can be green, nourishing and energizing. This is not self-indulgent. As research by Marc Berman and others has shown, access to nature definitely improves cognitive functioning and could even increase your productivity.[68]

3. *Grow*

Try to grow plants if you have the space. Anything from a window-sill or balcony to a full-sized allotment will do. Join a local gardening cooperative, or do something more adventurous and try guerrilla gardening, which involves planting in unusual public places in need of some brightening up. 'There is neglected orphaned land all over the place' writes the anonymous gardener behind *GuerillaGardening.org.* The website hosts a global community of individuals whose mission is to cultivate empty areas of land, however small. In 2012, *International Sunflower Guerilla Gardening Day* gave rise to sunflowers appearing overnight in front of the European Central Bank in Frankfurt, in Westminster in London, down a street in Bologna and on the central reservation of the A1 motorway near Bedford, UK. Social media is key to guerrilla gardening, since an important element of it is about sharing what you have done and encouraging others to get involved, so make sure you tweet about it afterwards.

4. *Use public spaces*

Residents and visitors to Paris have recently been given the opportunity to log on at a free WiFi station in the middle of the street (Figure 3.5). The *Inhabitat* website reports that designer Mathieu Lehanneur collaborated with outdoor advertiser JC Decaux to tap into an underground fiber optic network in order to create a haven of peace available to everyone, and with free wifi too. Located at the Rond Point des Champs-Elysées, *Escale Numérique* (which translates as Digital Break) is protected by a sustainable green roof covered with plants and supported by a cluster of wooden poles. It features concrete swivel seats with mini tables and plugs on their base. There is also a large

FIGURE 6.5 *Digital break, JC Decaux (Photo: Felipe Ribon)*

touch screen, looking something like a gigantic smartphone, that provides updated information about services in the city for visitors or those without their devices. Lehanneur likens the project to the 'Wallace fountains, which since the end of the 19th century have offered Parisians the free drinking water which was circulating beneath their feet. *Escale Numérique* allows everyone to benefit, like a real public service, from a high-speed WiFi connection by raising it from beneath the ground'.[69]

City parks and other public green spaces can provide good places for combining your digital life with being outdoors and perhaps also being sociable in a face-to-face way rather than through mediation by an online community. This kind of suggestion sounds ludicrously obvious, but many of us are so locked into switching between work/relaxation silos that we do not see that combining them might soothe our digital isolation.

5. *Meet people*

Remember the symptoms of Directed Attention Fatigue (DAF) discussed in Chapter 2? If you are too good at concentrating and cutting out external distractions you might become overwhelmed and unable to cope. DAF can make you irritable, intolerant, aggressive and insensitive to social cues. Needless to say, it can seriously affect your ability to get on with people. I was reminded of this when I came across a 2008 marketing video from *Meetup*,

a company which facilitates networks dedicated to organizing meetings for over 11 million like-minded people around the world. The animation, called *Unplug your Friends*,[70] features a solitary individual surrounded by computers and phones in a dark windowless room. Absently surfing the web, he comes across the *Meetup* website and realizes that by lifting up the computer screen he can crawl through it into a dark tunnel he has never seen before. It leads into a sunlit park where many groups of people are gathering – one group is hula-hooping, another is for people with tails ('Tail Pride'), others are for kite-flying, yoga, robotics and public speaking. The video ends as our now smiling hero sets off to join a group, and an online form appears on the screen. 'Send an Intervention Email to your screen-addicted friend'[71] it suggests, while drop-down menus offer various humorous encouragements to engage them. This appealing little film sends a powerful message about the importance of face-to-face connection.

6. Go geocaching

Geocaching is a real-world, outdoor treasure hunting game using GPS-enabled devices. Participants navigate to a specific set of GPS coordinates and then attempt to find the geocache (container) hidden at that location. It is the perfect activity for geeks wishing to combine going outdoors with playing on their phones. You can do it alone or in teams. The latter is much more fun. Visit www.geocaching.com for detailed information on how to get involved.

7. Try forest bathing

Alone, or with others, you could take your technology into the trees. *Shinrinyoku*, or forest bathing, was introduced by the Forest Agency of the Japanese government in 1982 and has attracted an increasing amount of attention among medical professionals who have been testing its efficacy in combating illness and supporting well-being. The idea is that by spending time in a forest – usually several hours – the visitor breathes in volatile substances, called phytoncides, which are produced by the trees and believed to have a number of therapeutic effects ranging from stress reduction to cancer prevention. The therapy also includes other sensory effects by stimulating vision (scenery), olfaction (smell of wood), audition (sound of running streams or the rustle of leaves) and tactility (feel of the surfaces of trees and leaves).[72] Dr Qing Li, a professor at Nippon Medical School and president of the Society of Forest Medicine, is the expert in the field. He and his team have published numerous papers on the physiological effects of forest bathing on blood

glucose levels, mood, stress, even cancer.[73] To date there seems to be no data on its relationship with technology but it would be interesting to try out forest bathing in a connected way, perhaps using Skype to share the experience with other friends in other forests across the world (networks permitting, of course), or perhaps by combining a visit to a real forest with a visit to a virtual forest.

Dr Li has issued advice on how to go about forest bathing. Here is an example from the Australian website *Healthy Parks, Healthy People* which reports Dr Li's view that 'forest bathing is possible anywhere in the world where there is a patch of decent forest'. He also says that 'while forest bathing it's not important to do heavy physical exercise, but rather one should enjoy the forest through the five senses: the murmuring of a stream, birds singing, green colour, fragrance of the forest, eat some foods from the forest and just touch the trees'.[74]

Dr Li's tips for forest bathing are:

- Make a plan based on your daily physical activity and do not get tired during the forest bathing.
- If you take whole day forest bathing, it is better to stay in forest for about 4 hours and walk about 5 kilometres. If you take a half day forest bathing, it is better to stay in forest for about 2 hours and walk about 2.5 kilometres.
- If you feel tired, you can take a rest anywhere and anytime you like.
- If you feel thirsty, you can drink water/tea anywhere and anytime you like.
- Please find a place in the forest you like. Then, you can sit for a while and read or enjoy the beautiful scenery.
- If it is possible, it is better to take a hot spring bath (a spa) after the forest bathing.
- You can select the forest bathing course based on your purpose.
- If you want to boost your immunity (natural killer activity), a three-day/two-night forest bathing trip would be recommended.
- If you just want to relax for reducing your stress, a day trip to a forest park near to your home would be recommended.
- Forest bathing is just a preventive measure for diseases; therefore, if you come down with an illness, I would recommend you to see a doctor – not visit a forest.[75]

8. Use your smartphone to enhance your outdoor experience

There are numerous smartphone applications to support and enhance your outdoor life. A search for wildlife and nature apps will generate many examples for bird-watching, insect, animal and plant identification, parks and forest finding, even an app for identifying animal scat. But do not rely on your smartphone to plot your route. In August 2012, 16 climbers who had done just that became lost in fog on the Scottish Cairngorms and had to be led down the mountain down by rescuers. At least they could use their phones to call for help.[76]

9. And of course – go camping

In Chapter 1 we saw examples of the many ways in which the combination of camping and technology promotes creative truancy and opens the doors to new kinds of collaboration and innovation. There are many options to choose from including glamping (glamorous, or luxury, camping with all mod cons), wild camping out in the open, or even joining the growing number of technomads who travel in camper vans and RVs. Other wilderness activities such as wild swimming, running and fell-walking are worth considering too, but a gentle weekend in the countryside with plenty of fresh air and lashings of mobile internet access can be equally beneficial ☺.

Online

1. Visit a virtual world

In Chapter 2 we looked at Marc Berman's experiments into the effects on attention of walking round a park as opposed to walking in an urban environment. Psychologist Deltcho Valtchanov has conducted a similar experiment in virtual reality rather than real parks and streets. He built three very different virtual environments. First, a nature island with waterfalls, rivers, different kinds of trees, flowers, plants, grass, rocks, a beach and dirt paths criss-crossing the landscape. The environment contained ambient nature sounds while simulated wind made the leaves sway and the water ripple. Second, an assortment of 3-dimensional geometric shapes including coloured spheres, cylinders, cones, and rectangular and square boxes of various sizes. There were no sounds beyond the virtual footsteps of the

user as s/he navigated the space. Lastly, a scale model of Shibuya station in Tokyo, a dense urban area unfamiliar to any of the participants and featuring realistic and full-scale buildings and streets. There was ambient city sound but no people or moving vehicles. He then recruited 69 undergraduate students (32 male, 37 female) who underwent a series of tasks similar to those used in Berman's study to stress and tire the participants. Afterwards, they were randomly assigned to one of the three virtual environments. Valtchanov had conducted similar tests before and was concerned that the restorative effects he had found earlier might have been caused by the virtual reality environment itself, so he designed this experiment to test that. It was apparent, however, that 'it is virtual nature that is responsible for the observed restoration and not virtual reality itself'.[77] The results showed that immersion in the computer-generated virtual reality nature space prompted 'an increase in positive affect (happiness, friendliness, affection and playfulness) and a decrease in negative affect (fear, anger and sadness). There were also significant decreases in levels of both perceived and physiological stress. Although the three environments had been carefully controlled to be as similar as possible except for their themes, only those subjects who were immersed in virtual nature showed improved responses across the board. Valtchanov and his colleagues concluded that encounters with nature in virtual reality have beneficial effects similar to encounters with real natural spaces.

As gamers reading this know, there are many virtual worlds which simulate natural spaces. One such place is Chakryn Forest in Second Life, 'a romantic hideaway filled with dense trees and secret locations' made by Andrek Lowell of Lowell Creations.[78] Although many Second Life locations are private, Chakryn Forest is open to anyone, so I logged in to try it. My experience is a good example of the skills required for meaningful interactions in Second Life – skills I confess I have not yet acquired.

I found myself standing on a green forest floor close to a narrow stream where gentle splashes indicated the presence of fish or other creatures. The air was full of soft music and distant wordless singing which complemented the birdsong all around. Bright motes of light drifted down between the beams of sunshine penetrating the forest canopy high above, and around me stood the trunks of giant redwood trees towering towards the sky. It felt rather like being in the film *Avatar*. As I wandered on the springy turf, I noticed that the stream had broadened out into a fast-running river. Could I swim in it, I wondered? The prospect felt rather daring, especially since I am not very experienced at getting around in Second Life, but I walked my avatar forward and headed into the water until I was waist deep. I was not swimming, just standing up as if I were on solid ground (Figure 6.6).

FIGURE 6.6 *Chakryn Forest (thomtrance.otoole)*

I consulted the How To button and found instructions on how to fly, but none on how to swim. Minimizing the application, I opened my browser and Googled 'How do you swim in Second Life?' The answer took a while to find and turned out to be quite complicated. It depends, apparently, on whether the substance you want to swim in is 'Linden water' or 'prim water'. I knew that Linden is the company which produces Second Life, so guessed the first must be some kind of default. But 'prim'? More looking up before I discovered that a 'prim' is a single object shape, such as a box or a cylinder, from which more complex shapes are constructed by adding more properties, meaning presumably that 'prim water' is home-made and may be faulty. Then I found that the best way to swim in either water is to obtain a 'hud' for swimming. But what is a hud? Another search.

> A heads-up display (HUD) is a two-dimensional user interface element that controls inworld elements, such as your avatar or animations. A HUD typically consists of a control panel with buttons that do certain things; you activate it by 'wearing' it as you would an article of clothing.[79]

Ah! OK. I find a HUD for sale in the Second Life Marketplace, the *Swimmer 2.06 from Waterworks*. It costs L$400 (Linden dollars) or US$2.01, and would allow me to float, dive or swim in either kind of water 'because realistic water calls for realistic buoyancy'.[80] I am tempted, because by now I am longing to immerse myself in this magical river, but I am too much of a novice to know how to install it; as it is, I can barely stagger across dry land in Second Life. But wait, the music coming from behind the search page reminds me that for

the last 10 minutes I have been surfing the web trying to figure out how to swim while behind the browser my avatar has been standing in the shallow edge of a stream waiting for me to reinhabit her. I flick back the window to find her repeatedly twisting around like a zoo animal made neurotic by its imprisonment and hopping from foot to foot (this is because I do not know how to make her stand still). Then I notice what looks like a small hut in the distance and I am curious to explore but on the other hand the search for how to swim has been so disruptive to my attention that I have rather lost interest in Chakryn Forest. I decide to log off and come back again when I have time to learn more about how to get around. And therein lies the rub with most virtual environments. You have to know how to use them, and this does not come easily. It takes time to acquire the necessary knowledge and I would probably have fun doing it, but that is a very different cognitive experience from the meditative forest bathing I had come to Chakryn Forest to enjoy. Regretfully, I leave my avatar knee-deep in the water and log out. The gentle music stops abruptly but I know she will still be there when I come back, no matter how far in the future that might turn out to be.

2. *Play a video game*

Many video games feature evocative natural landscapes as part of the story world. *Flower* is an example of something a little unusual. It is a Sony PS3 strategy-simulation game which was designed by Jenova Chen to tap into our love of nature. It is, says Kellee Santiago, President of *thatgamecompany*, 'a videogame version of a poem which asks something different of the player'.[81] The story begins with a simple flower on a city windowsill which leads the player into the exploration of a complex outdoor scene and the unfolding of the story. *Flower* is intended to be unlike other video games: 'There's no score, there's no time-limit,' explains Santiago. But it does not seem to be much like nature either because 'There's no death'[82] she adds brightly, as the player swoops in pursuit of a swarm of unrealistically bright coloured petals. In fact, the game is a biophilic moment of soft fascination for players whose usual fare is something much louder and more violent. With gentle music but no text or dialogue, it is billed as a 'visual, audio and interactive escape' which 'exploits the tension between urban bustle and natural serenity. Players accumulate flower petals as the onscreen world swings between the pastoral and the chaotic. Like in the real world, everything you pick up causes the environment to change. And hopefully by the end of the journey, you change a little as well.'[83] *Flower* has won plaudits for the originality of the experience it offers to games enthusiasts who praise its restorative effects. Reviewer Neon Kelly notes, for example, that 'The sheer rush of colour recalls Sony's

own Bravia TV adverts, but *Flower* very much has a feel of its own – a tone that is gently soothing and yet keenly uplifting.'[84]

3. Add biophilic design to your online spaces

We already apply biophilic design practices to our offline spaces but what about biophilic virtual architecture? You might consider redesigning your own online places along biophilic lines. Some social networks are design-restricted, such as Facebook which has us all locked in to a dreary office blue, but plenty of other social media sites offer tools with which to personalize the look of profiles and homepages. You may already have created biophilic online spaces without realizing it, but now you can design with more deliberate intention. And if you live far away from loved ones but connect with them online, give some thought to designing the space where you connect. Is it really necessary to always Skype with a messy bookcase or half-open door in the background? You could provide a much greener – or bluer – location to meet your distant loved ones. Or build a meeting place in Second Life or other virtual world or online game. There are many possibilities to try.

4. Sample some next nature

Next nature, or culturally emerged nature, is 'the nature caused by people'. 'That may sound like a contradiction', writes Next Nature editor Koert van Mensvoort, 'but it isn't. Our cultural artifacts have become so intricate and autonomous that they function more like organisms or ecologies than like inanimate things.'[85] Mensvoort and his team aim to 'radically shift your notion of nature. Our image of nature as static, balanced and harmonic is naive and up for reconsideration. Where technology and nature are traditionally seen as opposed, they now appear to merge or even trade places.'[86] The provocative and inspiring Next Nature website makes you think about what we used to imagine was 'the balance of nature' in new and different ways. It does not especially address biophilia – a search for the term returned only one mention on the site – but many of the projects discussed intersect with it, and can inspire you to design your own projects. See, for example, the Botanicall, a houseplant that calls your mobile when it needs more water or light;[87] acoustic botany, plants that produce sounds, growing 'big shapes filled with gas produced by special bacteria';[88] and streetlight trees with leaves infused with gold nanoparticles which cause the chlorophyll to produce a reddish luminescence and light the surrounding area.[89] You might consider adding some next nature features to your biophilic environment.

5. Go offline

Another way to experience online is to spend some time offline and be mindful of the differences. Try, for example, a digital detox vacation in the Caribbean nation of St Vincent and the Grenadines, where travellers are challenged to leave their smartphones, tablets and other gadgets behind as a part of their vacation package. The organizers also provide a guidebook explaining how to function on a trip without tech, and even a life coach to help you through it.[90] Or you could install an app for getting away from your computer. *Freedom*[91] works by cutting you off from the internet for up to 8 hours at a time, although it does not seem to affect your mobile phone, which seems rather pointless for those with smartphones. Its sister app *Anti-social*[92] is kinder – it allows you to stay online but blocks all social media sites. Or, like William Powers, you could go for the full-blown Digital Sabbath. In *The Distraction Addiction* Alex Soojung-Kim Pang offers a detailed and helpful guide. Here is a to-do list condensed from his instructions:

- Set a regular time.
- Schedule either a full waking day or a 24 hour period.
- Figure out what to turn off. Do this ahead of time.
- Don't talk about digital Sabbaths.
- Fill the time with engaging activities.
- Be patient.
- Be open to the spiritual qualities of the Sabbath.
- Enjoy your escape from 'real time'.[93]

The Digital Sabbath is not for everyone. Personally I prefer to be bathed in wireless all the time, but it would be an interesting experience, and many have found it very rewarding.

6. Be mindful of your technology footprint

Being mindful about biophilia must inevitably lead to a heightened awareness of environmental issues. In 2006 Fred Turner pointed out that 'behind the fantasy of unimpeded information flow lies the reality of millions of plastic keyboards, silicon wafers, glass-faced monitors,

and endless miles of cable.'[94] All of these technologies, he reminds us, 'depend on manual labourers, first to build them and later to tear them apart'.[95] In 2011, the American entertainer Mike Daisey presented a sell-out one man show about the working conditions in Apple's factories in China. But an investigation by the radio programme *This American Life* found that Daisey's story contained numerous fabrications and he was forced to retract it.[96] Yet the furore caused by the show did have a noticeable impact on the technology industry and in January 2012 Apple announced its intention to become the world's first fair trade electronics company. Tom Foremski of the Silicon Valley Watcher blog wrote 'This is exactly the course of action Silicon Valley Watcher campaigned for in May 2010, following a large number of suicides at Foxconn, one of Apple's most important suppliers of manufacturing services.'[97] In 2010 he issued a challenge to technology companies who outsourced their manufacturing processes: 'Let's not forgot that those bright, sanitized work places, those clean work clothes, and filtered air conditioning, is not for the workers,' he writes, 'it's to protect the electronics from the humans. The wages are poor and the work is gruelling.'[98] But Apple may not win the race. The campaign organization Greenpeace produces *The Greenpeace Guide to Greener Electronics*, which they claim has been the internet's most trusted green electronics ranking since 2006. It ranks 15 leading mobile phone, TV and PC manufacturers on policies and practices to reduce their impact on the climate, produce greener products and make their operations more sustainable. As of August 2012 HP were in the lead, with Apple ranking fourth.[99] The top five that month were:

1 HP

2 Dell

3 Nokia

4 Apple

5 Phillips

7. Share #technobiophilia

Finally, this is a new and expanding area and it needs debate. Share your own experience and critiques, your experiment reports, misgivings and enthusiasms on whichever social platform suits you best. Tag it #technobiophilia or even just #biophilia.

Last thoughts

To end where we began, the problem with new technology, especially cyberspace, is that we love it. We love it and we fear that we love it too much, to the extent that we are constantly torn by passion and guilt in equal measures. But once we begin to understand what drives us we might, perhaps, be ready to make our peace with technology. During the course of research for this book I learned that the biophilic tendency pushes human beings to seek life everywhere, even in cyberspace. As a result, we have created elements of nature in virtuality where they did not exist before, and the fact that they can now be encountered throughout our digital lives seems to help soothe our connected existence. I have found that such restorative experiences can stimulate innovation and creative truancy, and that today there is a real opportunity to take the principles of biophilic design which are increasingly being applied to our physical surroundings and use them to enhance our technological environments, both in virtual space and in hardware design.

Eco-philosopher David Abram has written that 'Despite all the mechanical artefacts that now surround us, the world in which we find ourselves . . . is a living field, an open and dynamic landscape subject to its own moods and metamorphoses.'[100] But he has misunderstood. Millions of us are not simply *surrounded* by the mechanical artefact of the internet, we are *immersed* within it. It is actually *because of* the machine that the living field has been multiply extended. We navigate through cyberspace just as we might make our way in a forest; we build a homepage as we might lay out a garden.

So here we are, poised at a moment of crucial tension. Do we embrace cyberspace as part of the natural world, with all of its opportunities and flaws, or do we keep it at arm's length, as an unnatural guilty pleasure we should not really enjoy? Edward O. Wilson believes that this dilemma has been embedded in the human mind since the earliest days, a perpetual suspension 'between the two antipodal ideals of nature and machine, forest and city, the natural and the artifactual'.[101] In those terms, the internet is an artifactual product which in turn produces cyberspace, much as a candle produces a brighter area around itself.

In the last pages of his epic account of the Canadian Far North, *Arctic Dreams*, author Barry Lopez stood at the tip of Saint Lawrence Island and reflected on his expedition. 'To bring what is actual together with what is dreamed', he wrote, 'is an expression of human evolution'.[102] As I scratch away at the synergies between nature and cyberspace, I wonder whether our attempts to leave the body behind have re-wakened the biophilic impulse

lying deep within our ancestral memories and in doing so brought us closer to bringing together what is actual with what is dreamed.

By the time this book was in the last stages of completion I had moved to the south coast of England. On the day I wrote this page there was an unusually low tide and at sunset I left my desk to wander on the beach alongside many others who had come to take advantage of the chance to walk on a part of the sea-bed which is seldom exposed. Almost everyone was taking photographs, and I would bet that many of us would upload and share them. I certainly planned to. As I gazed out to sea I thought about how we pour our pictures into the bottomless internet to create a digital ocean of photographs: sunsets, waves, waterfalls, forests, flowers, gardens, animals and people from every part of the world. Over and over again, cyberspace brings us back to the physical.

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