Natural Inclusion

How To Evolve Good Neighbourhood

By Alan Rayner

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“In nature everything is distinct, yet nothing defined into absolute independent singleness”

William Wordsworth (1770-1850) from *Guide to the Lakes*

“Form is a dynamic inclusion of space - not an occupier of space - and so is not definable in absolute terms in an unfrozen world”

“Inclusionality enables us to understand our local selves and others dynamically as ‘somewheres’ in the context of everywhere, not ‘somethings’ as isolated objects”

“Death is a delocalization, not an ending of consciousness”

This book

About the Author

Alan Rayner was born in Nairobi, Kenya in 1950. He obtained BA and PhD degrees in Natural Sciences at King's College, Cambridge and is currently a Reader in Biology at the University of Bath. He is an accomplished biological scientist, ecological philosopher, artist and writer. He has published around 140 scientific articles, 6 scientific books (including *Degrees of Freedom - Living in Dynamic Boundaries*, Imperial College Press, 1997) and a 3 volume e book (*Inclusionality: The Science, Art and Spirituality of Space, Place and Evolution*, 2004). He has contributed to a variety of science- and art-based TV and radio broadcasts and presented many seminars and conference papers as well as convening several international conferences and symposia. The latter include a pioneering Science-Art event, '*The Language of Water*', which, in 2001, resulted in an acclaimed BBC Radio 4 series, '*Water Story*', and in 2006 '*Unhooked Thinking*', a landmark in changing our perceptions of addiction. He was President of the British Mycological Society in 1998 and has been a BP Venture Research Fellow and a Miller Visiting Research Professor at the University of California, Berkeley.

SUMMARY

This book offers a way out of the fearful addiction to conflict that has become deeply ingrained in human culture through viewing life as a struggle for existence. It describes a radical transformation of our understanding of evolution in which space, far from keeping everything separate, is a vital inclusion in the fluid dynamic geometry of nature. This opens up a new way of appreciating our natural human identities as complex, dynamically relating flow forms rather than isolated individuals. Hence it may be possible to live in a truly loving, creative and sustainable way within rather than at odds with our natural dynamic neighbourhood.

PREFACE

How are the attitudes that we may bring to the appreciation and management of natural form and beauty – including ourselves - influenced by our perceptions of reality? This question has been nagging at me for many years as I have sought to open up a way of understanding our natural human neighbourhood, which offers hope of living more loving, respectful, sustainable and creative lives together. Throughout these years I have felt that something is getting profoundly in the way of my own and others' well being, in spite of all the scientific and technological advances of the twentieth century that might seem to make for a more comfortable life. I have also wondered whether this something could explain the disconcerting mismatch that I have encountered between my personal love of the natural world and the way that I have been trained to work and think as a biological scientist.

Slowly, the realization has dawned on me that for millennia our attitudes have been biased through believing that nature can be defined into discrete material bodies that are separated by rather than pooled dynamically together in space. This belief is deeply embedded in the abstract logic of the 'excluded middle', where one thing cannot be other than itself, which underpins orthodox mathematical and scientific method and theory but is not supported by contemporary scientific evidence. It leads to the alienation from our natural human neighbourhood that underlies environmentally and socially unfriendly behaviour associated with damaging depictions of life as a 'struggle for existence'. It drives us to race frantically against the clock and view one another as rivals in the relentless pursuit of the power and money that we may imagine can fulfil our incompatible desires for absolute freedom and security. It traps us in an addiction to conflict that forces us to sacrifice our loving and creative human nature to all kinds of spurious idols and ideals in our homes, workplaces, learning institutions and other fields of battle.

This realization has led me and a few others to develop a radically different form of reasoning based on what we have called 'inclusionality' - awareness

of space as a vital inclusion of natural dynamic geometry. Here, all organic forms of life on Earth, including ourselves, can be viewed as dynamically bounded, relational systems - in other words as ‘embodied water flows’. We both combine and distinguish inner and outer spaces through our dynamic, permeable bodily boundaries. Far from being spatially isolated individuals, separated by absolutely fixed and sealed dividing lines, we inhabit a dynamic evolutionary neighbourhood where the logic of the ‘included middle’ applies, i.e. where ‘one’ is inescapably a dynamic inclusion of ‘other’.

For the last six years, I have been striving to incorporate this form of reasoning into a final year undergraduate course that I present on ‘Life, Environment and People’ to biology, natural sciences, psychology and management students at the University of Bath. The idea for writing this book emerged from the learning experience I have gained from this effort.

I developed the course early in 2001, because as a biological scientist I was very aware by then of the difficulties and opportunities that are involved in applying ideas and findings from my academic discipline to a ‘real-world’ social and environmental context. I recognized that with the growing modern emphasis on molecular mechanisms, biology students and researchers are being given little chance to appreciate these difficulties and opportunities. Correspondingly, the development of new technologies like genetic modification and cloning are running into deeply troubled waters. And the discourse in social, economic and environmental fields - indeed the very idea that ‘social’ and ‘economic’ can be distinguished from ‘environmental’ - is benefiting little, if at all, from our scientific understanding of living systems and their natural ecology.

My intention in the course was therefore to provide an opportunity both for myself and for students studying diverse disciplines to reflect critically and creatively on a single, pivotal question. How may we use, develop and communicate scientific and biological findings in a way that can both enhance and deepen understanding of our human relationships with the living world, including ourselves? In other words, how can scientific and biological

knowledge and understanding be made relevant to the social and environmental issues that concern us today?

Asking this question immediately draws attention not only to what I think are very serious limitations in current methods of scientific enquiry, perception and communication, but also to the possibility for opening up more natural and imaginative approaches. For there is no doubt in my mind that much of what is currently called ‘natural science’ is actually very far from ‘natural’ in its practice and theory. In fact, despite what it sets out to challenge, and its own findings in relativity, quantum mechanics and non-linear theory, I might go so far as to describe it as ‘supernatural’ or even ‘superstitious’. This is because of its foundation in the belief I mentioned earlier that an absolute line can be drawn between ‘something’, as discrete visible or tangible form, and ‘nothing’, as formless, void space. Nature is thereby regarded as consisting of independent material ‘bodies’, ‘particles’ or ‘objects’, whose movements depend on the application of external force and take place within a fixed reference frame of space and time. There is no modern evidence in support of this ‘picture’ of discretely bounded objects acting and reacting in discretely bounded space, and indeed much evidence that it is an illusion arising from our human binocular vision. Nonetheless it continues to be the basis for much scientific argument and explanation of natural phenomena, including so-called ‘natural selection’, to the detriment of understanding all kinds of evolutionary processes. And the logical paradoxes and inconsistencies it produces are at the heart of all kinds of human conflict that arise from the alienation of ‘one thing’ from ‘another thing’.

From the outset of my course, I was therefore aware that the answer to my question of how to apply scientific knowledge and understanding in a real-world context lay, ironically, in a radical transformation of the logical premise upon which our modern scientific worldview has been based. I was also aware that this premise is by no means confined to science, but has become taken for granted as a cornerstone in our systems of human governance, economics, education and all kinds of research enquiry in which we regard ‘individuals’ as competitive ‘performing objects’. It is a mind trap to which we

all too readily can become accustomed and defend with the utmost zeal. We do so because it makes our lives seem more secure, predictable and controllable in the face of the fearful uncertainty of the outside world. But in the process we can become ‘trap happy’ – content with the confinement that we impose on our own and others’ lives at the expense of living lovingly and creatively together. To escape the trap requires a transformation in our view of the world and our selves.

As I have already implied, the nature of this needed transformation is simple enough. All that it entails is a shift from a form of logic based on abstracting space from matter, to a form of logic in which matter (or, more technically, ‘electromagnetic information’) is a dynamic inclusion of space (or, more technically, ‘gravitational field’). But the implications of this shift to inclusional forms of reasoning are both enormous and deeply disturbing. They comprehensively and in my view comprehensibly change our understanding of everything, everywhere and the fundamental nature of uncertainty and evolutionary processes. They offer hope of learning to live more peaceful, loving and sustainable lives together in a spirit of natural neighbourhood. But they also can seem to threaten our security and liberty.

So my difficult challenge was and is how to admit such radical thinking within a community so deeply committed - indeed ‘addicted’ - to fixed and thereby alienating views of human and non-human nature. And, not least of my difficulties was and is how to cover such an enormous and potentially revolutionary field of enquiry, given my own inevitable limitations of knowledge, understanding and experience.

The approach that I continue to evolve will become apparent in the way I have written this book. It has four key elements.

Firstly, there is a clear focus for enquiry around the question of real world scientific relevance. This focus helps to dispel the external perception, from which I am prone to suffer, that I am somehow misleading students and preaching ‘anti-science’ and ‘free-fall philosophy’. Apart from perhaps

revealing something about the rigidity with which many scientists defend and impose their discipline, this perception could not be further removed from my actual intention. I am not attacking science at all, but rather seeking to liberate its potential to contribute creatively to social and environmental understanding, through questioning what currently constrains this potential. Nonetheless, I recognize that questioning what provides people with a sense of security, especially a false sense of security, is always liable to provoke a backlash unless approached with great sensitivity. I have found it to be like trying to help someone out of an addiction from which I cannot myself claim to be entirely free.

Secondly, I try to keep the enquiry as ‘invitational’ and as ‘participatory’ as possible. That is, I try to work as a guide or facilitator with personal experience of the territory, rather than as an authoritative instructor who imposes his own and/or his discipline’s expertise as the one and only correct source of wisdom. I make no assumptions about what others may or may not be thinking or feeling, and I make no attempt to persuade others to adopt my viewpoint. Correspondingly, I initiate a series of conversations about a variety of themes concerning life, environment and people, in which I encourage students both to express their personal views and be receptive and responsive to one another’s views alongside my own contributions. Hence it is possible to develop a ‘holographic’ imagery in which diverse individual perspectives are brought together in a way that reveals both their distinctiveness and complementarity in contributing to a richer, deeper understanding of human and non-human nature. In other words I use the neighbourhood of the students and myself to enhance our individual and collective understanding of complex relationships and identities.

Thirdly, I encourage a spirit of continual questioning of assumptions that underlie what we think and believe. What, I ask myself as well as the students, do you believe? Why do you believe it? What have you been told? Do you believe what you have been told? If not, why not? In this way I hope to allow fresh possibilities to emerge.

Fourthly, I encourage diverse modes of enquiry and communication in order to open up new possibilities for expression and comprehension. Correspondingly, I allow artistic and metaphorical as well as conventionally scientific methods, in order to bring a full range of human intellectual and emotional experience and sentience to bear. Here, I recognize that verbal language with its ‘thing words’ and ‘doing words’ is itself an abstraction from nature that cannot encompass nature but can, if taken literally, reinforce alienating definitions and create paradox. Similarly, I recognize that discrete, space-excluding assumptions lie deep in the foundations of mathematical expression. Some relaxation of these definitions is necessary if a fuller, more natural meaning is to be given space to emerge.

I would like to thank my family and co-learners who are unnamed co-authors of this book.

Alan Rayner
Bath

CONTENT SUMMARIES

Chapter One. *The Culture of Discontent*

Here, I set the scene by describing how I think an addiction to conflict has become deeply ingrained in modern culture through viewing life as a struggle for existence amongst independent individuals. I reflect briefly on the many ways in which the desire to change the world by opposition to and elimination of what is deemed to be ‘undesirable’ can lead to the sacrifice of human well being and creativity.

Chapter Two. *The Meaning of Neighbourhood*

Here I ask two ‘starter’ questions: ‘Who or what is neighbourhood?’ and ‘What is a tree?’ I use the way that these questions are commonly answered to illustrate how ready we are as human beings to define our selves and nature as discrete ‘objects’ or ‘categories’. I show how this readiness leads to the division between individualism and collectivism, which is associated with incompatible desires for absolute liberty and absolute security. I explain how it arises primarily from the perception of an absolute demarcation between ‘something’ and ‘nothing’, through focusing selectively on material aspects of nature whilst disregarding our dynamic spatial inclusion within the gravitational field. Nature is then assumed to be primarily static, so that all movement becomes dependent on the imposition of external force. We can escape this fixation through what others and I have called ‘inclusionality’ - awareness of space as a vital inclusion of dynamic natural geometry in which centres, boundaries and space are all dynamic relational aspects of natural, variably resistive and yielding flow-form. We no longer have to think of ourselves as self-centred, active-reactive individuals obliged to make abstract, either/or executive decisions. Instead can envisage our selves as

simultaneously receptive and responsive dynamic neighbourhood, with complex local and non-local identities.

Chapter Three. *Life as an Embodied Water Flow*

Here, I ask, ‘what is an organism?’ I contrast the widespread DNA- and digital computer-inspired perception of ‘calculating machine’ or ‘information processor’ with the view of ‘embodied water flow’. I ask why in our search for extra-terrestrial life what we always look for first is evidence of the presence of water. What is it about water that is so vital to the possibility of organic life, as we know it here on Earth? Conventional answers focus around the physical properties and role of water as solvent, chemical reactant, bodily fluid and habitat. But these answers tend to view water statically, as in a pond, and so overlook its importance as a dynamic inclusion in the evolutionary diversification of life, without which DNA would have no means of expression.

Chapter Four. *Scales of Life*

Here I ask, ‘what is a living body?’ and ‘what are the “building blocks of life”?’ These questions bring out the many different, nested scales of organization from cells to ecosystems and biosphere in which life takes form. They also reveal the distinctive individual and collective perceptions that can apply at each scale, and the difference between scientific and common parlance. In common parlance ‘body’ can imply both a ‘distinct identity’ and a ‘corporation’ of distinct identities. I suggest that this ‘both and’ view can help to provide a deeper understanding of nested, communicating scales of neighbourhood in common space. Here there are no such things as independent ‘wholes’ or ‘building block’ component parts. Hence the linkage between biological form and human social organization can be made clearer and provide an opportunity for learning about one through understanding the other. I explore this linkage, using genetic, cellular, multicellular and ecosystem level examples. As I do so, I contrast the rationalistic perception of structure assembled from parts - and the associated ‘building-block’ metaphor of

biological and social organization - with the inclusional perception of neighbourhood flow-form. I show how the former perception may give rise to social and ecological damage and dysfunction.

Chapter Five. *Death and Diversity*

Here I ask ‘what is death?’ Perhaps more than any other, this question brings out the deep implications for human health and happiness of the distinction between the rationalistic view of space as ‘nothing’, an empty outside, and the inclusional view of space as ‘no thing’, a vital inclusion of dynamic neighbourhood. For from the rationalistic, individual-centred viewpoint, death implies the annihilation - coming to nothing - of individual identity. From an inclusional perspective, however, death, like space and love, is a vital inclusion of the world of the living. When held dynamically within bounds, death feeds, protects, structures and transforms the diversity of life as an evolutionary neighbourhood of de-localizing and re-localizing flow-form. I illustrate this understanding by referring to some of the most fundamental phenomena recognised, but perhaps not comprehensively understood, by biological and ecological science. These include heterotrophy, decomposition, senescence, programmed cell death, cancer, parasitism, somatic incompatibility, sexual compatibility, territoriality, speciation, metamorphosis, indeterminate phenotypes, alternative phenotypes and ecological succession. All these phenomena point to the fundamental nature of living systems’ outward forms and behaviours (i.e. their ‘phenotypes’) as complex, dynamic identities rather than single, fixed entities.

Chapter Six. *Evolutionary Creativity*

I ask ‘what is the difference between evolution and revolution?’ This question brings out the distinction between linear and non-linear concepts of dynamic processes.

Linear concepts are based on the abstraction of/from space of/from an independent, fixed time frame, divided up into discrete units against which the performance of discrete entities is judged. Change is correspondingly perceived as both incremental and one-sided (adaptive) - the ‘reaction’ of an object to the ‘action’ of externally imposed force. Where change is irreversible (i.e. action and reaction are not equal and opposite and there is an ‘arrow of time’), this implies that at least some of the coherent energy of the force is ultimately lost as heat (entropy).

Non-linear concepts, by contrast, explicitly or implicitly treat space as a vital inclusion of natural, fluid-dynamic neighbourhood, which, in lacking any fully discrete boundaries is by its very nature self-evolving and so has no need for an external agency to stir it into action. Time is inextricable from a continual process of contextual transformation. Linearity emerges from curvature, as when primarily spherical domains are close-packed into hexagonal array or the straight sides of a tree trunk emerge from a dome-shaped growth zone. Synergistic and parallel processes abound as all is steered through all, with distinct but not discrete flow-forms reciprocating one another’s movements, both yielding and resisting but never absolutely closing down or opening up possibility. Simultaneous reception and response in a resonant two-way process of dynamic inner-outer balancing or ‘attunement’ subsume sequential action and reaction. The way is open for a neighbourhood of dynamic phenotypes to co-evolve creatively in tune with their living space through varying the permeability, deformability and continuity of their unfixed boundaries. I show how this process of attunement can be understood in terms of the chemistry of oxidation and reduction, and related in turn to varied life history patterns and the importance of playfulness, both in the short term and long run.

Chapter Seven. *Beyond Objectivity*

Now I begin to ask, ‘so what? What difference might an appreciation of the inclusional nature of evolutionary neighbourhood make to the way we live our

lives and enquire about our place in the world? I approach these questions by asking two further questions, the answers to which can reveal much about sources of human content and discontent. What do we think human and non-human nature is really like? How would we really like human and non-human nature to be? If the answers to these questions are the same, we will feel content and strive to defend the status quo against any contrary idea, which we will perceive as a threat to our liberty and/or security. If the answers differ, then we will feel oppressed or vulnerable and strive to change or escape our situation. It all comes down to a question of definition. Not only does the act of definition set up the potential for endless conflict between opposing definitions, but it may also act in opposition to the indefinable nature of nature itself. Here I question the many ways - mathematical, scientific, linguistic, political, educational and cultural - in which we can and do impose objective definitions upon our selves and nature. I reflect on the social, psychological and environmental implications of this practice and consider how it may be possible to grow beyond it through the development of more fluid approaches to logic, language, enquiry, education and artistic representation.

Chapter Eight. *Challenging Unpredictability*

Here I ask ‘what is the difference between working with bamboo and cast iron?’ This question brings out the distinction between natural form and artifice. It also brings out the difference between natural dynamic geometry and abstract geometry and the reason why the latter is often preferred to the former whilst greatly restricting creative expression and incurring great environmental cost.

For many people, the most unwelcome aspect of natural dynamic form, and the inclusion of space that it implies, is its lack of cast-iron certainty. Yet in not coming to terms with this uncertainty we may not only overlook all kinds of creative possibility but also make all kinds of trouble for our living space and ourselves. Here I examine ways in which inclusionality may help us to understand and work with rather than against uncertainty, in scientific and

mathematical terms. My discussion will include an introduction to elementary statistics, chaos theory and fractal geometry, as well as an explanation of why these fall short of a fully inclusional comprehension of uncertainty and how these shortcomings can be transfigured.

Chapter Nine. *Managing Life and Environment*

After addressing some basic questions about the nature of evolutionary perfection and how this relates to notions of leadership, I ask, ‘why might we want to harness a horse?’ This brings out the different kinds of attitude that we may bring to managing the dynamic processes of our own and others’ lives. Is the intention to impose control over the wildness that we perceive might otherwise be let loose? Is the intention to provide some kind of communication channel through which a feeling relationship can be established? Using a variety of social and technological examples, I appraise the efficacy and efficiency of styles of management that seek to impose standards and conformity upon nature and human nature, often with the short term objective of enhancing competitive performance in an abstract time frame. I contrast these with receptive-responsive styles that in the long run seek to encourage diversity and allow space for its complementary expression and communication. I consider ways in which we can work with nature to manage nature, for example in environmental remediation. And I consider ways in which we can mimic nature in our engineering design, as in the field of ‘biomimetics’.

Chapter 1

The Culture of Discontent

Addiction to Conflict

Many of us[1], I imagine, hope for no more and no less in life than simply to live, love and be loved, in reasonable comfort and with sufficient stimulation to keep our minds and muscles active. At least, that's always been my hope. Unfortunately, trying to fulfil such simple yearnings seems to become ever more difficult and complicated.

Despite, or perhaps because of the extraordinary scientific and technological advances of the twentieth century, life for many of us seems very far from being as comfortable, inspiring and loving as it might be. Suffering, conflict, environmental degradation and moral confusion abound. We are confronted daily with contradictory messages about how we should or should not behave. We can't always live up to one another's or our own expectations and so can become depressed, anxious, vindictive and divorced. And it can be exhausting to try to keep up with new knowledge, new technology, changing fashions and cultural shifts.

It's all too easy when caught up in such a maelstrom to feel that somehow we're not good enough for this world, or that this world's not good enough for us. We may then cast aspersions upon both nature and human nature, describing these as selfish, greedy and cruel or indifferent. We come to see life as a 'Struggle for Existence' where love and compassion are expressions of frailty, not the strength that we need to thrive. Like Shakespeare's Hamlet,

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[1] Throughout this book I use 'we' and 'us' as collective terms for the common 'humanity' and 'natural neighbourhood' of which I feel 'myself' to be a dynamic inclusion, even though the attitudes and behaviour I describe need not apply to all in general or anyone in particular. Often these terms may be read as 'shorthand' for 'many of us'.

we get entangled in vicious loops of thought and behaviour that end in human tragedy:

'To be or not to be, that is the question: whether 'tis nobler in the mind to suffer the slings and arrows of outrageous fortune, or to take arms against a sea of troubles, and by opposing end them?'

This desire to change the world by opposition to and elimination of what is deemed to be 'undesirable' can place us at loggerheads with one another and our living space in a perpetual winter of discontent. We make enemies, not friends, and so create an 'Anti-culture' of one against other rather than a 'co-creative culture' of one with another. Our thoughts and behaviour become driven by hostility rather than inspired by receptivity. Even our most co-operative interactions are sustained by the need to form alliances of 'us' against 'them', 'here' against 'there' and 'good' against 'evil'. Our urge to make the world a better place continually makes things worse as we try to solve problems in the same way that we created them. In the midst of the sea of troubles that we make for ourselves, we become addicted to conflict, and thereby to all kinds of recurrent patterns of self-destructive thought and behaviour that are hard to break free from once entrenched.

This *culture* of opposition is perpetually reinforced by unquestioning acceptance of the *objective logic* of opposition evident in Hamlet's painful decision-making: the divisive, 'excluded middle' logic of 'either/or' - 'is' or 'is not'. In following chapters I hope to show how this logic, which harks back at least as far as the philosophies of Aristotle and Parmenides, is based solely on outward appearances, like the tip of an iceberg, without appreciating what lies beneath the surface. To regard such superficial appearances as all there is to reality is deeply paradoxical and profoundly inconsistent with our human experience as well as contemporary scientific evidence. It can get us into Titanic trouble! Yet it continues to pervade almost every nook and cranny of modern Anti-culture.

If we wish to make room for more sustainable and joyful ways of life, I think we need a different kind of logic that is more representative of our wider human sentience and not based solely on a distanced perception of what takes shape on our radar screens. This is the 'logic of the included middle', which, at its heart, is about appreciating the inseparable relationship between *content* and *context*: no phenomenon occurs in isolation from the *receptive* space of which it is a fluid dynamic inclusion. Nature is acknowledged to be neither a complete whole nor an isolated part, but an evolving *dynamic incompleteness* with no fixed boundaries.

As I hope to show in chapters to come, there is sound reason and evidence underlying this different kind of logic. Moreover it can radically transform our understanding in a way that enables us to recognise that the enemy we may seek bitterly to oppose in what we perceive as the annihilating darkness of immaterial space, is actually none other than love.

Meanwhile, to set the scene, I want to illustrate the great variety of ways in which our current use and abuse of the logic of opposition can lead to profound discontent, by isolating material content from spatial context and thereby excluding love from our lives.

Human Sacrifice in the Modern Era

From our modern vantage point we may look back or down in horror at 'primitive' cultures that sacrifice human life upon some altar of misunderstanding in an effort to appease or please forces beyond their ken. Surely, by now, we may think, we know better. But do we really? Or have we simply exchanged one form of sacrifice for other, less explicit forms? Is our logical inclination to define what is 'self' by objectively excluding what is 'not self', actually suicidal in some strange way? Here I describe some of the interrelated ways in which I think many of the seeming benefits of modern life are gained at enormous social, psychological and environmental cost. I also

hint at some of the more fulfilling and creative possibilities that I will discuss later on in the book.

Elitism: Sacrifice of the Many to One or a Few

"The great masses of the people…will more easily fall victims to a great lie than to a small one" - Adolf Hitler

"I have called this principle, by which each slight variation, if useful, is preserved, by the term of Natural Selection"

"We will now discuss in a little more detail the struggle for existence"

"The expression often used by Mr Herbert Spencer of the Survival of the Fittest is more accurate, and is sometimes equally convenient" - Charles Darwin

One of my regular correspondents, Ted Lumley, describes how on his first day at school, he deliberately tripped over in order to avoid winning a running race. At the tender age of six years, his intuition rejected the idea passed down to him that we must all compete with one another as independently driven individuals in order to ensure our prosperity. It simply didn't fit with his young mind's observations of a natural world in which all kinds are included - bright and beautiful, great and small, weird and wonderful, dull and ugly, fragrant and smelly – in the making of vibrant, sustainable communities. And it didn't feel right for his 'success' to be 'won' at the expense of someone else's 'failure'.

The compulsion for us to oppose one another and rank our performance from 'better', towards the top, to 'worse', towards the bottom of a competitive hierarchy of 'winners' and 'losers', is, however, virtually ubiquitous in modern human culture and belief systems. Culminating in an external Authority-figure or physical 'Force', this hierarchy is accepted, often without question, as 'the

way life is', like it or lump it. It is even regarded as the basis for 'healthy competition', a way of getting the best out of our selves and improving our situation.

Nonetheless, especially where winners are rewarded with privilege and losers suffer deprivation of one kind or another, it is plain that competition can be the most demoralizing, wasteful and destabilizing of human practices. How could it be otherwise, when in any particular field, there can ultimately be only one overall winner, to whose position of monopoly all losers aspire? Far from a coherent community in which the unique creative potential of all is fulfilled and to which all can contribute co-creatively and complementarily, the scene is set for relentless strife. Love, honesty and energy are all liable to be sacrificed in the rush to succeed, and stragglers fall by the wayside where they may, if 'lucky', receive the trickle down charity of those more highly placed. Meanwhile, those at the top are likely to find themselves extraordinarily out of touch from, yet increasingly hard-pressed by the masses that they may have sought to pull rank over. And in this lonely, lofty situation, which they may imagine they have reached solely on their own merits, they are hardly likely to be capable of making judgements that take full account of context.

Although I doubt whether such 'winner-takes-all' competition can ever be 'healthy', I do think there is a place for what might be called 'healthy differentiation' along a gradient of possibilities rather than a hierarchy of fixed positions. Here the aim is not to eliminate or dominate the opposition, but to *learn* what we are each uniquely capable of and how we can enhance our skills in relationship with others in the process of developing diverse and complementary social roles. Perhaps if this truly *educational* aim had been made apparent at Ted's first day at school, he wouldn't have felt the need to trip himself up. And those who came second, third or fourth wouldn't need to feel that they had lost, as so many of us do in modern culture when we judge ourselves or feel ourselves judged to be failures, and allow our fear of failure to stifle our enterprise and ambition.

Authoritarian Leadership: Sacrifice of Truth to Power

"Every once in a while, Truth still pipes up in meetings. When this happens, more often than not, Truth is simply bent over an authoritative knee and soundly spanked into silence." - Philip Su

“The Law is the true embodiment Of everything that’s excellent. It has no kind of fault or flaw. And I, my lords, embody the Law” - W.S. Gilbert

Those who actively seek a place at the head of a competitive hierarchy can only do so because they desire power. This desire may stem on the one hand from seeing power as a means of serving their self-interest by draining resources from their neighbourhood. On the other hand it may arise from an unshakeable belief in their own authoritative right to know what’s best. Either way, truth becomes a victim of some kind of deception of self or other, based on the application of excluded middle logic, as is evident in all kinds and scales of corrupt governance, throughout the world. For, in a real-world dynamic neighbourhood, local form is dependent upon and cannot be isolated from nor have dominion over non-local context. All local form is uniquely situated and hence has a unique perspective and no such form can be complete in itself. The truth is that truth is not definable in absolute terms: there is no such thing as ‘the whole truth and nothing but the truth’ that can be known from a fixed position. To pretend otherwise is the basis for the conscious and unconscious abuse of power that inevitably gives rise to dissonance and suffering in the wider community. But once such pretence has been allowed to establish itself, it becomes very difficult to dislodge because it punishes any dissent or honest enquiry into its theory and practice.

Correspondingly, the history of our honest endeavours to understand nature and human nature is filled with examples where truth has only emerged slowly and painfully, in the face of punitive administrative power. And where truth has prevailed, this has all too often only been through the sacrifice of courageous, compassionate, creative people prepared to use their skills, speak their minds and take their punishment.

There is no need, however, for any form of administration to assume this stifling, punitive falsehood. The legendary King Arthur's Round Table and the 'sharing circles' of indigenous people represent a very different approach, which is what I think evolving good neighbourhood is truly about – i.e. valuing unique perspectives brought lovingly and respectfully together into common focus.

Misogyny and Child Abuse: Sacrifice of Female Influence to Male Ambition

"The fundamental fault of the female character is that it has no sense of justice" - Arthur Schopenhauer

"The souls of women are so small, That some believe they've none at all" - Samuel Butler

"Punish your son in his early years and he will comfort you in your old age and be the ornament of your soul. Do not spare your child any beating, for the stick will not kill him, but will do him good" - seventeenth century Russian etiquette manual

Closely allied to elitism and authoritarianism is a tendency to categorize women as inferior and even sub-human. No doubt this categorization is allied to perceptions of their more overtly nurturing role and bodily relationship with natural processes, combined with their lesser physical strength and competitiveness overall compared with men. It has led to terrible abuses in the past and continues to do so in many cultures today. Even in supposedly 'liberated' cultures, many professions, including my own, are male-dominated and women have difficulty being promoted and receiving equal pay for equal work. Moreover, in trying to redress the balance, there is a tendency for hostility and inverse discrimination against men in the pursuit of political

correctness that fears any acknowledgement of gender distinctions whatsoever.

Not just women but their offspring continue to be subject to abuse. Although the fearful excesses of Victorian times, highlighted by Charles Dickens, have lessened, children are still forced through a punishing schedule of schooling and examinations, whilst tales of parental neglect continue to abound.

Majority Rule: Sacrifice of a Few to the Many

"It is proof of a base and low mind for one to wish to think with the masses or majority, merely because the majority is the majority. Truth does not change because it is, or is not, believed by a majority of the people" - Giordano Bruno

Whereas one way of ‘winning’ is to be singled out and given authoritative liberty through having some superior individual quality, an alternative, very popular route is to share some common view or attribute with many others and so gain the collective security of being in larger numbers. This gives rise to the curious political paradox of a governing elite being given power through its appeal to the masses in many so-called modern democracies. Of course, notwithstanding the claims of their leaders, these are no democracies in the sense of systems of governance by all for all, but a covert form of mob-rule or elective dictatorship in which those on the minority ‘side’ are suppressed. Here, being far-sighted, imaginative, sophisticated, different or deep may be a severe disadvantage, sure to result in a life of frustration on the sidelines, where talents are wasted and voices rarely heard and quickly stilled. The mainstream can develop a brute force that carries on regardless, even if slightly less inclined than it used to be to burn those like Giordano Bruno at the stake for their heresy.

Trend Setting and Fashion Following: Sacrifice of Individual Expression to Mass Hysteria

“And e’en while fashion’s brightest arts decoy, The heart distrusting asks, if this be joy” - Oliver Goldsmith

“The fashion of this world passeth away” - 1 Corinthians

A related phenomenon to elitism and majority rule occurs when the expressions of a few come to monopolize the minds, behaviour and appearances of the many, whose lives and identities then become reproductions of others rather than their own unique creations. Celebrities become worshiped as idols whose success is enjoyed vicariously. Everyone scrambles to be ‘in’ rather than ‘out’, ‘with it’ not ‘without it’. Huge industries develop around the art of persuading people that what they already have is obsolete or unsatisfactory in one way or another, and that they must have something new. Ideas are valued more for their ‘timeliness’ than for their pertinence. Nothing much lasts or is truly cared for, because love hasn’t actually got much to do with ‘it’.

Perfect Nonsense: Sacrifice of Creative Possibility to Unrealistic Ideal

“Faultily faultless, icily regular, splendidly null, Dead perfection, no more” - Alfred, Lord Tennyson

In yearning for the ‘success’ that brings fortune and adulation to a select minority, we may view this as the reward for attaining some kind of personal ‘perfection’. By the same token, the relative lack of success enjoyed as a rule by the majority of us implies being blighted by imperfect ability or appearance. With such ‘not good enough’ thoughts in mind, we can find ourselves endlessly trying to remove or hide flaws in our make-up in order to gain or retain the success that we may crave. We focus upon and curse every spot of trouble that emerges to disturb our serenity and devote more and more of our energies to remedial treatments ranging from cosmetic to radical surgery. Meanwhile, the creative possibilities of our lives, some of which may arise

from the very imperfections that we seek to cure, fade into the background. Which raises the question of what criteria do we use in our judgements of perfection and imperfection? Do these criteria make sense or nonsense of our real lives as living, breathing, dying organisms in dynamic relationship with one another and our surroundings? Do we claim paradoxically that ‘none of us is perfect’ and use this both as an excuse for failure and as a driver of our perfection-seeking behaviour? How do we endeavour to make ourselves perfect?

Mechanization: Sacrifice of Human Imagination to Material World

"Many people would be disposed to say that it was not the machine, but what one did with the machine, that was its meaning or message. In terms of the ways in which the machine altered our relations to one another and to ourselves, it mattered not in the least whether it turned out cornflakes or Cadillacs." – Marshall Mcluhan

One of the ways in which we have come increasingly to seek to replace what we regard as imperfection with perfection is by trying to replace the flesh and blood organic reality of our natural bodily form with machines that are more precise and reliable. It has become all too evident, however, that machines can take over as well as smooth the running of our lives, leaving us made redundant or enslaved by our own manufacturing industry. And, as I will explore further later, we may even try to make machines of ourselves through rigorous discipline and training regimes designed to remove all trace of waywardness from our character.

Clearly, the ‘perfection’ being sought here is that of absolute regularity - of the kind to be found in clockwork and the rigid form of geometry abstracted from nature by Euclid. By the same token, what is being abhorred is the irregularity that is abundant in the playfulness of natural dynamic form.

It is an austere kind of perfection that imposes uniformity upon both human and non-human nature, consigning us to box our lives within discrete regulatory boundaries that we dare not transgress for fear of creating havoc. It is the perfection sought by all kinds of orthodox or ‘right-minded’ belief systems, including the one known as fascism. It is a perfection that entraps us both mentally and physically, denying our human feelings and imagination whilst feeding on our insecurity. Countless authors and artists have tried to reveal the dispiriting, dehumanizing, nightmare scenarios that can arise from seeking this kind of perfection. But who can deny that it continues to hold us in a vice-like grip as we log in to our computers, get snarled up in traffic and encase our world in concrete and steel?

Force-Fitness: Sacrifice of Creative Balance to Work Ethic

“Consider the lilies of the field, how they grow; they toil not, neither do they spin” - St Matthew

“Who first invented work and bound the free And holiday-rejoicing spirit down?” -Charles Lamb

One of the most obvious examples of how we are prone to treat ourselves as performing mechanical objects can be found in the way we can set ourselves to work within structures defined by ‘job descriptions’. Before we can even embark on ‘gainful employment’, we are often subjected to a competitive selection process, which assesses whether our qualifications and personal characteristics make us fit the niche prescribed for us. This process continues after embarkation to govern our promotion up various kinds of hierarchical ladders. Those who don’t make the grade are outcast upon the ‘scrap heap’ of unemployment.

Placed under such selection pressure, many of us feel obliged to conform to what is expected and so suppress those sensitivities that make each of us uniquely human, for fear of these being regarded as ‘weakness’. We force

ourselves to fit the job rather than fit the job to our unique individual skills and experience. Outwardly, we may feign contentment, whilst inwardly our minds and bodies may be screaming at our wilful self-abuse in the name of ‘productivity’. And so our fear keeps us carrying on regardless until at last we may be put on leave or pressed into early retirement, diagnosed as suffering from ‘stress’, or worse. No longer ‘productive’, the forced fitness deserts us, laying waste to our creative energies.

Numerical Tyranny: Sacrifice of Quality to Quantity

“That action is best which procures the greatest happiness for the greatest numbers” - Francis Hutcheson

“Tell me not in mournful numbers, Life is but an empty dream, For the soul is dead that slumbers, and things are not what they seem” - H.W. Longfellow

Behind our self-enforced productivity lies a numbing definition of what productivity means, by way of measurable outputs. In order to measure any aspect of human or non-human nature accurately and in a consistent way that means the same to all, it has become necessary to reduce it into discrete units that can be counted. I say ‘reduce’ because in this ‘idealization’ of nature into what we have come to call ‘numbers’, the vital variability and spatial connectivity of all form is eliminated. It’s like chopping the fingers and thumbs from our hands and making them all the same size and shape in order to play games of addition, subtraction, multiplication and division with them.

We play these numbers games sure in the knowledge that as long as we don’t make a procedural error (mistake) we will get the same product (right answer) as anyone else who is following the rules of arithmetic to perfection. By getting the right answer we feel we have proved the validity of our initial assumptions and procedures. We then feel no need to enquire further or deeper. We fail to recognize the paradox deep in the heart of elementary mathematics, where the numbers 0, 1 and 2 all have fundamentally different

forms - as can be verified by the different results of multiplying them by one another and themselves. The paradox arises because of the treatment of infinite space as nothing, 0, and corresponding treatment of infinitesimal and infinity respectively as limited and limitless matter. Correspondingly, contextual *receptivity* is misinterpreted as subtractive *negativity*, opposed to rather than a dynamic inclusion of *positive.*

So it is that many of us have allowed our lives and values to be overwhelmed by an unshakeable belief in the authority of numbers. In a vain effort to address questions of quality, we habitually ask questions of quantity: how much, how many and how long? Often, we make the assumption that ‘more is better’, unless we are trying to lose weight or save time, effort or money. But real quality, which incorporates context, is not so easily assayed. To appreciate such quality requires experience, sensitivity and intuition combined into wisdom - qualities that cannot themselves readily be defined or measured objectively.

In a pressure-cooker culture, real quality therefore tends to get ignored. And the greatest tragedy occurs when we ignore it in ourselves by quantifying our human performance and character in terms of pure statistics that neglect our identity and needs as unique, complex, loving human beings. When we make numbers out of our selves that exclude our receptivity.

Linguistic Tyranny: Sacrifice of Poetry to Literal Definition

“Philosophy is a battle against the bewitchment of our mind through the medium of our language.”

"A picture held us captive. And we could not get outside it, for it lay in our language, and language seemed to repeat it to us inexorably." - Ludwig Wittgenstein

Bound in unholey (unreceptive) alliance with the tyranny of numbers comes our reduction of nature and our selves into objective categories to which we attach nametags. Our habituation to this unholeyness has become deeply enshrined within our formal ‘education’ systems where, from the outset, attention focuses on learning to read, write and do arithmetic as the basic accoutrements of a civilized life.

To be sure, it is not verbal language itself, but the compulsion to use this language *literally*, as a means of capturing local identity within an unforgiving confinement of its creative potential, that is distressing. Actors refer to this confinement as ‘type-casting’. Psychologists call it ‘stereotyping’. It makes it all but impossible for people to escape from definitions imposed by themselves or others. These definitions literally imply the singling out of one or a few characteristics or actions as the basis for classification, whilst excluding others from consideration. In extreme cases they can result in a life sentence of being labelled as, for example, tinker, tailor, soldier, sailor, rich man, poor man, beggar man, thief or murderer. In such guises our underlying humanity can all but disappear.

As I will be exploring in later chapters, there is no actual need to use language, nor for that matter numbers, in this self-confining way. Once the rigid frames that we are inclined to impose on nature are seen for what they are - abstract constructions of human perception - they can be relaxed, allowing a much freer, more poetic expression to emerge. In this form, language can become a celebration rather than curtailment of diverse, ever-transforming identity - a ‘guide-lining’ from which we create and derive unique meaning for ourselves. But, so long as we take or use it purely literally, as a means of ensuring conformity, it will hold us in thrall, bound up by its constraints, rather than enthralled by its abundance of expressive possibilities.

Financial Tyranny: Sacrifice of Real Needs to Economic Drivers

“Neoclassical economics is bankrupt. Its quantitative models of optimisation and equilibrium have no realistic measure to place on the value of the environment. Economists cannot factor in opportunity costs, the losses incurred when the habitats are destroyed and species go extinct. They are unable to handle multiple margins outside a narrowly defined market economy” – E.O. Wilson

“Money can’t buy me love” - John Lennon and Paul McCartney

Just as words and numbers are abstract ways in which we try to re-present actual form and process in order to communicate what we have in mind, so money represents how much value we bestow in our possessions in order that we can trade them. Money, like words and numbers correspondingly emerged as a convenient substitute for real resources, whilst in itself having value only through common consent. Should we so desire, we could therefore, by common consent, cast the extraordinary power that money has acquired over our lives to the wind, without changing the physical reality of our situation by one jot. But we don’t and won’t as long as the logic of opposition that serves the notion of ‘ownership’ (see below) holds sway. And so we sustain an essentially fake commodity that drives a wedge between rich and poor, mighty and meek, individual and neighbourhood, human and non-human. We serve a fickle accountancy whose values fluctuate with fashion and that takes little or no account of the enormity of what is given implicitly in the natural world before plundering it for more. We suffer the slings and arrows of outrageous fortune, oblivious of the beauty within and around us.

Clockwork Tyranny: Sacrifice of Living to Time

“Hurry, hurry has no meaning” - African saying

"I would rather be ashes than dust! I would rather that my spark should burn out in a brilliant blaze than it should be stifled by dry-rot. I would rather be a superb meteor, every atom of me in magnificent glow, than a

sleepy and permanent planet. The proper function of man is to live, not exist. I shall not waste my days in trying to prolong them, I shall use my time." - Jack London

‘Time is money’ it is commonly said. Here the connection between enslavement by one abstract commodity and another can be seen. Time has become the fixed reference frame against which we schedule our lives and measure our productive performance. We ‘race against the clock’ in order to be ‘competitive’ and accomplish as much as we can before ‘time runs out’. We avoid ‘wasting time’ by rushing around, eating ‘fast food’ and being punctual, oblivious of wasting a much more real and valuable currency that is vital to our own and our environment’s sustainability: energy.

The way that energy can be sacrificed to short term demands is evident in the difference between marathon runners and sprinters. Sprinters surrender stamina for an all out burst of speed. Marathon runners conserve energy by closely attuning their pace and breathing with environmental circumstances. By the same token, when we give precedence to a deadline, we run the risk of exhaustion through neglecting our human needs to maintain our energy balance. Although sprinters do have their place in the community, a community full of sprinters is neither ergonomically sustainable nor pleasurable as we fail to digest the rich experience that life has to offer.

Ownership: Sacrifice of Common Spirit to Selfishness

“How can you buy and sell the sky, the warmth of the land? The idea is strange to us. If we do not own the freshness of the air and the sparkle of the water, how can you buy them?…Every part of this earth is sacred to my people. Every shining pine needle, every sandy shore, every mist in the dark woods, every clearing and humming insect is holy in the memory and experience of my people. The sap which courses through the trees carries the memories of the red man….This we know. The earth does not belong to man, man belongs to the earth. So if we sell you our land, love it as we loved

it. Care for it as we cared for it. And with all your strength, with all your mind, with all your heart, preserve it for your children, and love It ... as the Great Spirit loves us all. Amen." – Chief Seattle.

"Objects in themselves are external to man, and consequently alienable by him. In order that this alienation may be reciprocal, it is only necessary for men, by a tacit understanding, to treat each other as private owners of those alienable objects, and by implication as independent individuals" - Karl Marx

"Property is theft" - Pierre-Joseph Proudhon

"Few rich men own their own property. The property owns them." - R.G. Ingersoll

"Imagine no possessions" - John Lennon and Yoko Ono

Time, money, words and numbers all owe their power to hold humanity mentally, if not physically in thrall, to another, far deeper, modern conviction – belief in the absolute right to own property. This notion of ownership is itself an expression of belief in the definability and consequent independence of the individual and its living space. It continues to predominate in spite of the fundamental, non-definable nature of physical reality.

As soon as the notion of ownership is accepted, it opens the way to the kinds of demarcation dispute that are all too familiar in our modern culture of discontent, from the bickering of siblings and divorcees to the fateful confrontations of superpowers. It also makes us careless about anything that we don't own and profoundly fearful of losing what we do own. This is the basis for attachments to material 'things' and resentment of any kind of trespass or change, as enshrined in the 'Englishman's home is his castle' and 'not in my back yard' syndromes. We focus on 'belonging to' rather than 'belonging with' and so reinforce our sense of isolation. Our fear of loss makes us too scared to share, so that we jealously protect and accumulate assets

way beyond our real needs but never to an extent that can fully satiate our desires for security and freedom. In the process, we dissipate planetary resources and fail to connect emotionally, so that our lives become barren in our never-ending quest for riches. We may know that material wealth doesn't necessarily bring happiness, but this doesn't stop us from frantically trying to secure it, at one another's expense.

Blame, Shame, Claim and Fame: Sacrifice of Shared Responsibility to Cold Shoulders

"Fame is no plant that grows on mortal soil" - John Milton

"There is a shame that bringeth sin, and there is a shame that is glory and grace" - Ecclesiasticus

With the idea of sole ownership comes belief in sole responsibility. Each of us, as fully independent entities driven by some internal executive centre of our being, is thereby seen as solely responsible for our actions and progress or lack of progress in the world. This sets the scene for a culture of blame, shame, claim and fame. When something appears to go 'right' there is a 'rat race' to take credit and gain authority by claiming sole responsibility for it. When something appears to go 'wrong', there is a rush to 'pass the buck' and find something or someone 'else' to blame. Rarely is responsibility shared. Acceptance of sole responsibility excludes the soul responsibility of living in a dynamic neighbourhood of common space, from which we cannot set ourselves apart.

Criminality and Rebellion: Sacrifice of Human Need to Rules of Conduct

“One of the Seven was wont to say: ‘That laws were like cobwebs; where the small flies were caught, and the great brake through’” - Francis Bacon

“I know not whether Laws be right, Or whether Laws be wrong; All that we know who lie in gaol Is that the wall is strong; And that each day is like a year, A year whose days are long” - Oscar Wilde

Given the intense pressure to save time and gain money in a culture of competitive ownership, the temptation or desperation inevitably arises to ‘cheat the system’ in order to achieve these ends. A line therefore begins to form between what is or is not regarded as ‘cheating’. This is the line of Law and Order. But who draws this line and for whose benefit? The answer is obviously one and the same - those who own something that empowers them and that they don’t therefore wish to share with others.

In this way emerges the familiar, police-reinforced legalistic divide between satisfied conformists and unsatisfied cheaters that is the source of so much distress and fear in modern communities. Those who have the desire and desperation to cheat are demonized as ‘criminals’, deserving punishment but undeserving of human consideration. Those who have a sense of well-deserved ownership that is protected within the law bitterly resent and fear those who may take away their belongings. But both, in reality, are no more and no less than human beings, divided by a line that entraps both within and outside self-constructed walls.

The need to break laws doesn’t always arise, however, from an intention to cheat the system, but rather from a desire to reform it through identifying what it is about the system that induces cheating. For any system that, through excluded middle logic, induces whilst despising cheating is caught up in its own hypocritical double blind double bind. It desperately needs release, but cannot accept what it needs to accept to make sense, because what makes sense is excluded from the system by its self-definition of what it is not. Law defines what is within itself by defining what is outside itself. Orthodoxy in general, whether it is scientific, religious or philosophical defines its self by

what it is not. It cannot honestly therefore be receptive to what lies beyond its definition and so cannot escape its own dishonesty. Any potential reformers are themselves caught up in this deception and seen, from the prospect of those safely ensconced, as rebels, radicals or revolutionaries who should be put down or excluded. In this situation there is a danger that reformers may not only find themselves operating off-limits and with little support, but also that their sense of frustration may become so intense that they lose sight of their own longing for honest, loving and respectful relationship. In extreme cases they may be driven to react to violation with violation, and find themselves defined by the system as terrorists.

Escapism: Sacrifice of Reality to Virtual Reality

"Man seeks to escape himself in myth, and does so by any means at his disposal. Drugs, alcohol, or lies. Unable to withdraw into himself, he disguises himself. Lies and inaccuracy give him a few moments of comfort" - Jean Cocteau

Faced with the distress, restrictions and hostilities encountered when living in an adverse culture, it is only natural to seek refuge in whatever way you can. Addiction to conflict can set the scene for all kinds of self-destructive, recursive patterns of thought and behaviour that have come to be known as 'addictions' or 'mental disorders'. And, inevitably, the most sensitive, creative and aware souls are most susceptible to these conditions, whilst the thicker-skinned carry on regardless, in blissful ignorance. Those empowered by being most able to tolerate the intolerable aspects of modern culture can be those most intolerant of human frailty. It is they who are inclined to label sufferers as 'diseased' rather than 'dis-eased'. And the labelling leads to a search for 'what is wrong' within the individual and his curative treatment, rather than for the source of distress within the culture and for its amelioration.

My recognition of the possible connection between addiction to conflict and addiction in general began to develop in earnest when, in April 2005, I met

William Pryor, a great great grandson of Charles Darwin. William wrote ‘The Survival of the Coolest’, a memoir of his addiction to heroin and alcohol in the 1960s and 1970s. He explains how his addictions emerged in response to the distress of not being seen by his emotionally dysfunctional family. What love they gave him was performance-related; the more he lived up to the family's privileged, illustrious and snobbish past, the more would he be appreciated. His father once said to him, "it doesn't matter what you do, William, as long as you are brilliant at it". William went on to excel at being an addict and scapegoat for the family's unresolved, unspoken unhappiness.

There was much that I could personally relate to in William’s story, and within a year we had organized a conference together, at the Assembly Rooms in Bath, entitled ‘Unhooked Thinking’. Among the contributors to the conference was Bruce Alexander. Bruce described how in the late 1970s he had conducted experiments with rats to determine how their situation affected their tendency to consume supplies of morphine. Rats kept in a Rat Box Hell of isolation of the kind traditionally used in animal behaviour experiments consumed a lot. Rats given the run with their pals of a rich and varied ‘Rat Park Heaven’, consumed very little. QED, you might think.

Imperialism: Sacrifice of Local to Global

“I came, I saw, I conquered” – Julius Caesar

Recorded human history is full of stories of the invasion and conquest of resident people to serve the interest of some greater power. Commonly some figurehead leads this power. This figurehead may, depending on how beneficent or malignant their purpose is viewed, be described as ‘Great’, ‘Magnificent’ or ‘Terrible’. Regardless of this description, however, what lies behind the invasion is an attitude of mind that places ‘I’ and/or ‘Us’ up against and superior to what is eliminated or subjugated. The effect of this attitude is to spread uniformity though the local colour and heterogeneity of the resident population, whose actual or potential generous hospitality and lack of superiority are betrayed and belittled as frailties by overwhelming external force.

In recent history such globalizing force has commonly emanated from European ‘civilizations’, as exemplified by the subjugation of indigenous North and South American, African, Asian and Australian communities. In its wake, it has hence become irretrievably identified with one of the most potent expressions of addiction to conflict in modern culture: racism. The invasion and devastating exploitation of dark-skinned people and their naturally rich homelands by pale-skinned people has been superseded by a reciprocal immigration of dark-skinned people into the abstractive wealthy territories of their former colonists and enslavers. The resulting tensions are enormous as the resentments of the exploited come into confrontation with the suppressive influence of the exploiters, who naturally fear that what they did to ‘other’ may in turn be done to them. Only a remarkable degree of loving understanding, respect, forgivingness and release from deprivation can ease these tensions.

Whereas imperial power used predominantly to be expressed through force of arms, in the modern era it can also be expressed more subtly and insidiously, through economic and technological means and the spread through language and force of argument of the rationalistic thinking that leads to colonialism. This more subtle form of spread is evident in what has been called globalization, associated with the politics of capitalism, the rise and rise of information technology and the increasing hegemony of the English language with which I am myself now, ironically, trying to communicate.

Pollution: Sacrifice of Global to Local

“Where there’s muck, there’s brass” - Black Country saying

“The environment is everything that isn’t me” - Albert Einstein

We live, with all other organic forms of life in a global Earth surface that we have come to call the ‘biosphere’. There are no corners in this curvature, and so no single fixed centre or defining line that can be pinpointed or ruled anywhere other than by arbitrary imposition. Every divergence is simultaneously and reciprocally a convergence, every ‘source’ simultaneously and reciprocally a ‘sink’, every expansion simultaneously and reciprocally a contraction, every night simultaneously and reciprocally a day. So, what goes around inevitably comes around. In a global scheme, one locality’s effluent is another locality’s influx and all localities are pooled together in common space. All localities are hence simultaneously under one another’s mutual dynamic influence, whose evolutionary expression in the long run is way beyond the predictive reach of conventional mathematical analysis.

We have known about this geometry for centuries yet still seem for the most part to be incapable of accepting its implications, preferring instead to stick to the defining principles of an Euclidean ‘Flat Earth’ mentality where we can disregard everything beyond our immediate locality as being of no consequence. To this mentality, ‘over there’ is, by definition, ‘not here’. But in the surface of a sphere ‘here’ is inextricably an inclusion of everywhere and *vice versa*. Like it or not, what happens here cannot be abstracted from what happens there. Oil washes up with entrapped bird carcasses on beaches. Radionuclides from Chernobyl find their way into Welsh sheep. Acid rain sweeps from western to eastern Europe.

Only now, as atmospheric carbon dioxide concentrations are increasing frighteningly in what some calculate (notwithstanding the inadequacy of

analytical mathematical models) to be a runaway ‘greenhouse effect’, are the potentially catastrophic implications of our Flat Earth mentality beginning to strike home. We cannot remove the influence of our local industry from the global living space that this industry is in dynamic relationship with. If this industry carries on in profit-motivated disregard, one-sidedly out of balance with its own repercussions rather than attuning with its situation, catastrophic imbalance may arise. And nothing is more liable to produce such imbalance than relying on the fossil fuel heritage of the biosphere above and beyond what can be sustained through the continual supply of solar energy that Earth receives.

Wasteland: Sacrifice of Living Space to Human Abstraction

“What are the roots that clutch, what branches grow out of this stony rubbish?” T.S. Eliot

“After one look at this planet any visitor from outer space would say ‘I want to see the manager’” - William S Burroughs

In a world of one-sided excess, the exploitation of living space to fuel polluting, profit-making industries produces waste that is returned to devastated land in heaps or holes filled with spoil and trash. This return to Earth of mined, refined, manufactured and harvested residues is a far cry from the natural recycling processes of growth, decomposition and re-growth within the litter, humus and soil of natural ecosystems. It scars the landscape in a way that has us trying to shield our eyes and so place it out of sight and out of min(e)d. Yet the wastelands of modern urban, industrial and agricultural landscapes are never far from view, whilst the natural forests, hillsides, plains and grasslands from which they are abstracted fade further from our vision and memory.

So painful to many of us is this devastation of natural beauty and productivity, that it has pricked our consciences into developing recycling schemes and conservation projects. And it is those of us who, amidst our abstractly created wealth, have least left, who desire a ‘return to nature’ most. Meanwhile those who have most left, least desire it as they endeavour to improve their situation of financial deprivation in a competitive marketplace.

This situation can give rise to some weirdly inconsistent patterns of behaviour as we try to salve our consciences but fail politically and individually to get at the philosophical and psychological roots of the problem. We try to induce financially deprived people to conserve their natural resources by encouraging ‘ecotourism’. We fly round the world in pursuit of natural wilderness whilst rain forests continue to be flattened at an alarming and unsustainable rate to serve the needs of agriculture to serve the needs of an oil-demanding industry. We try to conserve rarity in isolated sites of special interest and natural parks, whilst neglecting the common ground that lies in between. We try to preserve and stabilize whilst forgetting that natural processes are dynamic. We demand cheap and exotic foods from the other side of the planet whilst failing to sustain the diversity of what can be grown in our immediate vicinity. We try to put an economic price on ‘natural capital’. We try to legislate to ensure sustainable practice. We turn off a few light switches and crush a few bottles in order to save energy and recycle waste whilst failing to take an all-round view of what really makes ecological sense. Its all rather like getting worried about the froth at the mouth of the vortex whilst continuing to stir the system with all our abstractive might.

Disease Control: Sacrifice of Vitality to Sterility

“Bernard was right; the microbe is nothing, it is the terrain that is all” - Louis Pasteur

One of the clearest examples of our inclination to single out and eliminate what we perceive as an enemy can be found in the way that we attempt to

combat disease. No sooner do we identify what we regard as ill health in ourselves or in an animal or plant we care about, than the search begins for a causal agency that we can eliminate or at least control. And there is no doubt that this approach has served us well - at least on first sight.

Our modern *knowledge* of disease is vastly greater than it was even a century or two ago and many of us consequently suffer less and have much longer life expectancies than our ancestors did. But our *understanding* of disease and how to treat the condition may not have moved on so far. This is because of the continuing focus on causal agency that characterizes conventional medicine, veterinary science and plant pathology, whilst neglecting the larger picture of the context or cultural conditions in which disease is expressed. It was this need to consider the larger picture that Louis Pasteur, the founder of the 'germ theory' of disease confessed to on his death bed to his friend, Dr Renard: *'Bernard avait raison; le microbe n'est rien, c'est le terrain qui est tout'*.

If the larger picture is neglected whilst local cause is targeted, the upshot can be the many kinds of adverse side effects and 'one size fits all' abuses that currently prevail. Moreover, 'complementary' treatments that could take effective account of the complexity and uniqueness of individual cases are under-researched and dismissed prescriptively into the realms of quackery by neurotic disease treatment industries fearful of their commercial security.

Many of us, when we are ill, consequently find ourselves removed from tender loving care into sterile, clinical conditions where we are treated as invalid objects, our unique identities virtually lost in the label 'patient'. And many of our crop plants, when they become diseased, are sprayed with pesticides, which then enter the food chain that leads back into our own mouths. If only we could have the courage and insight to learn to treat the conditions in which disease emerges, rather than continually blame and batter the life forms that these conditions sustain, much suffering and expense might be averted. But we continue to wage 'war against disease' for much the same reason and in much the same way that some of us have attempted to wage 'war on

terrorism', oblivious of the side effects and complex implications of our one-sided actions.

Standardization: Sacrifice of Diversity to Conformity

"Variety's the very spice of life, That gives it all its flavour" - William Cowper

"Not chaos-like, together crushed and bruised, But as the world harmoniously confused: Where order in variety we see, And where, though all things differ, all agree" - Alexander Pope

"Let all things be done decently and in order" - 1 Corinthians

Evidently, a recurrent theme of the culture of discontent is its intolerance of variety. Any departure from 'normality' is seen as 'abnormal', a source of error, contention, unpredictability and general disorder.

In much the same way that Darwinian selection perversely eliminates the diversity upon which evolutionary creativity depends, we may therefore set about excising abnormality from our culture as though it is the epitome of original sin. Everywhere, we seek to discover appropriate 'standards' and impose them both upon our selves and upon the products of our endeavours, using some 'benchmark' against which to ask 'is it good enough?' We require our selves to dress, behave and perform in certain ways and may even go so far as to don uniforms and obey the most finicky rules of etiquette in order to be included as acceptable members of society. Similarly, we require the products of our industries to conform to acceptable standards of safety, reliability and performance. Nowhere are these requirements more obvious than in our educational systems, where we impose prescriptive curricula and rigorously test whether students come up to the mark required through painful examinations.

Important as it undoubtedly is to find ways to identify and assess quality, the imposition of exacting standards can have the opposite of the desired effect, eliminating what we need to be able to contribute complementarily and in diverse ways to the life of the communities that we inhabit. We replace the colour of the carnival with a dull monoculture of uniform entities that in the very ‘perfection’ of their matching standards are in no way equipped for life in an ever-changing flow-form. By all being the same, we might avoid disagreement, but lose all possibility of excited involvement in co-creative enterprise. Fascism, in its many guises of right-minded artificial intelligence, is no match in the long run for diversity and imagination, but may inflict untold damage in the short term. The animal humanity of Dr Who and his friends will always confound the limited, robotic megalomaniac mindsets of Daleks and Cybermen. But at what terrible cost?

There is therefore an enormous need for what I regard as ‘true education’, of the kind that opens up awareness of diverse possibilities, as well as the ‘training’ that instils the skills needed to accomplish particular tasks. If training becomes the sole purpose of our learning institutions, as is the current trend under the influence of central government and commercial organizations, our humanity can only lose out in the long run.

Lust for Freedom and Security: Sacrifice of Love and Compassion

“The reason why the notion of this enclosing whole concerns us is that it corrects a large and disastrous blind spot in our contemporary world view. It reminds us that we are not separate, independent autonomous entitities. Since the Enlightenment, the deepest moral efforts of our culture have gone to establishing our freedom as individuals” Mary Midgely

“We hold these truths to be self-evident, that all men are created equal, that they are endowed by their creator with certain inalienable rights, that among these are life, liberty and the pursuit of happiness” - Thomas Jefferson, American Declaration of Independence

“Nature does not complete things. She is chaotic. Man must finish, and he does so by making a garden and building a wall” - Robert Frost

Our intolerance of variety is most fundamentally an expression of our need for certainty, which can only come when we ourselves and/or the world we inhabit are *complete*. Incompleteness erodes the boundary around our individual selves that we need to make us autonomous or ‘self-sufficient’. It also erodes the boundary around the group - parish, nation, team, organization, etc - that we might define ourselves as belonging to.

The desire for individual freedom and collective security, through the imposition of discrete boundaries around self and group, are, correspondingly, the two greatest ‘hang-ups’ of the culture of discontent. It is expressed ubiquitously in our political rhetoric, in our everyday language and in the actions we take to exclude any form of wildness from our lives through the imposition of Euclidean structure - we build walls and cultivate gardens.

Yet even as we manifest this desire, some other aspect of our human nature recognizes that hard boundaries can actually stifle as well as protect and liberate life. We put windows in our walls, curtains over the windows and soft furnishings wherever we can to relieve the hard lines of rectangular surfaces. We may deliberately introduce some informality into our gardens or, exhausted by the cost of imposing control, let nature regain its ascendancy.

So what is this ‘other’ aspect of our human nature that makes us receptive to what our desire for freedom and security seeks to exclude? I suggest that it is none other than the love and compassion that comes naturally with our acceptance of our incomplete, impermanent, vulnerable situation as dynamic inclusions of living space. Without this acceptance, we transform ourselves from lovers of one another and our selves into rapists and victims, a culture of abused and abusive beings. We become profoundly discontent.

Debate: Sacrifice of Co-creative Conversation to Hot Air

“A great Whig authority used always to say that the duty of an Opposition was very simple - it was to oppose everything and propose nothing” - Edward, Earl of Derby

“No government can be long secure without a formidable Opposition” - Benjamin Disraeli

Along with the desire for completeness comes the desire for ‘closure’ that can resolve issues about which we feel uncertain one way or another. The way that we traditionally set about seeking this resolution is to argue either ‘for’ or ‘against’ a certain proposition and then decide which ‘case’ is the strongest. Such adversarial debate is fundamental to all kinds of political, legal and philosophical decision-making and is obviously founded in the logic of opposition that excludes the middle. Commonly it is said to provide a path to truth - an idea of the utmost significance to someone accused of committing a crime, for example. Yet it is founded on a context-excluding assumption that cannot hold true and is liable to result either in deeply unjustified conclusions or interminable bickering between sides unable to see one another’s point of view and seeking to ‘win’ through pure rhetoric. The resolution sought through debate is therefore liable to resolve nothing and prolong antipathy indefinitely. It impedes rather than facilitates the real communication that comes from co-creative conversation - the sharing of perspectives coming from different viewpoints that can allow the evolution of an understanding not available to any one holding a fixed position.

War: Sacrifice of Humanity to Ideology

“[A man of peace] is not against war
Because to be against anything is to be at war
He is not at war, he simply understands why war exists
And out of that understanding, he becomes peaceful” - Osho

“An empire founded by war has to maintain itself by war” - Charles, Baron de Montesquieu

“Onward Christian soldiers, Marching as to War, With the Cross of Jesus, Going on before” - S. Baring-Gould

“But war’s a game, which, were their subjects wise, Kings would not play at” - William Cowper

War is the culmination of the breakdown of communication that arises from the definition of what is not self, which fuels our addiction to conflict. It has no real place in nature.

Power Imbalance – The Runaway to Holocaust

The awful truth that I feel has been emerging about our human-sacrificing culture of discontent is that by believing, through the logic of the excluded middle, that life is a struggle for existence, we have made an enemy of love. We have also made an enemy of death, to the extent of developing an addiction to conflict that perversely feeds death with life rather than allows death to feed life. As I will discuss again in a later chapter, such enmities may be traceable to a transitional period in human cultural history, which corresponds with the Genesis story of the “Fall” - Adam and Eve’s exclusion from the Garden of Eden. But rather than interpreting this story as the consequence of disobedience to divine external Authority, it may more aptly be understood as symbolic of the alienation of human beings from the immanent divinity of Nature, through the quest for definitive Knowledge of the difference between Good and Evil.

In the very process of drawing a line between to be or not to be, and trying to exclude the latter possibility, we have sacrificed mutual love for one-sided power. This one-sided power is what I call the Vampire Archetype, a parasitic

and cancerous influence that declares itself independent whilst drawing succour from its loving and richly varied neighbourhood through a one-way filter. Left unchallenged, it feeds ever more insatiably through its expanding boundaries and so spreads uniformity through its host community until at last it becomes a virtual monoculture of itself. Whereupon, no longer able to sustain its activities, it implodes, leaving behind only the Wasteland of its former living space. Fortunately, it need not get that far, providing it is recognized - and recognizes itself - for what it is *and* is not. Whereupon, it can be rehabilitated within its loving neighbourhood.

Out of the Loop - Reversing the Dying Spiral

"All you need is love, love, love is all you need" - John Lennon and Paul McCartney

Chapter 2

The Meaning of Neighbourhood

'Oh, to find a solid without flux' - Plato

'The tree which moves some to tears of joy is in the eyes of others only a green thing which stands in the way. Some see nature as all ridicule and deformity… and some scarce see nature at all. But by the eyes of a man of imagination, nature is imagination itself' - William Blake

What or Who Is Neighbourhood?

Perhaps what springs to mind is the street where you live. Or, if you live in a rural setting, you may be thinking of the woodland, parkland or fields surrounding your home. Whichever it is, there is a sense of *locality*, what is in your immediate vicinity, around you. But how far does this locality stretch? When you write down your address, you may start with a house number, followed by a street name, a village or town, then county, then country. Perhaps like me as a child you might have added continent, planet Earth, Solar System, Milky Way, Universe. It's as though larger and larger shells of space surround you; each nested in the next one. You are located simultaneously within somewhere local and everywhere around. Perhaps that thought's too much for you, at least for practical purposes, and you want to define exactly where your neighbourhood begins and ends. Perhaps you might write down your postcode as a means of doing this!

On the other hand, perhaps you weren't imagining what geographically surrounds you at all, but rather some local grouping or *community* of which

you are a member. This community might inhabit a particular geographical district, or, increasingly, as our technology has advanced in scope and sophistication, its membership may be connected by transport or telecommunications links. So, who or what do you include in your community? Is it just you and the other people? If so, how many people? How large is the group of which you count yourself a member? Anyway, why do you only count human beings? What about all the other animals, the plants, the fungi, the bacteria and even the viruses - are they not also included? Then again, what about all the other manifestations of earth, air, fire and water, along with the immaterial space that includes and is included in them all?

When I ask people what or who is neighbourhood, their answers are usually along the lines I've just described, falling into one or other of two objective categories. Neighbourhood is either regarded as whatever surrounds an entity or as all the entities adjacent to one another within a particular space. Either way, neighbourhood is perceived instantaneously as 'something' or 'somewhere' fixed in place rather than as fluidly evolving space nested over innumerable scales.

The view of neighbourhood as what surrounds an entity corresponds with how Albert Einstein defined his environment exclusively as 'everything that isn't me'. The self is perceived individualistically as a subjective figure *wholly* alone (all one), an object isolated by the space between its own and others' sharply defined boundaries, dislocated from the ground on which it stands like a 'blot on the landscape'.

This individualistic view can give rise to feelings of loneliness, vulnerability, incapability, sadness, uncertainty and alienation. All of these imply a sense of dependence and associated longing for belonging, which are nonetheless pitted against the need to survive in a hostile world. As T.S. Eliot put it:

'Hell is oneself; Hell is alone, the other figures in it merely projections. There is nothing to escape from and nothing to escape to. One is always alone.'

Alternatively, there may be feelings of personal power, self-determination, certitude, rectitude, control, possession, paternalism, stewardship and, above all, freedom. All of these inspire a sense of independence and associated notion that one's neighbourhood is there as a potentially infinite repository to support growth and receive waste.

The view of neighbourhood as a group of adjacent entities encapsulated within some defining boundary of geographical, cultural or governmental influence subsumes the individual self within the collective enterprise. The group now becomes the whole object that the individual, as a component part, is required to serve.

On the one hand, this collective view brings feelings of oppression, confinement and loss of unique identity, as the self is required to conform to communal objectives. From this perspective, as Jean-Paul Sartre put it:

'Hell is other people'

On the other hand, there may be a feeling of comfort, security and safety in numbers. The self is not alone and can depend on others to provide support in a common cause without question. The individual becomes a member of the club, a company man or woman, a good team player and stalwart of the community, who puts the objectives of the group not only above their own and others' personal freedom, but also in competition with the objectives of other groups.

These objective categories of neighbourhood therefore set the scene for conflict between individual and group interests, providing the ground for the many forms of human sacrifice outlined in Chapter 1. One way or another, 'I' is opposed to 'You', 'I' to 'We', 'Us' to 'Them' and 'Here' to 'There'. Evolutionary change is interpreted in terms of what independent individuals or groups of individuals *do* in their own right and interest rather than how they *participate* in the way that their *neighbourhood evolves*. Emphasis is placed

on the *actions* and *reactions* of the *contents* of neighbourhood, whilst their ever-transforming spatial *context* is regarded paradoxically as a passive, constant background.

Why does it have to be this way, you might be wondering? Surely neighbourhood implies neighbourliness, a compassionate regard for others? Why can we not have a view of neighbourhood that is based neither on individualism nor collectivism but somehow combines them lovingly into the best of both worlds? Why can we not see neighbourhood as a vital, loving, self-evolving condition of natural human relationship? Why not indeed? Perhaps it has something to do with the way we human beings are prone to view Nature and our place in it. Which brings me to my next question.

What is a Tree?

Perhaps what you imagine in response to this question is some kind of fixture in the landscape, a natural wooden statue that the mind's eye captures in a snapshot of space and time. This statue is viewed through a window in our own body, which may in turn be behind a window in a building in which we are sheltering or a vehicle in which we are travelling. Quite likely you'll be imagining just one tree, standing proud in the middle of your field of view, because the question doesn't invite you to see a forest. You won't be thinking about a tree in terms of its relationship with others. Correspondingly, you'll also be imagining just one kind of tree, one that has special significance in your unique experience and mental modelling of the world. You probably won't be thinking about the immense variety of possible forms that trees can take, or if you are, your mind may be searching for some feature that all these forms have in common, so that you can generalize. Similarly, you are unlikely to be imagining the extraordinary variety of shapes that a tree assumes over its lifetime, as it emerges from a seed in soil, grows by combining water and carbon dioxide, matures, loses branches, decays and becomes soil, water and carbon dioxide. All these transformations occur in the productive light of photosynthesis and consuming fire of respiration, which respectively liberate

and quench the power of oxygen to support combustion in a global cycle of carbon. We tend to be unaware of them, however, because their slow pace relative to our own hot, fast lives creates an illusion of permanence in which we may well find or seek comfort, a rock of solidity amidst turmoil to which we can anchor ourselves. The tree's enduring structure becomes a frame of reference against which to benchmark our lives.

In my experience, three findings generally emerge from asking people what is a tree:

1. It is surprisingly difficult to provide simple answers for such simple questions – the underlying issues are far more complex than first meets the eye.
2. Different people are liable to provide very different responses to the question, reflecting their unique situational perspectives and experience. Rather than argue over which answer is 'best', a much richer understanding of the nature of trees may be gained by bringing the full diversity of the responses together in a common focus.
3. Most, if not all the responses are likely to attempt to *define* a tree as 'something out there', reflecting our habitual tendency to perceive our surroundings in terms of *solid objects in a fixed perspective*. Yet each definition has the effect of closing down possibilities and is insufficient to describe the 'big picture' of what it really means to be a tree in dynamic relationship with its living space.

How does this compulsion to define things arise? How may it limit and distort our comprehension of real world possibilities?

Before you answer, I invite you to sit down in a chair, and to stare fixedly at your knee. Now, still staring, stroke your knee with your fingers. Now, continue stroking, but close your eyes. Now open them again.

You might notice a tendency, when opening and closing your eyes, to change your perception of your knee. You may ‘flip’ from a detached, insensitive objectification of your knee as though it was ‘out there’ somehow disconnected from your body, to a feeling awareness of its presence as a subtly textured, dynamic aspect of yourself enveloped in and enveloping rather than isolated by space.

Whilst our binocular vision, from eyes in the front of our heads helps us to differentiate one thing from another and so catch or grasp ‘objects’ and avoid obstacles, this exercise demonstrates how it also has a dislocating effect. It seems that the objectivity of pure eyesight can dislocate your knee! It makes (air) space seem like a separating distance of ‘nothingness’ rather than a ‘pool’ in which we are immersed and gathered together.

When we close our eyes meditatively, we feel this pool around and within us as a vital ‘presence of absence’ rather than see (or rather, fail to see) what we take to be the absence of presence that comes between material objects. At the deepest level, we become aware of ourselves as gravitational inclusions of the universe through our sense of dynamic balance and acceleration. Unlike the standard ‘five’ senses of sight, hearing, smell, taste and touch, which are provided through organs (eyes, ears, nose, tongue and skin) explicitly detectable at the surface of our bodies, we tend to overlook or take for granted this ‘sixth sense’ or ‘inertial guidance system’. Yet it is vital to our appreciation of our spatial situation and its potential as we experience the roller coaster of our everyday lives. It can literally take our breath away when the solid ground of our substance gives way and we begin to fall. Perhaps we fail to take account of it because the relational movements of our internal organs and the fluid in the semicircular canals of our inner ears from which it arises are hidden beneath our bodily surface. But by failing to take account of it, something, or, rather, somewhere vital can go missing from our conscious interpretation of nature and human nature, leaving us loveless and prone intellectually to replace our receptive ‘centre of gravity’ with an executive ‘centre of control’. We can lose heart and create a culture of discontent.

As a corollary to this exercise, imagine air was water or, like a sheep or rabbit that you have eyes on the side of your head, giving panoramic rather than binocular vision. Does this change your perception of your surroundings and of yourself in relation to them? Are you less inclined to distinguish ‘something’ from ‘nothing’ and regard the latter as empty ‘distance’?

As we grow towards adulthood, especially when assuming roles as hunter-gatherers and protectors, so we come to rely more and more on our boundary-hardening, object-defining eyesight to learn about and gain influence over the world around us. We may even suppress our other senses or allow them to diminish, along with our emotional responses. In this way we can lose touch with reality, whilst imagining that we have a greater grip on it.

We may then be led to think in a very particular way whereby space is regarded paradoxically *both* as ‘distance’ that separates *and* ‘nothing’, a void through which independent material objects move, act and react through the imposition of external force in an abstract time frame. But, if there is ‘nothing’ between things, what keeps them apart? And how may their harmonic correspondences under one another’s simultaneous mutual influence, as evident in solar system dynamics, for example, be accounted for? Newton himself, as he admitted in his preface to the ‘Principia’, was unable to fathom this out, and left it, like others before and after him, in the hands of ultimate creative Authority: God. Similarly, neo-Darwinism leaves the guidance of biological evolution to ‘Natural Selection’, and governments surrender economic policy-making to ‘market forces’.

The perception of an absolute demarcation between matter and space leads inexorably to the ‘either/or’ logic of ‘to be or not to be’, which excludes the possibility of any ‘middle ground’. Everything, according to this logic is either A or not A.

This hard line, rationalistic ‘logic of the excluded middle’ has no *place for receptivity*, no room for *love*, and so renders ‘one’ eternally in opposition to ‘other’. It results in a form of orthodox enquiry, widespread in science and

academia, which cannot include that which it defines itself not to be. It thereby gives rise to deep paradox, of the kind evident when a Cretan informs you that all Cretans are liars. I think it is at the root of our human ‘addiction to conflict’, which equates ‘other’ with ‘enemy’ or ‘rival’ and so engenders all kinds of self-destructive thought and behaviour, including warfare, as described in Chapter 1. Moreover, we can psychologically project this human conflict onto non-human nature, creating an illusory impression of a ‘struggle for existence’ within a fixed container where there is a ‘survival of the fittest’ determined by ‘selfish genes’.

Within the exclusive terms of this logic, we see what we are predisposed to see and ignore and/or fear the uncertainty of what lies outside of our self-imposed definitive view. We hence force nature and human nature into a fixed-centred Euclidean-Cartesian framework or ‘box’ of x, y, z and t co-ordinates that is pure abstraction. Within this imaginary framework we can develop false senses of security, insecurity and control upon which to base a hugely disproportionate, space-excluding, inverted misunderstanding of evolutionary (transformational) processes of all kinds. We put the cart before the horse, at odds with the natural neighbourhood of which we are inescapably dynamic inclusions. And so, consciously or unconsciously, we may inflict unnecessary suffering upon others and ourselves and despoil our living space.

For all the inventiveness of science and its development of sophisticated microscopic and telescopic tools, however, no evidence has been found for an absolute demarcation between matter and space. Although there is evidence for distinct atomic and sub-atomic domains, space, as a *receptive presence of absence*, has so far been found to permeate everywhere, from microcosm to macrocosm. Science itself has found solidity to be an illusion, but has not as yet assimilated this finding into its logical foundations and analytical practice.

All theories and concepts constructed from a logical premise of absolute discreteness/completeness, no matter how elaborate or sophisticated, are built on brittle foundations. All logical systems based on this premise impose

discrete limits for which there is no evidence in reality. They are *super*natural, in the sense that they *super*impose a mythical fixed structure upon Nature.

To return to the question of ‘what is a tree?’ Our scientific investigations have revealed that trees comprise a nested series of *holes*, from those amongst and around the branches, to those amongst and within the cells of leafy and woody tissues, to those amongst and within the atomic structure. We also know that trees do not actually stand still forever, but continually transform, even though this is difficult to appreciate in an instant.

Geometrically, a tree comprises a dynamic *nested holeyness* of outer and inner spaces with permeable boundaries. This geometry, which corresponds closely but not *entirely* with what modern mathematicians call ‘fractal’ geometry, enables us to begin to appreciate a tree as a *dynamic neighbourhood*, both enveloped in and enveloping others. We can mentally picture its coupled inner and outer dimensions as a complex, fluid dynamic togetherness or *dynamic incompleteness* mediated through transient, permeable, reconfiguring linings. How very different this perception of a tree as a dynamic neighbourhood and flow form is from one of a fixed object, a singularity severed from its context. And if this perception can apply to such a seemingly persistent structure as a tree, how much more so may it apply to creatures like us human beings?

The Evolutionary Nature of Neighbourhood

Perhaps it is becoming clear that our conscious or unconscious imposition of objective definitions upon our natural neighbourhood is what destroys the possibility of loving, fluid dynamic relationships and replaces it with a struggle for power. A discrete boundary is mentally fixed either around the individual or around the group, which severs it from its dynamic context. I say ‘mentally’, because such fixation is physically impossible in real-world dynamics: it is purely an artefact of our imaginary abstraction of matter from space, something from nothing. But that doesn’t remove its power to alienate through

treating boundaries as excluded middles rather than included dynamic interfaces through which distinctive realms of space are both coupled and differentiated.

I have found that the following exercises dramatically illustrate not only the alienating influence of excluded middle logic but also how this can be transformed into a more creative, fluid dynamic understanding of our natural neighbourhood.

First, find a suitably thick-rimmed coin - for example, a British pound coin - and ask yourself to choose ‘heads’ or ‘tails’. Having made a choice, toss the coin in a spinning arc and catch it. Now, place the coin carefully on its edge on a flat surface. Tell yourself, ‘I was right and I was wrong’, and give the coin a nudge to set it rolling.

What, if anything, does this exercise reveal to you about dynamic neighbourhood? Here are some suggestions.

1. Both practically and metaphorically, the coin toss is a means of imposing a final decision and for assessing risk (statistical probability) as accurately as possible in the face of uncertainty. It is also a metaphor for adversarial debate - ‘arguing the toss’ - and ‘winning’ or ‘losing’.
2. But the decision and risk analysis rests on there being only two possible outcomes, each one of which excludes the other and once arrived at is final in the absence of external intervention.
3. For this to be so, a third possibility, which holds the other two dynamically and reciprocally together, must be excluded. It is excluded by reducing it to ‘zero’ - removing all space from it, so that the coin has no width/depth, like an Euclidean line or plane. The coin, deprived of its inner, outer and intermediary aspects, is then compelled to lie on one side or the other on the plane surface on which it is superimposed.
4. If this third possibility is retained, however, the coin can continue to roll in a never-ending non-linear exploration and expression of the topography of its context.

5. Hence it can be seen that the ‘heads’ or ‘tails’ choice is the product of an imposition that removes the role of spatial-inclusion in the roll of the coin itself, and so renders the coin bipolar, a divided identity.

Now, find a sheet of paper, say about 30 cm x 20 cm, and gripping each end of this between your fingers, hold it out in front of you. Say to yourself, and to anyone else watching, ‘here is a uniform Oneness; how can Two emerge from this One?’ Now, fold the paper in half and press with finger and thumb along the length of the fold to introduce some local stiffening. Now, using the stiffening in the paper as a pivot, push one half towards the other half, first one way and then the other. Notice what happens. Now, tear the paper along the line of the fold and consider the consequences of this action. Now hide one half of the paper behind your back, as though it doesn’t exist, and move the other half about in front of you.

Here, the sheet of paper, encircled within your outstretched arms and body, represents the *coherence* of energy-space or ‘natural presence’ that *differentiates* or ‘multiplies by subdividing’ to produce a ‘twosome’ or *dynamic couple*. But this twosome is simultaneously a ‘threesome’ because it includes the fold/boundary/interface/stiffening, which itself is but a local derivative, formed through the in-folding of the original, non-local ‘Oneness’. The couple is therefore a ‘Three-in-oneness’, a ‘qua-ternary’ flow-form, in which the ‘dance’ of ‘one’ is reciprocated by the ‘other’ in a dynamically balancing, gyroscopic relationship. This reciprocal movement of one with the other pivots around their mutual interface, in much the same way that the ‘heads’ and ‘tails’ of the rolling coin relate reciprocally through the thickness that expresses them both and is itself but a local derivative of everywhere, within and without the coin.

The tearing of the paper represents ‘excluding the middle’ by treating the fold as a discrete limit rather than a pivotal place. The flow-form collapses; each ‘side’ is dislocated from the other and their relationship switches from complementary to adversarial. The qua-ternary ‘one-with-other’ is converted

to binary one-or-other and ultimately to unitary one-without-other if a selection is made by making the other disappear. Only adhesive tape can now repair the damage and restore *some* (but not all) of the coherence of the original dynamic relationship!

It's rather like dislocating your knee - the place where your thigh bones and shin bones articulate together as distinct yet coupled identities, providing you with all those flexuous possibilities of walking, running, hopping and dancing. Sever the connection and the bones lose all ability to respond receptively to one another in complementary engagement. Fix the connection, by removing the fluid-filled space between their articulating surfaces, and you'll have severe arthritis! The dynamic possibilities of your knee depend on it being neither rigid nor dislocated in its intermediary role of allowing your thigh and shin both to be differentiated and to work together in reciprocal relationship.

So, by regarding boundaries like knees, as pivotal, space-including places of co-created, co-creative relationship, a different view of evolutionary neighbourhood emerges from making either/or choices that favour one possibility whilst excluding the other. The dance of responsive structure and receptive space - the *out-lined* 'figure' and *in-lined* 'ground' so well recognized in Art but ignored by orthodox science - brings new forms continually to life through their dynamic interfaces.

Perhaps all kinds of apparent opposition, including that between individualistic and collective definitions of neighbourhood, can be transformed into complementary dynamic relationship this way, through the incorporation of fluid space. This possibility is the basis for a 'logic of the included middle', arising from an awareness of space as a vital inclusion of natural dynamic geometry. Along with a small group of co-enquirers, I have called this awareness 'inclusionality', to indicate both its connection to and distinction from the objective rationality or 'rationalism' that rations out reality by dividing it into isolated portions.

The effect of inclusionality is correspondingly to transform our understanding of neighbourhood from one that implies an inevitable struggle for power between discrete entities into one that holds open the possibility of complementary, receptive-responsive relationship. Instead of being either excluded from or confined by its neighbourhood, the ‘self’ becomes its neighbourhood, a dynamic combination of individual and collective, local and non-local aspects. There is no contradiction in regarding ‘other’ as a vital aspect of self-identity and so both ‘selfish’ denial of and ‘altruistic’ sacrifice to neighbourhood make no sense and are evolutionarily unsustainable. We can realistically love our natural neighbourhood as ourselves, dynamically balancing the reciprocal needs of our mutually dependent individual and collective identities rather than setting these at loggerheads.

This idea of ‘self as dynamic neighbourhood’ takes us out of the loop of the imaginary independent individual’s addiction to conflict into an understanding of the real nature of ‘complex self-identity’. This complex self cannot be alone (all one) as a fully discrete object that is somehow paradoxically both driven solely by internal purpose or ‘free will’ and subject to the power and judgement of purely external force. It is an inclusion and manifestation of the evolutionary flow that is nature itself, both receptive and responsive, without need for an external or internal driver or controller.

You may find that the following exercise helps you visualize the receptive responsive nature of the complex self as dynamic neighbourhood, embodying both local and non-local identities. Find or purchase a toy ‘windmill’ of the kind children (and some adults who have retained their playful spirit) like to stick into sandcastles. Lay it to one side. Now, walk across a room. Ask yourself and any friends who might be watching you ‘what has just happened?’ Note your answers. Now ask, ‘what else has happened?’ Now, walk across the room again, holding the windmill out in front of you.

This exercise reveals just how prone we are, when viewing a changing scene, to focus on the explicit material content and lose sight of the implicit spatial context in which this content may appear to act independently, but invariably

is actually responding receptively to its dynamic situation. The usual answer to the question ‘what has just happened?’ is to say ‘I/you have just walked across the room’. The usual response to the follow-up question ‘what else has just happened’ is mystified silence and/or expressions of puzzlement.

That there is more going on than immediately meets the eye becomes clear through the spinning of the windmill when we hold it in front of us as we walk. But how does this spinning arise and what does it express? Is the windmill driving and expressing itself as an independently acting object? Of course not, you might say, with good reason. Because this would imply that the free-wheeling of the windmill is driven by its internal ‘self centre’, whereas this movement actually depends on energy assimilated from elsewhere and brought to a focus around a central hole via the spiral-form of the propeller blades. These blades were themselves initially shaped by manufacture rather than ‘pre-existing’. Their movement depends both on the resistance and receptivity of the air-space. We might then suggest that the ‘elsewhere’ driving the windmill is actually the walker, motivated by his internal purpose or ‘free will’. But if we reflect that the walker has no independent existence, but forms into place and is motivated through assimilation of energy from elsewhere then he or she can have no pre-existent ‘internal driver’ either.

Ultimately, we may conclude that the source of all apparent movement is ‘everywhere’ and cannot be ‘dislocated’ to some fixed object centre or ‘hub’ that radiates without receiving power. There can be no such thing as independent action or responsibility. All movement of material content implies a simultaneous reciprocal transformation of spatial possibility through the receptivity and responsiveness of inner and outer worlds in dynamic neighbourhood.

Correspondingly, to judge any behaviour as though it is independent of its neighbourhood is not only unrealistic but also potentially the grounds for profound injustice and conflict. On the other hand, to recognise that our behaviour both conditions and is conditioned by our dynamic neighbourhood provides the grounds for compassionate understanding and sustainable

relationship. We can move on, when confronted by problems, from asking, as if we were self-centred, independent, executive actors, ‘what can I do about this’ to ‘how may I respond receptively in this situation?’ That way we can attune harmoniously with rather than attempt to force-fit our natural neighbourhood, as I will describe in more detail in subsequent chapters.

Chapter 3

Life as an Embodied Water Flow

What Is an Organism?

If my writing in the previous chapter has struck a chord, you might respond along the lines of ‘an indefinable fluid dynamic neighbourhood’. Following conventional, excluded middle logic, however, an organism would most likely be defined as some kind of object. From a biological perspective, to make this definition as comprehensive and current as possible, this object would need to be described in such a way as to incorporate all the extraordinarily detailed information about molecular and cellular structure and mechanism that has been discovered in recent years. It would also need to exclude whatever might be deemed to lie outside the animate form of the object, whilst accounting for its capacity for reproduction and purposeful movement. The dominant metaphor upon which many modern definitions of an organism are based therefore corresponds very closely with the thinking behind the Scientific and Industrial Revolutions. One way or another, the organism is regarded as a machine. But what kind of machine might this be?

The Organism Regarded as a Living Machine

Before evolutionary theory became generally accepted, organisms were widely regarded as the creations of an external maker, in much the same way that we regard the products of our own manufacturing industry. To find out more about these creations, techniques of dissection and vivisection were used to explore the anatomy below the outward appearance of organisms and identify the functions of different parts. In taking the living machine apart in this way, the hope was that we might not only be able to understand its

workings but also repair and even re-assemble or re-create it when it went wrong, expired or needed improvement. This hope lives on in the modern development of genetic engineering, transplant surgery, infertility treatment, cloning and regenerative medicine. Yet to many minds it is either hopelessly unrealistic - at least in its most extreme ambitions - or profoundly dangerous to our psychological and social well being.

There is something deeply troubling about regarding human and other organisms as reproducible living machines, which Mary Shelley's depiction of Frankenstein's Monster was intended to evoke. Some *vital quality* is missing from this mechanistic picture. The Romantic Movement sought to point out this lack of feeling. But it was overlooked in the rush for progress in the rationalistic war against the sea of troubles, in much the same way that nowadays ideas like inclusionality have difficulty finding fertile soil amidst the stony ground of an unreceptive Anti-culture, addicted to conflict. Meanwhile, far from using an understanding of evolutionary process to expose the myth of the externally created machine-organism, rationalistic adherents of natural selection theory developed this myth into an even more potent, emotionally alienating metaphor.

The Organism Regarded as a Calculating Machine - an Information Processor

During the twentieth century, the widespread acceptance of Darwinian theory combined with the discoveries of genetics and development of information technology to convert the natural organism into a fully autonomous form of artificial intelligence, complete with hardware and software. The organism became a set of designer genes in a robotic body whose only function was to convey digital information from one generation to the next as exclusively and prolifically as possible. This super-selfish replicator came fully equipped with prodigious powers to exterminate its opposition and calculate the costs and benefits of its actions in order to make the most of itself in an entirely predictable future - give or take a few cosmic accidents.

Current evolutionary theory is correspondingly largely a field of sophisticated gamesmanship, using more and more complex digital mathematical models to work out how one gene, or set of genes can outdo another in a specific arena of conflict. Correspondingly, proponents of this theory can, like Daleks and Cybermen, make formidably unreceptive adversaries, encased in their own self-definitive argument. But there is always some vital quality lacking from their armoury that their calculations cannot account for under the simultaneous, indefinable contextual influence of three or more flow forms. This vital quality is paramount to sustainable evolutionary neighbourhood.

Where can this indefinable quality be found, which can loosen the grip of rationalistic solidity and open up creative evolutionary possibility? It's obvious, really, as soon as the supposition that reality is objectively definable is relaxed and life is understood to replicate DNA in its own image, rather than *vice versa*. But what's obvious depends on what you're looking for.

To a rationalistic thinker, what an inclusional thinker regards as most obviously vital to life's ever variable evolutionary flow may attract the least attention or credit, just because it is so intuitively obvious. The truth seems too simple to be true. Correspondingly, if you ask many a well-trained modern biological scientist what's needed to create life and the first thing that will probably be mentioned is DNA. In fact I've heard one of my academic colleagues say at a staff meeting that we don't expect degree-level biology students to know much about the diversity of organisms any more, and certainly don't expect to have to teach them much about it. It's too old fashioned, boring and lacking in promise of career success and financial reward. We expect them to know and ourselves to teach them about DNA, because that's where the research funding and academic kudos are to be found. So a first class modern biology graduate can get away with thinking that a penguin's a strange kind of fish or mammal and that grass is all the same thing, as long as he or she knows all about reverse transcriptase, TATA boxes and polymerase chain reactions.

Our modern obsession with DNA as the be-all and end-all of life fits perfectly with the information processing machine metaphor. As is now almost common knowledge, DNA has come to be regarded as the genetic ‘blueprint’ in which the ‘instructions’ for organism assembly are encoded. Cracking this code and working out how it is put into operation continues to be vaunted as the greatest triumph and most significant and glamorous endeavour of modern biological science. There’s almost a sense that we can comfortably consign everything else to ‘natural history’, an ‘unscientific’ past endeavour best dealt with by anthropomorphic popular books and TV programmes that aren’t too technically demanding for the uninformed public. Biology has largely lost sight of its natural roots in the rush for technological advancement and knowledge of mechanism.

Missing Context: the Solute, the Solvent and the Solution of Life on Earth

Meanwhile, in that other glamorous, technologically demanding modern scientific adventure, the one where we search excitedly for the possibility of life on other planets, the first ‘thing’ we look for is not DNA but an altogether much less elaborate chemical compound. We look for water.

To my mind, this difference in objective epitomizes how readily we dislocate content from context as we try to find ‘solutions’ to our problems of understanding and interacting with nature. We know implicitly all along that in both a real and metaphorical sense, the ‘solvent’ is present and vital to the ‘solution’ of life. But we tend to disregard it due to our focus on the explicit information contained in the solid ‘solute’ that is dissolved in the solvent.

I often find that if I ask a group of people what a salt solution (brine) contains, the first answer usually given to this seemingly naïve question is ‘salt’, or even ‘sodium chloride’ or ‘NaCl’ by those with a technical bent. In my following silence, or if I ask ‘what else?’ there are often looks of puzzlement until someone pipes up ‘oh, and water, of course’, as an afterthought. Just as in

the ‘windmill’ experiment I described in the previous chapter, what is invisible or taken for granted eludes our attention until its obvious presence is pointed out. Then it may seem just ‘too obvious’ to be taken seriously enough for its full significance to be understood and acknowledged.

So why is water so vital to organic life as we know it here on Earth (NB I am restricting the scope of this question because some people insist, with justification, that all the universe is alive, and what we usually call ‘life’ is not therefore divisible from it)? The standard answers to this question are often rehearsed at the beginning of elementary biology courses and textbooks before moving on to detailed descriptions of structures and mechanisms. In an oddly dry and static way, they usually focus on the unique physical and chemical properties of water *per se* as a passive background medium and habitat, which enable living processes and organisms respectively to sustain themselves. The objective eye ironically now treats water itself as a special kind of object, rather than appreciating what water represents universally as a source of the fluidity that renders all into indefinable, dynamic relational flow form, distinct but not absolutely discrete.

The Local Story of Water in Life: the Biochemical Medium

Water is a transparent, odourless liquid, which freezes at 0 °C and boils at 100 °C at atmospheric pressure. It covers about three-quarters of the Earth’s surface. It attains its maximum density at 4 °C and is a good thermal insulator and weak electrical conductor. Its chemical formula is H_2O, consisting of two hydrogen atoms bonded to an oxygen atom. Correspondingly it has a molecular weight of 18 (i.e. 1 + 1 + 16).

These properties of water are not what might be expected on the basis of chemical formula alone. Non-metallic, non-halogen compounds with such a low molecular weight would normally be gases under the conditions of temperature and pressure prevailing at the Earth’s surface.

It is generally thought that these properties are due to the fact that water molecules are *polar* - i.e. not uniformly electrically neutral - which gives rise to the phenomenon of *hydrogen bonding.* The relative attractiveness of the oxygen atom for electrons compared with the hydrogen atom leads the former to become relatively negatively charged and the latter relatively positively charged. The oxygen and hydrogen atoms of adjacent water molecules hence tend to associate together either in ice as a very regular, fixed array, or in liquid as an irregular, dynamic array.

As a liquid containing polar molecules, water is an excellent solvent for substances, or parts of substances that are not electrically neutral. Such substances or parts of substances are described as ‘hydrophilic’ or ‘water-loving’. On the other hand, electrically neutral substances or parts of substances are described as ‘hydrophobic’ or ‘water-repellent’.

The fact that water does not dissolve everything equally sets up the possibility for a complex relationship between structure and mobility in the cells and tissues of living organisms. Relatively insoluble, hydrophobic materials form the main part of the membranes and walls that line the interiors and exteriors of cells and organelles. Soluble, hydrophilic materials occur on the surfaces and within the pores of these linings, as well as at large within the liquid pool in which these linings are immersed. The chemical reactions upon which living processes depend take place between substances in solution. Water itself may be included in these reactions, as when, during photosynthesis, it is split into hydrogen and oxygen and, during respiration, it is reformed from hydrogen and oxygen. These chemical reactions can also be ordered in particular sequences by being localized to particular structural regions.

Water, then is the predominant ingredient of living, active organisms, the *milieu* for hydrophilic and hydrophobic substances to come into and out of solution as they interact chemically and form cells and tissues. Even as we acknowledge this, however, many of us may minimize its implications through treating averages as the ‘norm’ and ignoring variations in circumstance and differences in perspective that arise from using different measurement criteria.

For example, it is often stated that the average human body contains 60-70 % water. It is less well recognized, however, that the percentage goes up in children and babies and down in older people, and men on the whole are wetter because they contain less fat than women. Also, if the percentage is given in terms of numbers of molecules rather than weight, it is over 99 %, which gives a very different impression.

The Natural History of Life in Water: the Liquid Habitat

Just as the hydrophobic and hydrophilic ingredients of organisms are pooled together in water, so many organisms themselves inhabit pools of water that vary in size from droplets to oceans. It is generally held that organic life must first have evolved in water, and that this aquatic origin inescapably influences the form and functioning of organisms in an enormous variety of ways. Correspondingly, the emergence of some organisms as containers of water that resist drying out to varied degrees through their hydrophobic bodily linings is literally one of the most significant landmarks in biological evolution, opening up great opportunities whilst imposing considerable constraints. As I will explore further in later chapters, the full significance of this transition in understanding the evolution of creatures like human beings, even to the extent of underlying our predisposition to conflict, has largely escaped the attention of non-contextual thinkers.

Meanwhile, it is widely acknowledged that one of the most remarkable properties of water due to the effect of hydrogen bonding, which is vital to its ability to support life even in a cold climate, is the fact that its density is greatest at 4 °C. Bodies of water on the earth's surface therefore freeze from the top down. The formation of ice as a less dense surface layer serves as an insulator that protects underlying liquid water and its inhabitants from freezing. Theoretically, an outwardly cold, ice-bound planet or moon with a hot core could therefore support life in deep, dark waters, using chemical and thermal

sources of energy, in much the same way that diverse communities form around hydrothermal vents in the Earth's oceanic depths.

The Dynamic Story of Water Within and Without Life: Poetry in Motion

So there are some truly remarkable elements even in the prosaic account of the importance of water in and around life just given. But is there some way in which the very specificity of this account doesn't even begin to convey the kind of vitality represented in bodies of water that moves and expresses the emotions, that enraptures the poet and musician and invites the young and young at heart to playful splashing? How might this kind of vitality be important not only in the sustenance but also in the evolution of biological diversity?

Here is where an artist's understanding of the general as well as specific role of solvent and medium can add intuitive insight to the analytical scientist's particular knowledge. The solvent/medium, of which water and oil are examples with complementary abilities to dissolve polar and non-polar substances, has the effect when added to pigment of mobilizing it into a fluid dynamic form that can be worked into myriad expressions. The solvent is not just a passive background in which things take shape and move around, but is, like the space around and within the toy windmill I discussed earlier, vitally and inseparably included in the process of evolutionary transformation. In fact, most fundamentally *any* kind of solvent might be regarded as *a bringer of receptive space*, which liberates substance from *absolute definition*. By the same token, space, as the receptive presence of material absence, may be envisaged as the ultimate *solvent* and *fluidizer* of the universe, without which all would be a dimensionless concrete point.

Herein lies the reason for the transformation of the logic of the excluded middle, based on abstracting space from matter, to the logic of the included middle in which responsive substance (or, more technically, 'electromagnetic information') is a dynamic inclusion of receptive space (or, more technically,

‘gravitational field’). All life, all nature, is fluid dynamic neighbourhood, nested over all scales from microcosm to macrocosm.

A glimpse of this vital role of solvent as spatial attractor can be found in a phenomenon of the utmost biological significance, yet whose deeper implications are rarely brought out. If a sugar lump is dropped into a glass of water, the sugar dissolves and its molecules disperse via the process of *diffusion* until their concentration becomes uniform throughout the water. At least, that’s the usual description of what happens. If, on the other hand, a living cell, or piece of living tissue is put into the glass of water, the sugary solution within the cell or tissue will stay put, whereas water will flow into the cell or tissue by the process called *osmosis*. In the case of plants and fungi, the inflow of water results in a tendency for the cells to expand, which is counteracted by the resistance of their surrounding ‘cell wall’. This results in the build up of internal ‘pressure’, analogous to that in a car or bicycle tyre, known as ‘turgor’. Ultimately the expansion of the cell ceases when the resistance or ‘inward pressure’ of the wall exactly balances the outward pressure of the cell contents, and the cell is described as ‘turgid’. It is as though the cell sucks water in until its containing boundary can expand no further.

There appears superficially to be a difference here between situations in which solute particles move outwards, from high concentration to low concentration by a process of diffusion *through solvent*, and situations where water molecules move into living cells and tissues from more dilute to less dilute solution by osmosis. What could account for this difference?

Actually, there is no difference between the two situations in terms of the process that is occurring; what differs is the frame of reference within which this process is being observed and interpreted. Crucial in this respect is the presence of a one way filter, in the form of the membrane between the insides and outsides of living cells. This membrane is ‘semi-permeable’ in that it allows passage of water molecules but not solute. In both situations, water flows inwards from more dilute to less dilute locations, but the reciprocal

outward displacement of solute from more concentrated to less concentrated solution is constrained by the presence of the cell boundary. In the absence of this boundary our objective human attention tends to focus on the solute particles, like members of a dispersing crowd, moving from denser to less dense locations as if being repelled by one another.

Without the one way filter in place, we are prone to impose our own reference frame and so, in the same way as revealed by the windmill exercise, to *lose sight of* the reciprocal influx of solvent that accompanies the outward displacement of solute. In the presence of the retaining boundary, however, our attention flips to the apparent movement of the solvent. So we find our attention shifting back and forth between content and context in a way that is very inconsistent.

On the other hand, if we allow our attention to be drawn primarily by the distribution of the solvent, what becomes apparent is the relative affinity or attractiveness of the more internally informed for the less internally informed fluid. In water, this affinity is technically described as osmotic potential, and it has a negative value when referenced to a ‘pool of pure water’ of zero potential. Water is hence attracted to places with ‘more negative’ potential, which gives rise to a positive osmotic or turgor pressure when these places have a restraining boundary that limits reciprocal displacement of solute.

It is possible to think of this kind of reciprocal relation between fluid spatial context and dynamic informational surface as a universal phenomenon, operating over all scales of organization. Solvent space is not a passive background through which objects move independently, but a vital inclusion of evolutionary processes of contextual transformation of fluid dynamic neighbourhood everywhere. By its very nature, this dynamic inclusion of space in natural transformation cannot be expressed in literal, definitive language; it can only be evoked allusively through imagery and metaphor, as I am trying to accomplish here. Infuriating as it may be to mechanistic thinkers the deep significance of water as the conveyance of solvent space in the diversification of life cannot be expressed prosaically. It is poetry in motion,

which can only be appreciated through the feeling of gravitational inclusion in the receptive flow, where all is distinct, yet no thing defined into *absolute*, independent singleness.

The Organism as Embodied Water Flow - a Dynamic, Evolutionary Neighbourhood

To summarize, water can be understood as the solvent and bathing fluid that brings space into the Earthly lives of organisms. It is the receptive medium into and through which life forms gather and distribute the energy that puts them in motion via photosynthesis, chemosynthesis, digestion, respiration, transport and translocation. It provides the continuity between generations, through and in which genetic information can flow and be exchanged and expressed in endlessly diverse forms. It is and always has been the unfixed dynamic pool in and through which organic forms of life thrive, diversify and respond to and influence their surroundings and neighbours - an ‘artists’ medium’ whose properties both constrain and contribute to life’s heterogeneity and versatility.

A start can be made towards understanding the dynamic role of water in life by asking what possibilities for innovation and relationship exist in just a single droplet of water. Inclusionally, this droplet is a pool of energy-space, a dynamic context whose surface-tense boundary is the informational interface between its inside and outside. Assimilating or discharging energy sources can alter the surface area of the boundary of the droplet.

Assimilative processes result in expansion and subdivision or ‘self-differentiation’ of the droplet into finer scales of organization. At low input rates there is isotropic (equal in all directions) expansion, which minimizes the increase in surface exposed to the outside. At higher rates, ‘symmetry-breaking’ occurs, the droplet polarizes into a rivulet or subdivides into branches that are distinct, but not discrete. These processes resemble those of a spore or seed swelling and germinating. At even higher rates, the droplet

may dissociate into smaller droplets and ultimately molecules, resembling the formation of dispersal structures and gametes. Viewed at a snapshot in time, these forms may appear to be individual units but this ignores their common spatial source, which is only apparent when the process is viewed in dynamic context.

As the boundary generated by expansion and self-differentiation takes shape, its possibilities for change become constrained by what has already been produced. Moreover, since this surface cannot be fully sealed, it inevitably leaks out as well as gathers in sources of energy and so is only sustainable as long as supplies don't run short. If boundary proliferation were to continue without the replenishment of external energy sources it could therefore only end in an irretrievably finely divided condition. But this doesn't happen because as external availability of energy decreases, processes of 'self-integration' set in, which minimize losses by means of the coalescence, sealing in and/or redistribution of boundaries. Water vapour condenses into droplets and rivulets, droplets and rivulets coalesce into pools, rivers and networks and liquid water freezes into a myriad ice forms, with a release of stored energy ('latent heat') accompanying each reduction in exposed surface.

Such are the creative possibilities for differentiation and integration of form even in a droplet of pure water. Now, allow substances to be incorporated or dissolved within the droplet's contents or added to the surface of the droplet to form an insulating coating or envelope. Harnessed in this way, the dynamic potential for elaboration of diverse water forms becomes even greater.

In those embodied water flows that we have come to regard as organisms, substances added to and enveloping water constrain and enable the expression of diversity over scales ranging from the boundaries of molecules to ecosystems. These substances may be organic or inorganic, hydrophilic or hydrophobic. They may originate outside the organism's boundaries; they may be synthesized within, via gene expression, and they may be a combination of both produced by chemical reactions at boundaries. They include the

carbohydrates, fats, proteins, nucleic acids and other metabolites found in living cells. They include the tanned hides, bark layers, cuticles and cell walls that protect and contain the living contents of innumerable forms of plant, animal, fungal and bacterial life as they move and grow. They include the calcium-enriched shells and coatings of invertebrates and algae. They also include the earthy highways, byways, dams and buildings created by animals ranging from termites and earthworms to moles, beavers and human beings.

Water Recycling - The World as an Embodied Water Flow

The local story of water flowing within, through and around the dynamic boundaries of organisms cannot be the ‘whole story’, but nests inclusionally within a larger story. This larger story, the ‘water cycle’, concerns the flow within, through and around what adherents of Gaia Theory regard as one giant organism, planet Earth as a Whole. But again, this cannot be the whole story, because it nests in its turn within the larger story of universal fluid dynamics.

Simplified accounts of the water cycle typically tell how as sunrays beat down onto the surfaces of lakes, seas and oceans, so some of the water evaporates into the air. As the warm, humid air rises, perhaps forced upwards by mountainous landmasses, it cools and condenses to form clouds. From these clouds falls rain, hail, sleet, and snow. Liquid water then percolates underground or runs over ground, eventually returning to the bodies it came from.

On the one hand, such simplified accounts tend to present a view of Earth as a closed circulatory system, whilst taking for granted its receptivity to universal influence in general and solar radiation in particular. On the other hand they miss the finer details of the involvement of organisms in the process. They omit the circulating bodies of water that form the lives of plants, the migrating pools of water that roam the landscape in animal bodies and those great

hidden connectors and communicators that form the channels of fungal growths, not to mention the tiny puddles within bacteria.

Water Courses Here, There and Everywhere

Thinking of organisms as embodied water flows within the embodied water flow of Earth opens up a much more fluid perception of living patterns and their evolution via boundaries of dynamic, co-creative relationship rather than abrupt severance. This brings a sense that life *eases* rather than *bullies* its way in the world, by both creating and following receptive spatial paths of least resistance. Life forms droplets, pools, rivers and eddies everywhere, both deep and shallow, in the process of producing populations and communities of organisms in dynamic neighbourhood. Evolution is a process of continual contextual transformation, a necessary co-evolution of larger context with its locally expressed content, with each shaping and being shaped by the other, like landscape and river. Genetic ‘nature’ and environmental ‘nurture’ are inextricable from each other’s influence in the dynamic boundaries of living systems.

So, how do dynamic boundaries influence the patterns produced by the watery flow-forms of life? Here three basic relational properties of boundaries can be recognized, which influence the patterns produced by flow-forms by varying their resistance to the transfer and distribution of energy sources. The *deformability* of boundaries is reciprocally related to their rigidity, which resists expansion and contraction due to assimilation and release of energy sources between insides and outsides. The *permeability* of boundaries affects their resistance to passage of energy sources between insides and outsides. The *contiguity* of boundaries affects the internal channelling of energy sources, the resistance to which is increased by various kinds of interruption and decreased by enhanced connectivity.

By varying the deformability, permeability and contiguity of their boundaries, living systems can gather, conserve, explore for and redistribute energy

sources in close and highly efficient correspondence with their local contextual circumstances. There could be much here for human societies to learn, if we are ever to dwell in truly sustainable relationship with our living space.

Only under circumstances of external plenty is it appropriate for boundaries to be both relatively permeable, allowing uptake of energy sources, and deformable allowing expansive growth and the consequent differentiation/ proliferation of boundary surface. These circumstances are generally assumed to apply indefinitely by capitalist economic theory and neo-Darwinian models of evolutionary fitness.

There are, however, many circumstances when the supply of external resources runs short, including when there has been earlier uptake into the system. Under these circumstances, the increase of permeable surface would promote net loss of energy sources due to leakage, and so processes that limit or redirect growth become necessary. These processes minimize surface exposure by sealing, fusing and redistributing boundaries to serve distinctive life functions. Correspondingly, by rigidifying, fusing and sealing boundaries, living systems can conserve energy sources in resilient, dormant structures that survive adverse conditions, as with plant seeds, bulbs, corms and tubers. Alternatively, by sealing deformable boundaries it is possible to explore adverse terrain from a local haven, as in plant runners. By partitioning off redundant parts, the energy sources they contain can be redistributed to other parts of the system, as with the ageing and fall of plant leaves.

The more one envisages life as a dynamic inclusion of watery space, the more one senses the presence of watercourses here, there and everywhere within the biosphere. As in river systems, they can have tributary-like branching patterns where energy is being gathered in, distributary-like patterns where energy is being distributed outwardly, and form connective channels for internal flow.

Tributary-like patterns can be found in the membranous and tubular inclusions of all kinds of living cells. They occur in the blood-collecting veinules of capillary beds, in the dendrites of nerve cells, in the roots of plants and in the veins of photosynthesising leaves. They appear in the trails of all kinds of motile organisms from slime bacteria to wildebeest assembling for migration or foraging for food and in fungal growths in nutrient-rich locations. Distributary-like patterns can also be found the inclusions of living cells, in the blood-distributing arterioles of capillary beds, the pre-synaptic terminals of nerve cells, the inflorescences of plants, the veins in flowers and fruits, the spread of migrating organisms to new pastures and explorative fungal growth.

Connective channels can be found within the lumens of living cells, major blood vessels, nerve axons, plant runners, stems and trunks and their internal pipelines, trunk routes of migrating organisms and fungal cable-like growths. They are also characteristic of those most powerful communication systems formed by living systems, the fluid networks or anastomoses that arise when branches fuse with one another. As I will discuss in more detail in subsequent chapters, these networks occur at all scales of biological organization and have enormous, yet largely unappreciated inclusional significance in the evolutionary dynamic neighbourhood of life on Earth.

Imaginative Courses - Thought, Learning and Evolution

The branching and networking of living systems is not restricted within the immediate bodily linings of their watercourses. It also extends beyond those linings in the imaginative, unfixed processes of thought, learning and evolution that lead to diversification of all kinds. Only when we confine imagination within a fixed frame of reference will it follow a linear path. Liberate it from such confinement and away it goes, exploring everywhere!

Who hasn’t felt the joy of allowing the mind to wander in this watery way, full of wonder, never knowing what surprises and difficulties and discoveries await? This is the essence of evolutionary creativity, an experiential learning

process that is by no means random and unbounded. It accumulates information and complexity as it creates and follows spaces of least resistance, mediated through its dynamic guide-linings. Life becomes autocatalytic, more and more accomplished as it roots and branches like a tree, expanding its influence, building cumulatively upon the foundations of its own fluid dynamic structure.

Chapter 4

Scales of Life

What Are the Building Blocks of Life?

How often do you come across this expression, ‘building blocks of life’, in explanations of biological structure and function? It seems that this metaphor is used very widely indeed. But what does it mean? What does it say about how we tend to think about natural form?

The very notion of ‘building block’ implies a discrete unit of material structure that is used with others like it to construct a larger unit of structure. A set of smaller parts is used to assemble a larger whole in the same way that we construct buildings and edifices of logic and language founded on absolute initial definitions.

There is, therefore, a direct link between the use of this metaphor and atomistic thought arising from the fallacy of the excluded middle. The products of nature are divided down into smaller and smaller sub-products until some elemental units are reached that can’t be divided further. These units are then assumed to be what nature is assembled from via some force or agency. But this assumption depends on regarding space as nothing, an absence that nonetheless comes between things, rather than a dynamic inclusion of everything. It makes no consistent sense, but has nonetheless been the basis for rationalistic ‘reasoning’ for millennia.

So, what is ‘it’ that gets described as a building block? Actually, there are many answers to this question, which depend on the scale of organization at which life is being examined. At each scale there is a tendency objectively to define life in either individual or collective terms, rather than express it as indefinable fluid dynamic neighbourhood. This tendency results in

inconsistency and paradox and has damaging implications. It obscures the understanding of patterns, processes and relationships applicable to *all* scales, through which the evolutionary significance of diversity and communication at any specific scale can be appreciated. Before I explore the contrast between rationalistic and inclusional perceptions of neighbourhood at each of these scales, I therefore want to set the scene by asking another question.

What is a Living Body?

In biology, a living ‘body’ is generally thought of as equivalent to an individual organism. It may consist either of a single ‘cell’ (as in ‘unicellular organisms’) or an assembly of cells (as in ‘multicellular organisms’). Correspondingly, cells are regarded as the simplest level of organization in which life can be sustained, whilst containing many smaller entities incapable of living on their own. The latter include: organelles like nuclei, mitochondria and chloroplasts; molecular composites like virus particles and chromosomes; molecules like nucleic acids, proteins, fats, carbohydrates and water; atoms, ions and sub-atomic particles. Gatherings of individual organisms on the other hand may be referred to in various ways depending on their relative proximity to and interaction with one another. Populations, colonies and societies are gatherings of the same species. Symbioses, communities and ecosystems are gatherings of different species.

Hence the definition of ‘the living body’ becomes pivotal in the either/or division between individual and collective - differentiated and integrated - views of biological organization. At scales smaller than this definition, thinking tends to be focused on the individual and its components as objects, whereas at larger scales the focus is on groups and their individual components as objects. The inseparability over all scales of individual from group is overlooked as the common space that includes and is included in all is excluded by treating boundaries as severances.

By contrast, in common parlance ‘body’ can imply both a ‘distinct identity’ and a ‘corporation’ of distinct identities. I suggest that this ‘both and’ view can help to provide a deeper understanding of nested, communicating scales of biological neighbourhood and complex self identity in common space. Here there are no such things as independent, space-excluding, ‘wholes’ or ‘building block’ component parts: the latter are acknowledged to be human constructions based on abstract definition. Hence the relationship between biological form and human organizations can be made clearer and provide an opportunity for learning about one through understanding the other.

Molecular Scales - Genes and Their Expressions

For many modern biologists, it is genes and their components, together with the molecules and their components that genes give rise to, which are most readily thought of and described as life’s ‘building blocks’. For neo-Darwinian thinkers in particular, genes are the independent ‘units of selection’ upon which evolution depends to make its ‘preserve or discard’ decisions in the struggle for existence.

So, what then are genes? Can genes really be defined rationalistically as discrete units of hereditary information, as many currently contend? Or is there rather more to their real meaning and significance than immediately meets the objective eye?

According to modern convention, genes are sequences of purine and pyrimidine bases (guanine, cytosine, adenine and thymine or uracil) in DNA (deoxyribonucleic acid) or, as in some viruses, RNA (ribonucleic acid). They can be copied by a process of replication and give rise, by processes of transcription and translation, to sequences of amino acids in proteins. As a collective (known as genome or genotype), genes contain the ‘message’ or ‘instructions’ for organism assembly. As a collective (known as proteome), proteins provide the structures and catalytic converters (enzymes) through which this message is incorporated into bodily form and behaviour

(phenotype). The genes, their bases, the proteins and their amino acids, along with their component atoms of carbon, nitrogen, oxygen, hydrogen, phosphorus and sulphur can hence all be thought of as biochemical building blocks.

There are in this deterministic description all the hallmarks of belief in central executive authority; indeed it has been called the ‘central dogma’ of molecular biology. The gene, perceived as an independent internal agency appears to control the form and expression of the surrounding organism through its minions, the proteins, which do its bidding - including its own replication, transcription and translation.

Using language as an analogy, it is as though the ‘word’, having arisen as a distillate of evolutionary meaning that can be stored, relayed, reproduced and reconstituted afresh in diverse contexts, comes to dictate and source this meaning in its own right. The word gains sole possession of meaning in the same way that Man, symbolically, has sought dominion over the possibilities inherent in the receptivity (femininity) of Nature of which He is himself no more and no less than a vital dynamic inclusion and local rendering. The word becomes self-defining and disrespectful and fearful of the uncertainties of the void whose maternal influence it has usurped. Its local dependence upon Nature is disregarded as it presides over all, filling the world with reproductions of itself. In this symbolic form, the Word becomes the parasitic Selfish Gene and Vampire Archetype, struggling to replace the receptivity of its own source with the positivity of pure power and thereby excluding the possibility of evolutionary transformation. It becomes the focus of a dead, unreceptive, unresponsive language that perpetuates only more of the same.

In these terms, modern evolutionary genetics represents the latest expression of a long heritage of human intellectual excommunication from natural dynamic neighbourhood, and there is no doubting that it has a very powerful allure for the rationalistic mind. It seems to open up all sorts of hopes for empowerment with new, more sophisticated knowledge, from which there is the prospect of a more contented future, distanced from our human frailty and

mortality. But it is also potentially the stuff of nightmares, a breeding ground for intolerance, perfectionism and eugenic principles, whereby a desired end goal may justify any terrible means.

The notion that a gene, *in itself*, can *cause* or *do* anything, whether it is to make me brush my teeth in the morning or suffer from obsessive compulsive disorder, is, however, profoundly unrealistic as well as potentially damaging. From such a perspective there is no hope of understanding comprehensively or comprehensibly the great, unsolved biological mystery of how phenotypic meaning ('solution') emerges from the dynamic inclusion of genetic content ('solute') in spatial context ('solvent').

Yes, of course, after enormously expensive technological endeavour we can amazingly now read the sequence of words and letters of the genetic language in terms of nucleic acid bases and amino acids (of which there are twenty different kinds in biological proteins). With this knowledge we can do all sorts of exciting scientific and criminal detective work. But this knowledge alone won't allow us to make meaning of genetic language any more than someone will be able to understand what I have written in this paragraph purely through reading the sequence of words and letters. Meaning cannot be abstracted out of context.

Obvious as it may seem for me to say this, genes do not make water or carbon or any of the mineral elements and their included space, in whose dynamic context life is arrayed in all its variety and complexity. It is therefore meaningless to neglect this context by focusing solely on the local expression to which it gives and from which it derives form. Genes cannot and do not determine the qualities of life. The qualities of life are inherent in genes through which they are given diverse expression by varying the fluidity and pigmentation of dynamic boundaries and their contents in a living, ever transforming language.

From an inclusional perspective, the rationalistic idea of prescriptive genetic dictatorship can therefore readily be transformed into a deeper, more

comprehensive and comprehensible view of genes and their expression as the epitome of fluid dynamic evolutionary neighbourhood. All that is needed is the inclusion of space in their portrayal.

Here, genes can be thought of as dynamic configurations of receptive space, more like a malleable imprint or mould than a rigid building block, open to possibilities of replication, transcription and translation through the reciprocal relationship of ‘figure’ and ‘ground’, or ‘stylus’ and ‘groove’. These possibilities can be blocked or unblocked by proteins known as ‘transcription factors’, which enable the ‘differential gene expression’ whereby different phases in an organism’s development can assume very different forms and behaviours. Genes do not occur in isolation from one another, but are linked together to varied degrees in chromosomes, which may in turn be pooled together within nuclei. The proteins into which genes are translated can also be thought of as configurations of receptive space. Even a tiny change in this configuration, arising from a ‘mutation’, can radically affect their operation. Genes may include ‘spacers’ that have to be excised before expression is possible. They can shift to different positions on the same chromosome and to different chromosomes. Chromosomes from different parents are recombined during sexual ‘reproduction’ (which doesn’t, therefore, as the word implies make more of the same). Genes are commonly ‘co-expressed’ in suites. The phenotypic implications of the expression of more than two genes under one another’s simultaneous mutual influence are incalculable using conventional methods. Even the tiniest shift in relationship can have momentous implications without any major change in genetic content. Chimpanzees and human beings are extremely similar genetically, and even fruit flies have much in common with them.

Altogether, when the dynamic neighbourhood of genes is considered, their interplay with one another and their context are perhaps as complex and unpredictable in the long run as those of people. In a sense they are quite like people, nested within us as diverse, distinct but not discrete co-expressions of our common space at the molecular scale. But, vital as they are in our understanding of evolutionary heritage and complexity, they do not in

themselves make people, nor do they make people *do* anything. The source of life's meaning and motivation is necessarily more universal than can be defined within some local executive control centre. Rather than ask what genes do, we might more meaningfully ask how their form and expression responds receptively in their dynamic neighbourhood within in our dynamic neighbourhood? How is their situation and expression coupled dynamically with our human phenotype as worlds within worlds, whirls within whirls?

Cellular Scales - Parts, Parcels and Dynamic Envelopes

Before genes became the focus of attention, another kind of receptive space became widely regarded as the basic structural unit within which life is confined as a prisoner of definition: the cell.

It is said that cells made their first appearance on the stage of biological science when Robert Hooke stared through the objective of his newly invented microscope at a piece of cork, and saw lots of little boxes. From then on, analytical scientists had a convenient container within which to focus their attention and assume that the structures and goings on they found there could simply add up to the form and behaviour of the 'whole' organism. Indeed, in some cases, as I have already mentioned, the cell may be synonymous with an organism's body.

With this focus, the fundamental 'secrets of life' could be probed in ever finer detail, using increasingly sophisticated microscopic and biochemical tools. The contents of cells were identified and their function inferred using the same principles of dissection and vivisection that had served earlier investigations of bodily anatomy. Ultimately, the genes that Mendel had first described as inheritable *phenotypic* attributes, like the height, colour and wrinkliness of pea plants and their seeds, were narrowed down to segments of DNA and the modern conception of fundamental, context free, units of life.

By their very nature, however, living, active cells cannot be absolutely independent sealed units, any more than can their contents. Rather, they thrive, in the dynamic relationship between their insides and outsides, mediated through their variably permeable, deformable and continuous enveloping membranes and walls. It therefore makes more sense to regard them as receptive-responsive fluid configurations of space than as discrete object-boxes.

The vital significance of viewing cells in fluid dynamic neighbourhood becomes apparent as soon as consideration is given to the implications of the relationships of two or more cells co-existing alongside one another. This is an important consideration in understanding multicellular organisms like us human beings.

To sustain its biochemical activity (metabolism) a cell uses chemical energy to assimilate substances through channels in its semi-permeable membrane. This is analogous to a petrol pump that uses petrol to fill itself with more petrol. In a group of such pumps, one pump's inside is another's outside. Hence, if one pump is stronger, it will drain its neighbour(s), getting progressively stronger in the process through its increasing supply of fuel. There is a biblical redistribution to those that hath at the expense of those that hath not through a one-way door. This cancerous, parasitic potential is, however, forestalled in multicellular systems through the opening of communication channels, known as 'gap-junctions' between neighbours. These channels make their insides continuous through even though distinguished by their membranes - like rooms with doorways in their party walls. Resources then flow to wherever there is least in the neighbourhood, so sustaining all rather than allowing some or one to prosper at others' cost, destroying their partnership.

An even more salient illustration of the limitations of the 'sealed box' portrayal of the cell can be found in many fungi and fungus-like organisms and parts of organisms. Here, cell growth is characteristically *polarized*, confined to a parabolic dome-shaped tip. Elongation of the cell boundary from this tip gives

rise to a tube, known as a ‘hypha’. This tube can continue to elongate, as well as producing more elongating tubes by branching, as long as it is supplied with water and nutrients - i.e. potentially indefinitely - forming a collective system known as a ‘mycelium’. Moreover, the tips of the branches within this system can fuse (anastomose) with one another, so converting the initially ‘dendritic’ (tree-like) system of radiating branches into a dynamic, labyrinthine network. Some examples of these networks have been found spread over up to several square kilometres of ground and estimated to be thousands of years old. They contain zillions of nuclei and other organelles. Whilst these organelles may well be partitioned into distinct compartments along the length of the tubes by cross-walls called ‘septa’, their internal space is nonetheless typically continuous through gaps in these walls. Hence it is a moot point whether a mycelium is regarded as a single, potentially enormous cell or as a multicellular collective. Absolute definition one way or another isn’t helpful here and may well impede deeper understanding of its extraordinarily versatile, receptive-responsive, shape-shifting, *indeterminate* organization, which I will consider further in a later section and in the next chapter.

Multicellular Scales - Tissues, Organs and Pipework

The bodies of many plants and animals contain distinct arrays of cells called ‘tissues’, and may also include distinct arrays of tissues called ‘organs’. These tissues and organs are ‘specialized’ to serve different, complementary functions in the life of the organism.

That this complex, *multicellular* organization does not arise - as the ‘building block metaphor might imply - from the assembly by some external agency of discrete, pre-existing cellular units is immediately obvious from observations of embryonic development. Rather, it generally emerges through the self-differentiation and integration of a dynamically bounded receptive female space consisting simply of a relatively large single cell called an ‘egg’, following ‘fertilization’ by a relatively tiny single sperm. This conception reflects in microcosm the vital inclusional complementarity of receptive immaterial

space and responsive electromagnetic information in the dynamic implication and explication of the macrocosm.

In many ways, embryonic development (‘ontogeny’) therefore beautifully expresses the inclusional transformations of evolutionary flow-form. It also highlights the senselessness of excluding spatial receptivity from our understanding of natural dynamic geometry. But, sadly, even embryology seems currently to have been taken over by deterministic thinking that seeks to explain ontogeny *entirely* in terms of internal genetic control, subject to only the moderating influence of external environmental factors.

At first, after the fertilized egg or ‘zygote’ has multiplied by dividing itself a few times, most embryos consist of little more than a group of more or less similar cells. For tissues to form, some kind of re-organisation has to occur, so that the cells become distributed into distinctive layers or regions where they follow different developmental pathways. The way that this re-organization occurs contrasts markedly between most plants and animals, reflecting the difference between those forms of life that grow from place to place and those that move bodily from place to place.

In plants, the embryo becomes polarized into an elongated structure. New cells form at the tips of this structure by division from either a single apical cell, or a group of cells known as a ‘meristem’. Further tips may then arise by means of branching. All the cells and tissues of what is known as ‘the primary plant body’ arise from these tips. In woody plants, secondary meristems known as ‘cambia’ then thicken the trunks and branches of roots and stems by giving rise to additional layers of wood (to the inside) and bark (to the outside). This localization of cell division within apical meristems also occurs in some colonial invertebrates (animals without backbones, see below) and is a basic feature of indeterminate multicellular structures, analogous to the extending tips and branches of fungal hyphae.

By contrast, in the majority of animal embryos the production of new cells is not localized, but occurs within all the developing organs and tissues. Here,

from the viewpoint of an external observer, development appears to be highly prescriptive, occurring in a set sequence and directed towards a specific, determinate, functional end point, the sexually mature adult. Viewed from within the developing body boundary, however, indeterminate processes analogous to those seen in plants and fungi are evident, and even minute variations in the relational dynamics of these processes have the potential to result in radically different overall outcomes.

Following fertilization of an animal egg, the number of cells and/or nuclei increases via a series of doublings. As this process continues, an internal space or ‘blastocoel’ develops, preparatory to a remarkable self-integrative phase of boundary-infolding, known as ‘gastrulation’, which culminates in the formation of inner, outer and intermediate tissue layers: endoderm, ectoderm and mesoderm. Cells within these layers then undergo self-differentiation, and ultimately become specialized for distinctive roles in skin, nerve, gut, muscle, connective tissue, bone, blood vessels, liver, kidneys etc.

The processes that follow gastrulation are generally considered to be administered by a genetic programme that activates and inactivates distinctive sets of genes. For this programme to give rise to an appropriate sequence of changes, it is important for the developing embryo to be buffered, as far as possible, from the vicissitudes of the outside world. The developmental context is therefore internally self-regulated, within the confines of an enclosing boundary that minimizes exposure to the outside, at least until the moment of birth.

Progression through the developmental programme both equips the emerging adult for engagement with its real-world contextual boundaries and narrows down its options for change. The condition of all possibilities (‘totipotency’) from which development begins in the zygote leads, through self-differentiation, into increasingly narrow, bifurcating paths of specialism, entry to each of which is conditional upon those paths that have already been followed. This process of simultaneous multiplication and narrowing down of options from the initial coherent state of the zygote is known as determination.

It can be likened to the emergence of rivulets from a pool of water that overflows its banks.

Here there is a fundamental difference between determinately developing animals and indeterminately developing plants. With few exceptions, determined animal cells cannot change their developmental course - only the ‘stem cells’ that have attracted so much attention recently in the field of regenerative medicine retain totipotency. So long as they remain alive, even fully differentiated plant cells (those that are in their final functional form) can, however, regenerate into whole organisms. In artificial culture, such regeneration involves ‘de-differentiation’ into an uncoordinated mass, known as ‘callus’. In nature it commonly involves passage through an intermediary ‘storage’ phase, like a bulb or corm.

In general, determination and subsequent differentiation are achieved ‘epigenetically’, i.e. via changes in the expression rather than the content of genetic material. There is much evidence that these changes are effected through the expression of genes which block or unblock the expression of other genes through the production of transcription factors. These genes include the ‘homeotic’ genes, first discovered in the fruit fly where mutations in them can have such curious effects as inducing a leg to develop in place of an antenna.

As has already been implied, the separation of distinctive life-maintaining functions into local regions or tissues with specialized attributes allows each efficiently to get on with its own work, with minimum interference from others. But at the same time, this specialization leads to an inability to function in isolation, in much the same way that a carburettor cannot run an internal combustion engine without the co-operation of an ignition system and vice versa. It is therefore essential to have in place some kind of communication system that interconnects their activities. This generally takes the form of a set of pipelines that either conduct fluid, as in the ‘vascular’ systems and air channels of plants and animals, or electricity, as in the nervous systems of animals. The pattern of development of these pipelines is fundamentally

indeterminate, resembling that of a fungal mycelium as they connect up their sites of supply and distribution.

Nervous systems contain two types of cells: elongated ‘neurons’ that transmit electrical impulses and variously shaped ‘glia’ that provide packaging around the neurons. The neurons are often bundled together into cable-like structures known as nerves.

Neurons commonly have four distinct regions: a cell body, a tributary-like gathering-system of ‘dendrites’, a distributive channel or ‘axon’ and a junction between the cell body and axon, the ‘axon hillock’. During development, axons can both branch in a delta-like pattern and elongate at their tips. In so doing, they maintain and proliferate connections at specialized junctions known as ‘synapses’, both with tissues (especially muscles and glands) and with other neurons.

The extent and rate of spread of electrical charge along a neuron depends on two properties, the permeability of the cell boundary to ions and the conductivity of the cell interior. Wide, well-insulated neurons therefore conduct nerve impulses further, faster and more efficiently than narrow, uninsulated ones. Correspondingly axons are both wide and well-insulated. In vertebrates, the insulation is provided by specialized glial cells, known as ‘Schwann cells’ that wrap their plasma membranes around individual axons to form a many-layered coating known as ‘myelin’.

The transmission of a nerve impulse across a synapse depends on the action of chemicals called ‘neurotransmitters’. Acetylcholine is an example of a neurotransmitter that enhances transmission, whilst gamma amino butyric acid is an example of a neurotransmitter that impedes transmission. Depending on the identity of the neurotransmitter, synapses may be ‘excitatory’ or ‘inhibitory’, respectively propagating or resisting a nerve impulse. A single neuron may receive impulses from up to thousands of other neurons that synapse with it. Whether such a neuron fires an impulse

depends on the overall balance between inhibitory and excitatory signals that it receives.

Multicellular plant bodies typically consist of two complementary systems – roots and shoots, interconnected by two sets of pipelines or vascular tissues, known as ‘xylem’ and ‘phloem’. Water and mineral nutrients absorbed by roots are distributed through xylem, whereas the photosynthetic products of shoots are distributed through phloem. In herbaceous plants and in young shoots and leaves, xylem and phloem are associated with one another in cable-like ‘vascular bundles’ or veins. In perennial plants, the xylem is normally contained in a central cylinder of wood, whereas phloem is a component of bark. The external boundary of bark consists of an insulating layer of dead cells impregnated with a hydrophobic corky substance known as ‘suberin’.

The vascular systems of animals also consist of an interdependent combination of gathering and distributive pipelines, namely veins, lymph ducts and arteries. Veins and arteries are surrounded by relatively impermeable layers of muscle and connective tissue, which are particularly thick in arteries. At their gathering and distributing end-points, however, these major blood vessels characteristically branch into progressively finer sets of thin-walled, permeable channels known as ‘capillaries’. The capillary systems enable oxygen, carbon dioxide, nutrients and waste products to be transferred between tissues and blood stream, and are organized into patterns that resemble the intricate venation of a leaf or branching mycelial network of a fungus.

As well as being routes for passage of resources and waste products, vascular systems provide channels for transmission of substances known as ‘hormones’. In animals, hormones are usually produced in specialized tissues or organs and can either be hydrophobic or hydrophilic. The binding of hydrophilic hormones to receptor molecules on cell surfaces usually leads to a rapid change in cell activity, as with the ‘alarm’ hormone, adrenaline. Hydrophobic hormones, by contrast, usually lead to changes in gene expression, as with the steroid ‘sex’ hormones. Plant hormones, of which six

basic kinds are known (auxin, gibberellic acid, ethylene, cytokinins, abscisic acid and brassicolides) all affect some aspect of growth or development through changes in cell boundary properties and internal metabolism. Their complex, counteractive interplay results in varied patterns of shoot and root emergence, extension and branching.

Social Scales - Populations, Colonies and Societies

Many of the complementary patterns of integration and differentiation evident in cells and groups of cells also occur within and between groups of organisms. As organisms multiply in relatively unrestrictive, energy-rich situations, they dissociate into highly subdivided arrays that are unsustainable in the absence of continual replenishment of resources. As the external availability of resources diminishes, however, more coherent, self-integrated organizations are adopted.

In the same way that it does at smaller scales, this context-dependent interplay in necessarily incomplete, fluid-dynamic neighbourhood makes absolute definition impossible. But this has not prevented the ‘individual organism’ from being treated as the fully definable building block unit from which fully definable collective units are assembled. Confusion and endless vacuous debate are then inevitable concerning where to place the dividing lines between one unit and the next.

Correspondingly, in conventional ecology, a population is defined as a collection of individuals of the same species. But this definition requires us to ask what individuals are, as well as where a collection of them begins and ends and what a species is. The answers to these questions are anything but straightforward, and have both geometric/mathematical and genetic dimensions.

Classical mathematical models - of the kind that are still being used both in evolutionary theory and in human demography - assume that in the absence of constraints populations will consist of randomly distributed, point-centred individual units of limited size arrayed in a uniform field. But how realistic is this assumption, even for organisms like us human beings with determinate growth forms? Such models are less to do with reality and more to do with the convenience of imposing a flat-Earth Euclidean frame upon nature within which to confine our attention and seemingly enhance predictive ability. The trouble is that their predictive ability in the real world may actually be lessened by failing to recognise that we Earth-dwellers live in the highly heterogeneous, dynamic surface of a sphere with no fixed corners. This surface includes organisms, like fungi, and social formations, like human cultures, whose indeterminate growth potential may be restrained only by availability of resources. All populations will therefore be at least to some degree spatially structured (heterogeneous) and none will have absolutely smooth edges. Moreover, all populations will both have and be subjected to global influence and none can be absolutely isolated and independent. Any realistic account of populations therefore needs to include spatial and temporal heterogeneity both in the form of the population members themselves and in the scale and distribution of the places in which these members locate and assimilate resources.

The genetic dimension becomes important in understanding the implications of encounters between neighbouring population members. Of special interest here is the influence of genetic difference, how this difference arises and how it affects our ideas about what constitutes a ‘species’.

Throughout life on Earth, two seemingly opposite responses are evident between genetically different population members: a mutual or one-sided warding off or ‘rejection’ and a mutual or one-sided embrace or ‘acceptance’. Whereas rejection generally appears in such guises as territoriality and immunity as a response of the ‘body’ or ‘soma’ maintaining its identity by keeping itself to itself, acceptance is ‘sexual’, often mediated through special conjugative ‘private parts’. The situation, however, is more complex than can

be accounted for by tidy, sharply defined alternatives between rejection and acceptance on the one hand and between somatic and sexual interactions on the other. Somewhere or other, complete definition always breaks down, because sexual and somatic encounters can't be kept entirely separate.

It is as though there is a basic tendency for genetically unlike bodies to differentiate from one another, which is overridden by the attraction of sexual integration. If the attraction is insufficient, the differentiation will prevail and the encounter will be 'incompatible'. Complexities arise because this situation occurs *both* when the genetic difference is too small *and* when it is too great. In the latter case, members of different populations will become sexually infertile, the condition that is generally regarded as necessary for the evolution of distinct species.

There is therefore a delicate counter-balance or 'tension' between these reciprocal tendencies for somatic differentiation and sexual integration, which can have very complex and unpredictable implications that depend very sensitively upon context. From an objective, context-free standpoint, which focuses one-sidedly only on the individual scale of life, these implications can seem perplexing if not downright irrational. This no doubt contributes to some of the marital difficulties and other conflicts that many of us experience, as well as the difficulties many neo-Darwinian thinkers have explaining why we should reproduce in such costly ways with a partner rather than by ourselves! Why on Earth, when we spend so much of our everyday lives appearing to behave in accord with our need for individual prosperity do we then go and turn everything upside-down in receptive response to the inviting prospect of the bedroom? But when the larger neighbourhood context is included in our enquiry, all the seemingly strange twists and turns that accompany this about-face begin to make sense.

At first sight, incompatibility, and the seemingly aggressive responses that can accompany it may appear to be an expression of *opposition* to other and resultant *competition* and *conflict*. It may, however, more aptly be understood inclusionally as an expression of *phase interference* and resultant

differentiation between neighbouring flow forms. This differentiation ensures that unique *identity* is sustained at the individual scale of organisation under conditions where energy is being assimilated from a plentiful resource supply. This unique identity both recreates and is recreated by *diversity* at the population scale, through self-integrative processes of sexual recombination, which are induced when external resource supply diminishes. This diversity allows complementary relationship between different forms and resistance to the spread of destabilising influences (e.g. infections) in a dynamic neighbourhood of variable rather than uniform individual identities. Hence, the seemingly contradictory somatic and sexual appetites apparent at the individual scale of organization can be understood in the context of the social scale of organization that both generates and is generated by them.

An insight into the physics of flow form underlying these biological expressions of incompatibility and compatibility may be gained simply by throwing stones into a pond. I became aware of this possibility early on in my biological research, when I noticed that the patterns formed in this way appear remarkably similar to those formed by fungal colonies (mycelia) growing and interacting on agar jelly in a dish. The margins of the colonies surge out like a wave front. Quite often, rhythmically alternating, concentric ridges and troughs of aerial and submersed mycelium develop. Upon meeting, a trough or a ridge forms at the interface of the colonies. Where the colonies are genetically identical, and the peaks and troughs correspondingly of equal frequency and amplitude, this initial interfacial distinction often disappears as the aerial and submersed zones align and merge harmonically with one another. Where the colonies are not genetically identical, the interface between them either persists and intensifies as a mutual ‘barrage’ zone or is superseded by the emergence and spread in one or both directions, following mating, of a new or ‘secondary’ mycelial phase.

Biological compatibility and incompatibility may correspondingly be interpreted as an expression and example of ‘constructive’ and ‘destructive’ ‘interference’ between wave fronts. Compatibility occurs when responsive and receptive phases coincide with or reciprocate one another in synchronous, *resonant*

relationship. Incompatibility, on the other hand, occurs when the participants are ‘out of phase’ or ‘mismatched’. The degree of mismatch - i.e. the degree of ‘freedom’ or ‘uncoupling’ of one from the other - is infinitely variable, such that the likelihood of absolute mismatch is infinitesimally small. There is always, therefore, the possibility for compatibility to emerge and be cultivated through a process of harmonization or dynamic attunement, even in the most seemingly incompatible initial encounter. By the same token, the possibility for incompatibility to develop and intensify through non-reciprocation of one with the other, is present even in the most seemingly mutually supportive arrangement. I will return to a discussion of how compatible and incompatible responses may be mediated chemically by oxidation and reduction reactions in the next two chapters.

My use of fungal mycelia to illustrate the principles of biological compatibility and incompatibility and why the latter may be regarded as an expression of differentiation in fluid dynamic neighbourhood rather than conflict or competition between discrete identities serves also to raise another question of definition. What is a colony?

Biologically, colonies are generally defined as congregations of unicellular or multicellular organisms of the same species. But it is again immediately clear that such a definition is impossible to apply strictly to any kind of organization in which there is a dynamic interplay between processes of differentiation and integration. How does a colony differ from a population on the one hand and from a society on the other? Here again there are both geometric/mathematical and genetic issues to consider.

Geometrically, the key distinguishing features of a colony in conventional terms are that its members are separable yet live close together in a fixed place i.e. a colony is regarded as an object that comprises an association of smaller objects. But how separable, how close together and how fixed in place? Is a fungal mycelium, for example, with its spreading and anastomosing hyphal tubes that aren’t readily definable either as individual cells or as a huge individual cell meaningfully regarded as a colony? Is a pack

of dogs, a shoal of fish, a migrating swarm of army ants or a creeping slug of cellular slime moulds a colony? If not, why not and how else should it be described? How alike in form and behaviour are members of a colony? When may they be so different and complementary in their roles as to be more aptly regarded as a society?

Simple gatherings of similar organisms, such as herds, flocks and shoals of animals or clumps, tufts and stands of plants occur whenever the organisms are contained within an external boundary or are mutually attracted in some way or don't detach fully when they multiply. The boundaries of these simple gatherings may be relatively sedentary. Alternatively they may be sufficiently fluid to enable them to generate an immense variety of patterns by both creating and following paths of least resistance. Hence a herd of wildebeest can migrate from dry lands to wet lands along a delta-like array of well-worn paths, colonies of mosses can follow and accentuate cracks in walls and pavements, and flocks of birds or shoals of fish shimmer and fenestrate through air and sea currents.

As in embryonic development, initially simple arrays of similar forms can give rise to elaborate social structures through diversification into different specialized roles linked together by means of various kinds of communicative channels. Amongst animals, two examples of such complex social structures formed in this way, the one essentially indeterminate and plant- or fungus-like, the other more self-contained, are found in certain jellyfish-like creatures, the 'hydroids' and the 'siphonophores'.

Hydroids consist of individual 'polyps' - goblet-like forms whose gut cavities are all connected to one another, usually by a tubular system of erect branching 'stems' and creeping stolons or 'hydrorhiza'. The hydrorhiza extend outwards and give rise to further erect stems, so increasing the size of the colony. The polyps develop in a variety of distinctive forms. Many are feeding polyps, equipped with tentacles that trap prey. Others are reproductive, giving rise to free-swimming, bell-like 'medusae' that drift away and produce sexual

offspring. Yet others may be equipped with stinging cells that protect the colony or paralyse prey.

Siphonophores are complex assemblies not only of different kinds of polyp, but also different kinds of medusae, all communicating with one another through internal channels. As well as having sexual functions, the medusae may be modified into swimming bells, protective flaps or a gas-filled float. A well-known example is the Portuguese-man-of-war.

Another kind of social organization, in which organisms are pooled together through their behaviour rather than via direct bodily channels, is found in some kinds of insects, like ants and bees. Here, very different looking forms occur, known as ‘castes’, which have reproductive, feeding and protective roles: e.g. ‘queens’, ‘workers’ and ‘soldiers’. Specialization into different social roles also occurs in prides of lions, troops of baboons, packs of hyaenas, societies of meerkats and human societies, although this is less strongly associated with differences in bodily appearance.

The distribution of genetic variation and its spatial sources (i.e. genes and their context) amongst these collective organizations is important to understand. It influences how they behave both internally and in response to one another.

In groupings connected by direct bodily channels, all the members arise by multiplication from the same immediate local genetic and spatial source, much as all the cells in a human body originate from the same fertilized egg. Each member can hence be thought of as an offshoot (technically known as ‘ramet’) from the same stock (known as ‘genet’). Different genets, as their name implies, vary genetically because they are generated sexually from different immediate local genetic and spatial sources (notice how I have to qualify this statement with the word ‘immediate’, because the population is a ‘family of genets’, distinct but not discrete). Hence members of the same genet are generally somatically compatible with one another. Members of different genets, on the other hand, are somatically incompatible and may

show strong ‘rejection’ responses when they encounter one another, but these responses may be overridden by sexually compatibility. This ensures the genetically diverse population structure that I mentioned earlier in which members are genetically distinct but not genetically isolated from one another.

In social groupings that are pooled together through their behaviour rather than via direct bodily channels, a similar but significantly different situation occurs. Members of the same collective are generally closely related - as members of the same family - but not genetically and spatially identical in origin. Sexual outcrossing between members of one family and another family produces different families. Members of different families are therefore more genetically diverse than are members of the same immediate family. So again, there tends to be more variation evident in the population at large than in local family groupings.

Given the dynamic counterbalancing between sexual and somatic relationships I mentioned earlier, this has important implications for human cultures. Here colonialism and migration over large geographical distances have hugely disrupted our natural neighbourhood relationships, not only amongst ourselves, but also with the other life forms that have accompanied us on our travels. To understand more fully both the dangers and creative possibilities of this situation, it may be necessary to take into account a yet larger picture of the organization of life on Earth.

Ecosystem Scales - Partnerships and Communities

The dynamic interplay between processes of differentiation and integration is as much in evidence amongst as it is within what we human beings have distinguished as different species. It is crucial to the organization and evolution of natural community life. But what is a natural community? Again, the impossibility of absolute definition has not deterred many from applyin the building block metaphor, with in this case, the species as the basic constructive unit from which the whole is assembled.

In conventional ecology, a natural community is defined as the living component of an ecosystem, consisting of diverse species that combine together within a particular place to form a distinctive functional unit. In containing diverse species it is not the same as what in common parlance is called a human community, which is more akin to what in biological terms would be described as a colony or society, a coherent grouping within a population consisting of members of the same species.

Like human societies, natural communities are characterised by having at least some functional coherence, but, tellingly, this is not generally orchestrated around any obvious governmental structure or individuals such as a ‘parliament’, ‘king’, ‘queen’ or ‘leader of the pack’. Natural communities are what might be termed ‘self-orchestrating’ - their coherence arises from the complementary form and functioning of their members pooled together in space. For a natural community to continue to thrive, however, at least some of its members need to be ‘primary producers’, transforming sunlight or inorganic sources of energy into organic form. In many (but not all) situations exposed to sunlight, these primary producers are plants. They form the living and dying dynamic framing within, upon and around which heterotrophic organisms, incapable of producing their own food, dwell in dynamic neighbourhood.

In the sense that they include identities assembling together from disparate immediate sources, the building block metaphor does apply more readily to natural communities and their inhabitants than it does to collectives emerging through differentiation and integration from the same immediate source. The basic principle underlying this assembly is, however, the same as I have already described in the special case of sexual conjugation. It is the attraction of ‘one’ to the receptive space of an ‘other’, which one way or another serves as its ‘host’. This ‘host space’ may be in the form of another organism, whereupon it gives rise to what is known as ‘symbiosis’, and it may be in the form of some geographical feature, whereupon it serves as the spatial context of natural ecosystems and their inhabitants.

The word ‘symbiosis’ was first used in the nineteenth century by Anton de Bary to mean a combination of two or more organisms living together. The most fully developed forms of symbiosis are generally regarded as ‘mutualistic’, where each organism benefits from, and indeed may be dependent for its viability upon the presence of the other.

In terrestrial ecosystems, the majority of multicellular plants would be unable to thrive without forming mutualistic partnerships, known as ‘mycorrhizas’, with fungi that enter and serve as absorptive accessories to their roots. The fungi extend out, as mycelium, into soil and thereby provide their plant partner with improved access to mineral nutrients and water in exchange for organic compounds produced by photosynthesis. The mycelium can also interconnect different plants – even of different species. By providing communication channels between the plants, mycorrhizal mycelia are thought to enable adult plants to nurture seedlings and to enhance efficient usage and distribution of soil nutrients. When we look at a forest or other stand of vegetation, we may be deceived by its superficial appearance into regarding it as an array of separate branching sticks in the ground that can do no more than bump into one another as they grow and sway in the breeze. But the reality underground, out of sight and out of mind, is that the plants are connected to varying degrees by complex, genetically diverse networks of fungi, like solar powered fountains linked together by hidden pipelines.

Apart from forming mycorrhizas, the roots of some plants form associations with bacteria that are capable of converting atmospheric nitrogen into ammonia by a process known as ‘nitrogen fixation’. These associations have considerable importance in the generation and maintenance of soil fertility.

Where larger plants are unable to establish in terrestrial habitats, then another kind of symbiotic couple, lichens, covers surfaces that would otherwise be bare. Lichens consist of a photosynthetic filling of green algal or blue-green bacterial cells sandwiched between layers of fungal mycelium. Being tolerant of extremes of temperature and water availability, they grow very slowly,

contributing over many years to processes of rock erosion and soil formation, and are a source of a unique variety of chemical compounds.

Not only terrestrial plants, but also many animals depend on mutualistic symbioses. The guts of many animals contain assemblages of microorganisms that both benefit from and can aid digestive processes. Some of these associations are indeed essential to digestion, and the activities of different members of assemblages complement one another. Such complementation occurs between the fungi and bacteria that inhabit the rumen of ruminant mammals, and the microorganisms that inhabit the guts of lower termites. Some animals even cultivate partners that can aid digestion: amongst insects these include the wood wasps, ambrosia beetles, higher termites and attine ants, which grow ‘fungus gardens’.

Mutualistic symbioses are also of great importance in marine communities. The reef-building corals, for example, depend on the presence of photosynthetic ‘zooxanthellae’ within their tissues and so cannot exist below depths where an adequate supply of light can penetrate. The corals benefit through the provision of photosynthetic products and enhanced production of calcium carbonate (limestone) for skeletal support. The zooxanthellae obtain nitrogen and phosphorus from the food caught by the polyps as well as gaining shelter within the animal tissues.

Mutualistic symbioses have the potential to become so intimate, with the partners so interdependent that they become literally inseparable, so that what originated as partnership between distinct identities becomes, in effect, one and the same identity. It is now widely thought that the cells of plants, animals and fungi arose in this way, and that their DNA-containing organelles like mitochondria and chloroplasts are derived from bacterial and blue-green bacterial ancestors. During evolution, transfer of genes from these organelles to the cell nucleus has enhanced their interdependence and mutual compatibility.

It should be recalled, however, that partnerships brought about by self-integration of boundaries are potentially unstable if incompatibilities are not overridden, and that many mutualistic symbioses may evolve via a parasitic phase in which there is apparent benefit only to one partner. A number of degenerative conditions and male-sterility phenomena, for example, are thought to arise from dissonant mitochondrial expression.

Parasitism is an extremely widespread phenomenon, which is usually viewed detrimentally from a human perspective, as a cause of disease and death. But is this view yet another illustration of our human tendency to draw one-sided conclusions out of dynamic context? Could parasitism, as it is viewed at one scale of life contribute to vitality at another scale?

Both parasitism and mutualism are examples of the prevalence of a 'cost-benefit' approach to classifying symbiotic relationships, which is very revealing of underlying assumptions. For example, a common schema based on this approach classifies associations between two organisms into six categories depending on whether the outcome for each organism is beneficial (+), detrimental (-) or neutral (0): so we have ++, +-, +0, -0, 00 and – possibilities.

Quite apart from the enormous difficulty of calculating what the net costs and benefits to each might actually be in any particular case, this approach confines its attention (like Newton did in his analysis of solar system dynamics) to two bodies at a time within a discrete frame of reference. It therefore avoids the complexities of accounting for the simultaneous mutual influence of three or more bodies (the 'three body problem'), which I discuss elsewhere in this book. Moreover it is purely *transactional* in that it envisages the exchange of some kind of currency between two primarily isolated entities. It hence effectively ignores the complex dynamic neighbourhood, of which these entities are inseparable inclusions, and so may seriously misrepresent their role in ongoing interdependent natural processes. For example, we may take a limited snapshot view of a powdery mildew fungus growing on one of our crop or garden plants as a 'pathogen', 'attacking' the plant and thereby

feel compelled to rally to the defence of the ‘victim’. Perhaps we will do this by spraying the victim and its neighbourhood with fungicide or manipulating its genome, engendering ‘collateral damage’ of the same ilk as when in human warfare, we attempt to rid a host community of its pestilential influences.

By making rash judgements based on one-sided quantitative analyses that fail to account for dynamic context, we may seriously mismanage our environmental relationships and, in effect, make pathogens of ourselves. How many of the ‘diseases’ that we seek to eliminate from our living space are ‘dis-eases’ of our own making? How much worse might our eliminative control measures make the situation? How many of us recognise the wisdom of Louis Pasteur’s deathbed confession: ‘Bernard avait raison; le microbe n’est rien, c’est le terrain qui est tout’ [‘Bernard was right; the microbe is nothing, it is the terrain that is all’].

Perhaps we can turn our understanding around by thinking about what it really means to be a ‘host’. A host can be thought of as a provider of living space, an inductive, receptive place - an accommodative ‘hospitality suite’ that invites all comers to find shelter and sustenance.

How does it feel to think, for example, of a tree in this way? Elsewhere I have already described a tree geometrically as a dynamic nested holeyness or neighbourhood of outer and inner spaces with permeable boundaries. It is a relational place, enveloped in, neighbouring and enveloping other places whose coupled inner and outer dimensions comprise a complex ‘self’ or ‘flow-form’.

A tree is a great place for a party! Anyone who has thrown a party in their home will be aware of the rich creative and destructive potentialities of the situation! To close off these potentialities completely is to endure an isolated, dormant existence - no real ‘life’ at all. To open up these potentialities brings great promise, but also risk of damage to internal structure and function. The latter can, however, be minimized by mechanisms of ‘damage limitation’ that protect, repair and seal off vital partitions and sustain function, keeping the

activities of guests within fluid bounds, perhaps aided by the guests themselves. Should these mechanisms fail, for example through inadequate resource supply or infrastructure, then the system may be overwhelmed and lose viability.

Add to that that the guests in this host space are themselves complex flow-forms and there is scope for an immensely rich multiculture of relationships, whose character depends critically on circumstances. In this dynamic context we can begin to understand the extraordinary variety of life that finds accommodation within and without the tree's dynamic boundaries as it grows, dies and decays. We can also begin to recognize the complex ways in which the guests may influence one another's activities and in turn both influence and be influenced by internal and external environmental circumstances.

In these terms, a tree forms the receptive space of an ecosystem. It embodies a community of flow forms playing complementary roles in the sustenance of a rich diversity of life, akin to its own tissues, organs and communicating pipelines as a multicelullar organism emerging from the receptive space of a seed. Moreover, this community is a dynamic inclusion, a distinct but not discrete identity within the distinct but not discrete community of the forest within the distinct but not discrete community of the biosphere: a holey communion of dynamic neighbourhood, nested over all scales.

Universal Scales - Cosmic Neighbourhood

Descriptions and discussions of life on Earth generally stop, rather unnaturally, beyond that realm of curved space that has been called the biosphere. In much the same way that bodily boundaries of smaller scale have been treated as the limits of discrete forms of life from cells to ecosystems, the edge of the biosphere marks where Earthly life is *alienated* from the Cosmos and made a totality in its own right. But where is this barrier that seals us off from the Heavens? One thing we can be sure of is that if such a barrier did exist, life as we know it in all its evolutionary dynamic

complexity could not. Life on Mother Earth, as some like to call her, depends on the life of the Cosmos, whether or not the latter can assume organic form anywhere else in its myriad constellations. As a responsive *source* of life, Mother Earth is necessarily and simultaneously a receptive *sink* for energy flow conveyed like incoming sperm in shafts of sunlight. She cannot keep herself to herself, rotating independently about her own axis, but is inextricably caught up in the flow of inseparable cosmic inclusion of electromagnetic within gravitational fields that swirls, ripples, streams, connects and pools everywhere. In our human longing not to be alone, we dream of life on other planets and of breaking the bounds of Earth's biosphere to navigate our way amongst and beyond the far reaches of the solar system. But whatever was it that made us feel alone in the first place?

Contrasting Perspectives - Constructed Webs and Real, Live Networks

A recurrent theme in my foregoing exposition of the endless interplay between processes of differentiation and integration that applies to all scales of life in dynamic neighbourhood is the anastomosis of initially branched systems to form networks. These range from those evident within 'individual' organisms, e.g. fungal colonies, slime moulds, nervous systems, blood systems and leaf venation patterns, to those found in such 'collectives' as army ant swarms, wildebeest herds and all kinds of natural ecosystems.

Perhaps stimulated by the extraordinary development of the Internet, 'network theory' has become highly fashionable in modern mathematical, scientific and biological research. There is, however, something strangely unnatural about this theory, evident in its metaphors and methods of analysis and modelling, which illustrates very clearly the inadequacies and limitations of thinking in terms of discrete components and assembly lines. Far from solving the three-body problem, analytical models of networks compound it, building structures that like a spider's web are great traps for the unwary but useless as distributive communication systems. They are models of static, not dynamic neighbourhood.

Correspondingly, at the core of analytical models is the assumption that networks are assembled from pre-existing, initially discrete entities that are joined together by transactional linkages represented as lines or threads in a ‘web of interconnectedness’. Each entity within the web is described as a ‘node’ and especially well-connected nodes are called ‘hubs’. As is familiar in many human organizations, far from facilitating evolutionary potential, such hubs form powerful energy sinks or establishments, which control and restrict the flow of information.

By contrast with these spidery constructions, real live communication networks can be understood inclusionally of as *communities of common space*. They characteristically have the form, explicitly or implicitly, of connected *riverine* or *labyrinthine channels or tubes* with variably permeable and deformable inner-outer boundary linings and internal partitions. In other words, they are what my research colleague, Karen Tesson, has described in her PhD thesis as *flow-form networks*.

As I will explore further in the next chapter, fungal mycelia provide a good illustration of the dynamic properties of flow-form networks, from which a number of principles emerge that may be generally applicable to all kinds of naturally evolving collective organizations:

► Rather than being formed by stringing together a given set of initially independent entities, they *grow* into *place* through a combination of *self-differentiating* (boundary-maximizing) and *self-integrating* (boundary-minimizing) processes. The *nodes* in this system are the places from which the branches originally arise, rather than the loci of initially discrete entities. The branch-identities *are* the links in the system, not the ‘knots’ or local centres through which network transactions are administratively controlled. At no stage in the evolution of the system have these identities been *fully* dislocated from one another or the pool of common space in which they are immersed and of which they are dynamic inclusions.

► By *growing* into place, these dynamic systems exhibit *indeterminacy*, the potential for indefinite expansion and transformation within boundaries that vary in their *deformability*, *permeability* and *continuity* depending on contextual circumstances. This contrasts with the *determinacy* assumed by many to apply to creatures like our individual selves, sentenced to death within a fixed frame of bodily space and time and so bustling through life as if there were no place else to care for, notwithstanding the continuum of our social space.

► By connecting their internal space *in parallel* rather than purely *in series* (as applies to dendritic systems, lacking anastomoses/cross links), flow-form networks greatly increase their conductivity and consequent capacity to store and supply power at or to localized sites on their boundaries. In fungi, this increased capacity is what allows mycelial systems literally to ‘mushroom’ as well as to produce survival structures such as sclerotia (of which ‘ergots’ are a well known example) and rapidly extending cable-like aggregations - known as ‘rhizomorphs’ because of their root-like appearance and growth. Mycelial systems that lack or lose the ability to form anastomoses are prone to become dysfunctional and degenerate, proliferating numerous branches from local nodal sites in a way that looks very similar to some unrealistic ‘maps’ that have been made of the Internet using purely abstractive analytical techniques.

► Local, well connected centres in flow-form networks drain resources from the system, and inhibit its expansion. In fungi, fruit bodies and storage structures may form at such centres.

► Degenerative processes in flow-form networks are vital as a means of preventing retention of power by core components of the system. For example, ‘fairy rings’, consisting of an annulus of spreading mycelium, result from the degeneration of the colony centre and release of its resources to supply the growing margin. In the absence of such degeneration, expansion of the system stalls.

► The ability of flow-form networks to differentiate, integrate and degenerate, by varying the dynamic properties of their boundaries in tune with their circumstances and avoiding the wastage implicit in ‘cost-cutting’, allows them to produce extraordinarily efficient organizations in highly heterogeneous situations.
In fungi inhabiting the forest floor, for example, this ability allows them to make connections between local sources of nutrients in decaying wood, leaf litter and roots, to form an underground communicative infrastructure, which brings the lives and deaths of the trees into a common circulation.

So, altogether, these living networks are far more sensitively attuned to the ever-changing living space that their channels embody, than the inflexible meshwork entrapments our current abstractions represent. As my friend, Richard Williams, puts it:

“The connection between nodality, closure and determinacy as three ‘fatal attractors’ seems to me to form an ‘un-holey trinity’. We cannot escape the lures of any one of these as long as we still cling to the other two. They are mutually reinforcing assumptions. How about exploring how a modern ‘organization’, such as a University, would change if the habitual and unthinking insistence upon nodality, closure and determinacy were relaxed a bit? For example, what would happen to the notions of ‘individual rights and responsibilities’, ‘personal achievement’ and ‘intellectual property rights’?”

But to gain release from this fatal attraction, we have, ironically, to face up to a reality that many of us will do everything in our power to avoid, which is the subject of the next chapter.

Chapter 5

Death and Diversity

What Is Death?

What more disturbing question could I ask? Even as I do so, it feels like I'm tempting fate to answer me in the way that I would least like it to do!

But why is it so disturbing? What is this fatalistic need we have to avoid speaking of the void, to banish darkness from thought as we strive to survive at all costs in the world of the living? Is it this fear of the void that draws us, like moths, to the searing flame of light, making us capable of terrible human sacrifice at the altar of our need for reassurance that all will be well at the end of it all? Do we, through wilfully banishing darkness, lose our capacity for love?

Whenever I ask this question, I find that I receive two very different kinds of responses. The nature of these responses seems to depend fundamentally on how we perceive – sense and interpret – the space and boundaries that our bodies inhabit. They bring out the deep implications for human health and happiness of the distinction between the rationalistic view of space as 'nothing', an empty outside, and the inclusional view of space as 'no thing', a loving receptivity that is a vital inclusion of our natural dynamic neighbourhood.

The first kind of response expresses a very certain conclusion, based more on fundamental belief in the dichotomy between 'to be or not to be' than evidence from real life. Death is viewed as the removal of life from Earth, which results either in absolute annihilation - coming to nothing - or transfer to another, independent realm, above, below or beyond, in which there may be eternal bliss or eternal anguish. It's not a pleasant prospect unless you're sure you

qualify for Paradise and like the idea that some of your human companions might not make it with you because they're too bad.

From this position, life appears as a fixed term contract that begins and ends in either nothing or eternity, which individuals have to make the best of in one way or another. But which way is best? There are three possible attitudes that different people may display to varying degrees depending on how the severance between past, present and future is imagined.

Some tend to face life with eyes fixed predominantly in the excised present. Neither the past nor the future is of any concern beyond the life span of the individual because this individual wasn't there and won't be there. This is a prescription for hedonistic behaviour in which as much pleasure or profit is abstracted from life as possible in the short term, oblivious both of heritage and sustainability. Neither ancestry nor offspring are considered beyond an existence whose meaning disappears in an evanescent twinkling as both past and future are sacrificed to present excess.

Others tend to face life with eyes fixed predominantly on the future, from which the past is excised by the present. This future is determined absolutely by what immediately precedes it and we can even use calculus to plot its trajectory, providing that we have sufficient knowledge of the initial conditions prevailing at its outset. History appears irrelevant and to teach us nothing because it is a thing of the past and can be forgotten. By contrast the future - whether in this world or the next - becomes a desirable, eternal objective for which we can robustly set a course by any means that appears necessary in the short term of the present. In this way the means may come to justify the end, so that past and present are sacrificed to future, giving our all to ensure what is imagined to be the everlasting prosperity of our souls or offspring, without concern for what has come and gone before.

Yet others tend to face life with eyes fixed predominantly on the past, from which the future is excised by the present. This past is all we can know about and therefore care about, which we may wish to preserve at all costs as our

best insurance against the dreaded uncertainty of the future. We cannot forget this past, least of all the many insults that may have been suffered there, and so may sacrifice both present and future to it, locked into defensively preserving the dignity of our ancestry and heritage forever.

Whatever threatens these attitudes to our past, present or future - ultimately whatever is not recognizably in agreement with ‘us’ - is perceived as our enemy, which we must overcome if our desires are to be fulfilled. Ultimately, we may feel obliged to kill or be killed in a struggle for *survival* - persistent individual *existence* rather than thriving in dynamic, co-creative neighbourhood. In the thick of this struggle, love for other as inseparable from self is an embarrassment that we cannot afford to acknowledge. The way to individual desolation and global holocaust is opened wide as we rage against the dying of our own kind. In attacking others perceived as enemies, we feed death with life. We gamble with our lives as stake - our determination to win redoubled by the pain of every loss that we attribute to our enemy, who sees us in the same way, bitterly opposed. Such is the powerful fatal attraction of our human addiction to conflict.

The second, more inclusional kind of response offers no such fundamental certainty in that it sees death not as severance from the living world but rather as release from inner to outer receptive space, whereupon the possibilities for local reconfiguration are endless. Life continues with death a vital portal of exit and re-entry - expiration and inspiration - within its midst, allowing renewal in diverse, complex self-identities, that can never be exactly the same again. The cumulative legacy of these identities contributes endlessly to the evolutionary transformation of the ever present… unless some catastrophe befalls. Ancestral influence remains present as new forms emerge and subside in the flow from which neither past nor future can be dislocated. From a personal perspective, I can recognize that my current senses may not be aware of my presence and the beauty of the world beyond my local release, but others’ senses will, wittingly or unwittingly. This awareness invites me to care about all of us, with past and future feeding into and out of the dynamically transforming ever present. I recognize that the world could not be

the same without dinosaurs or human beings or whatever our lives may transform into. It is both a painful and joyful recognition, but made all the more painful than it need be through the prevalence of our human addiction to conflict.

In this guise of expiration, death not only has the potential to destroy life, but also, when held within dynamic bounds, feeds, structures, protects and transforms biological diversity. As I will now try to show, there are abundant illustrations that can be drawn from our knowledge of biological and ecological science of this role of death in the dynamic neighbourhood and complex identities of life as an embodied water flow.

How Can Death Feed Life?

We answer this question for ourselves, rather obviously, on every occasion that we take a meal! Distasteful as we may or may not find the idea, whether it be plant, animal, fungal or bacterial life that is consumed, eating it means that it dies at some stage prior to or during the process. Often, we may kill it ourselves. But this killing is not done because of our ideological opposition to what we consume - we may even love and deeply respect it, experiencing a bittersweet sorrow in our need to sustain our lives through the death of others. Dare I say it, but what could be *more* inclusional than transforming the flesh of another into one's self? Inclusionality is about acknowledging real life, not pretending in some sanitized version of it.

When we take a meal we participate in the great recycling process of the dynamic neighbourhood that has been called the biosphere. Perhaps that's the deepest meaning that can lie behind our ritual of saying 'grace' as an acknowledgement of our inclusion in this process. 'For what we are about to receive, may we truly be grateful'.

The inspiration for this process comes largely through the reception of sunlight by the solar panels of green plants and the associated combination of

carbon dioxide with the hydrogen from water to produce carbohydrates, whilst releasing oxygen. This photosynthetic receptivity of green plants makes them the sunlit world's primary producers of sources of organic carbon upon which the consumer world's animals, non-green plants, fungi and many kinds of bacteria depend. As producers, green plants are known as 'autotrophic', which means that they are 'self-feeding', making and consuming their own food within their bodily boundaries. Some kinds of bacteria are also autotrophic. As consumers, other organisms are known as 'heterotrophic', which means that they receive food directly or indirectly from other organisms, either by absorbing or ingesting it. By 'food' I mean organic chemical substances like carbohydrates, fats and proteins that are both incorporated into the living bodily structure of organisms by 'anabolic' metabolism and used as fuel in 'catabolic' metabolism.

The consumption of organic compounds as fuel involves the process known as 'respiration'. This can be thought of as a controlled explosion, analogous to that in an internal combustion engine, which releases chemical energy in a form (known as adenosine triphosphate or ATP) that supports the vibrant activity of living systems.

In its fullest expression, respiration involves that other product of photosynthesis, oxygen, to support the combustion of organic fuel into carbon dioxide and water - i.e. it is the *reverse* of photosynthesis. Hence the energy coming from the fire of the sun generated by the nuclear fusion of hydrogen into helium, is converted through photosynthesis into organic fuel, whose energy is released in a more earthly kind of fire, respiration, which re-produces the ingredients for photosynthesis.

This sets the scene for the global recycling scheme of living and dying known as the 'carbon cycle', in which oxygen plays a vital inclusional role due fundamentally to its spatial receptivity or 'attraction' for electrons, which I mentioned in Chapter 3. In many ways, oxygen can be thought of as the living world's first and deepest addiction - a substance incorporated into the very substance of organic life, which both hugely energizes and destroys living

form. As oxygen receives electrons, in the course of its chemical ‘reduction’ to water, highly reactive intermediates are produced that have the potential, if not contained, to break down the chemical integrity of living cells as well as the fuel that these cells supply or are supplied with. I will return later on to the significance of this potential, which may even extend to a role in our human addiction to conflict and its derivatives.

Within the carbon cycle, hugely complex arrays of feeding relationships become possible in which death enables redistribution from one form of life to another. These arrays are commonly referred to using such definitive, linear terms as ‘food webs’ and ‘food chains’, which belie their fundamentally inclusional nature as an expression of nested fluid dynamic geometry. Within this geometry, herbivorous animals consume plants. Carnivorous animals consume the meat from other animals, both as carrion feeders and as predators. Larger carnivores consume smaller carnivores. Carnivorous plants, like venus fly traps, supplement their photosynthetic diet by consuming small animals like flies as a source of nitrogen. Carnivorous fungi consume small animals like nematode worms. A host of small animals consume the detritus from larger animals and plants. Fungi and bacteria play enormously important roles in decomposition of the remains of other organisms as well as in parasitic and mutualistic symbioses of the kind I described in the last chapter.

There are also many ways in which death enables redistribution from redundant to active phases of development within the same life form. Amongst indeterminate developmental forms, like fungi and multicellular plants, this redistribution occurs across an interface between living and dying realms that continually re-locates as the growth zone reconfigures. In animals it is often associated with an abrupt transition between one phase of life and the next, known as metamorphosis.

A good illustration of the re-distributive role of death in the life of plants can be gained from that supposedly great symbol of British indefatigability, a mature oak tree! Notwithstanding its robust outward appearance when viewed from a

distance, upon closer inspection the telltale signs of an ever-dying story are everywhere to be found within and upon its bark-encrusted surfaces.

Imagine for a moment what this tree would look like if it had retained all the branches and leaves that it produced over its long life span: an impenetrable thicket! To make that resolute shape that we can admire in an instant, the tree has undergone annual cycles of expansion and shedding of its canopy, which we can trace in the scars of detached leaves, bud scales, acorns and twigs along its branches. These self-pruned detachments will have fallen as a rain of litter to the underlying ground, and been incorporated into soil through the process of decomposition, whence the mineral nutrients they contain can be transferred back into the tree through its roots and mycorrhizas. Meanwhile any soluble sources of carbon they contain will have been transferred back into the tree via an abscission zone before fall.

It’s not only the small twigs and leaves that die and detach from the tree. Larger branches, many metres long can also succumb as the canopy expands. These often can remain attached for many years as antler-like ornaments. Their ridged and grooved sculpturing is the product of tannin-rich interfaces produced by oxygen-induced cell death in the regions between non-decayed, water-conducting sapwood and non-conducting, decaying sapwood.

The tannin-rich ‘heart of oak’ is also produced through the death of cells in wood that has ceased to conduct water due to cavitation - the production of gas bubbles in its pipelines. Once removed from the tree, this heartwood provides a very durable timber, useful in the construction of ships and buildings, but within the tree it is susceptible to decay by fungi that can tolerate the tannins and carbon dioxide-rich regime to be found there. Correspondingly in many mature trees the ‘heart of oak’ is actually a hollow heart, a cavity that provides a habitat for many other forms of life, and into which the tree may itself root and form mycorrhizas.

Amongst fungi, one of the most familiar examples of the vital inclusion of death in life occurs in the hollow centre of fairy rings. I will describe these, along with other examples, later.

Metamorphosis in animals involves the conversion from a larva to an adult, e.g. the transformation of a tadpole into a frog or a caterpillar into a butterfly. Such transformations broadly correspond with the conversion of assimilative or growing phases into re-distributive sexual phases, and involve very obvious boundary reconfiguration.

In the case of a tadpole, the tail and gills which are appropriate for a life in water degenerate and become replaced by the legs and lungs that enable frogs to make their way on land. The degeneration and re-absorption of the tail is a re-distributive process that involves what is known as ‘apoptosis’, developmentally ‘programmed’ cell death.

Degenerative processes are even more apparent during insect metamorphosis, where virtually the entire muscle system of a larva is absent from adults. This transition also involves conversion from soft-bodied forms with relatively deformable external boundaries to hard-bodied forms with a rigidified, armour-like ‘exoskeleton’. The soft-bodied forms are able to enlarge partly because of the expandability of their skin or ‘cuticle’ and partly because once the cuticle can be stretched no further, it is separated off and discarded. Often there are several such moults (‘ecdyses’) between separate larval stages (‘instars’), analogous to the annual shedding of leaves and twigs from a tree. The timing of these moults is associated with a counteractive interplay between hormones related to the hardening off of old and generation of new cuticle in tune with environmental conditions. When the final instar reaches its size limit, the cuticle is hardened by a tanning process, which as in the formation of heartwood in an oak tree involves the action of phenol-oxidizing enzymes, to form a pupa. This pupa is a self-integrated phase that does not expand further and seals in the resources accumulated by the feeding larva. Emergence from the pupa then entails the degeneration of larval tissues, abandonment of the pupa casing and activation of embryonic cells that have

lain dormant during proliferation of larval tissues from the egg. Were it not that the adult form emerges from the same genetic context as its predecessors, we might well regard it as a parasite, just as we do those offspring of ichneumon flies that can spring from the host space of the pupa.

All, quite literally in all, the lives and deaths of countless life forms are pooled together in the global carbon cycle that is included in the global water cycle of the life of planet Earth. Yet for all the seemingly vast scale of this process, its productivity is constrained by the availability of its pivotal character, carbon dioxide. This is normally sustained at a fairly constant, low level through the dynamic balancing of photosynthesis and respiration in tune with geological processes of rock formation, dissolution and volcanic activity. The Earth, and by implication humanity cannot grow more than this limited availability of carbon dioxide, stabilized over aeons of biological and geological co-evolutionary attunement, will allow - notwithstanding our agricultural endeavours to support our burgeoning population growth with ever more food production. Unless, of course, a way is found to support hedonistic life styles by burning off vast quantities of fossil fuel and so, temporarily or persistently to destabilize this balance…

How Can Death Structure Life?

Once again, a tree stands as an excellent example, consisting, as it very largely does, of a bark-covered set of woody channels that connect its photosynthetic canopy with its water and mineral gathering roots and mycorrhizas below ground. Both wood and bark are the products of oxygen-assisted cell death, associated with the formation of relatively impermeable compounds known respectively as lignin and suberin. In this context the living (in the sense of metabolically active) tissues of a tree are distributed very thinly indeed within and over the skeletal lining that they continually add to. In somewhat similar ways, animals may fashion internal or external frameworks to live within and upon, both individually, as in shells and skeletons, and collectively as in coral reefs.

Another kind of framing, where programmed cell death that supports the life of a particular kind of organism serves ultimately to provide host space for a rich community of others is found in the bog-building moss, *Sphagnum*. Here, apoptosis produces a matrix of large, empty cells with porous, spirally thickened walls, interlaced with a network of narrow, photosynthetic cells. The empty cells enable the moss to be like a sponge, capable of holding up to twenty times its own body weight of water and gradually to convert initially open water into a build up of vegetation in which other plants can take root. The dead remains of the moss form peat, which accumulates to form a thick layer deep enough eventually for woodland to establish.

How Can Death Protect Life?

The degenerative processes associated with metamorphosis have generally been regarded as a vital and therefore prescriptively programmed part of the life of animals with distinct life cycle stages. In other walks of animal life, death has usually been regarded as an inescapable and fundamentally undesirable consequence of ‘imperfection’, the result of infection, damage, accidents, predation, toxins etc. More recently, however, it has been recognized that programmed cell death limits the proliferation of cells that would otherwise develop at the expense of the self-integrity of the organisms, as in cancers. Indeed cancers can be thought of as potentially immortal forms of life that bring death to the corporate bodies that they inhabit, and so to themselves.

Death can also serve to deny access to the host space of an organism by potentially disruptive intruders. Both the immunity systems of animals and what are known as the ‘hypersensitive’ systems of plants involve the oxygen-assisted ‘suicide’ of host cells as a way of sealing off their bodily interiors and releasing toxic compounds that can destroy or arrest the development of colonizers. Similarly somatic incompatibility systems, of the kind that I mentioned in Chapter 4, can prevent genetic hegemony and loss of diversity in populations of the same species.

How Can Death Transform Life?

Many of the examples I have provided above also serve to illustrate how death can transform life through the reconfiguration of spatial possibility. Previous structure provides both a dynamic foundation and source of energy for resurgent flows of life, both at individual and collective scales. At individual scales, the ability of a new developmental phase to reconfigure from a previous phase is well illustrated by metamorphosis. At collective scales, ecological succession of the kind illustrated by the Sphagnum story, illustrates how the contextual transformation brought about through pioneer colonizers can be embellished into layer upon layer of complexity, with each layer providing the dynamic foundation for the next.

Alternative Life Styles

All the foregoing examples of the role of death in life point to an even more general understanding of the fundamental nature of the outward forms and behaviours of organisms (i.e. their phenotypes) as dynamic, complex identities rather than fixed, single identities. Yet more evidence of such dynamic receptive-responsive identity is found in the ability of many life forms to alter their patterns of development and or behaviour to suit distinctive contextual circumstances.

Amongst plants, processes analogous to animal metamorphosis occur during what are called ‘vegetative reproduction’ and the ‘alternation of generations’. Vegetative reproduction entails the production of multicellular ‘plantlets’ that can mature into adult plants. These plantlets can arise from detached leaves, from explorative structures known as ‘stolons’, or from various kinds of ‘storage organs’ (rhizomes, tubers, corms, bulbs and bulbils).

The alternation of generations is quite a mystifying phenomenon for those of us used to the idea of human reproduction as a process in which adults produce babies that grow into adults. There is some vital part of our sexual cycle that is missing from or taken for granted in this idea, which is all too evident in plants. Indeed if we focused more on how plants recreate sexually rather than on how humans appear to reproduce, we might gain a much clearer idea of the role of sexuality in evolution than currently predominates.

Imagine that sperm and eggs could develop into multicellular bodies with a distinctive self-identity without first having to fuse with one another? Conception wouldn't then be regarded as the beginning of a new, potentially independent life, but as an inclusion of an ever-endless story involving two distinctive phases that differentiate and integrate out of and into one another. One of these phases would be 'haploid', containing a single set of chromosomes, or 'half' the number of chromosomes as the other, 'diploid' phase, which contains two sets of chromosomes. The haploid phase would be derived from the diploid phase by means of a kind of nuclear division called 'meiosis', in which the number of sets of chromosomes is reduced from two to one. The diploid phase would result from the fusion of two haploid nuclei during 'fertilization'.

With the exception of certain green and brown algae, this is more or less what actually happens in the majority of plants: instead of one generation appearing directly to beget the next, there are two distinctive kinds of generations that feed into and out of one another. The haploid generation is known as the 'gametophyte' because it is the source of the 'gametes' - egg and sperm - that fuse to form the diploid generation. The diploid generation is known as the 'sporophyte' because it produces, via meiosis, 'spores' that develop into the gametophyte(s).

In different groups of plants, both the forms of the gametophytes and sporophytes and the relative contribution they make to the ever-endless life cycle stories of plants, can vary greatly. In mosses and liverworts ('bryophytes') the gametophyte is the most prominent phase, producing

ribbon-like or leafy growth forms that eventually bear male and female sex organs (‘antheridia’ and ‘archegonia’ respectively). Fertilization of the egg cell in the archegonium results in the outgrowth of the sporophyte, virtually as a parasite upon the gametophyte, from which it is supplied with nutrients via a ‘foot’ at the base of a simple stalk or ‘seta’ surmounted by a capsule. Meiosis in the capsule produces spores, which are dispersed and then germinate into gametophytes. In the ferns, club-mosses, horsetails etc, the gametophytes are more transient, consisting either of small, membranous ‘prothalli’, or the contents of detached large female and smaller male spores, known respectively as megaspores and microspores. The sporophytes, which emerge from the fertilized archegonia no longer remains dependent for their nutrition on the gametophyte, and grow into prominent plants like tree ferns and horsetails. In the seed plants, the gametophyte is even less prominent, contained either in pollen (male microspores) or in female megaspores that are retained within a structure called an ‘ovule’, which when fertilized becomes a seed. Here, the life cycle therefore superficially resembles our own, with an immense variety of ‘adult’ sporophytes producing seeds containing embryos that germinate into seedlings that grow up into adults that produce seeds.

The distinctive forms of plant gametophytes and sporophytes are related to their degree of attunement with terrestrial conditions. The gametophytes dry out if they are exposed to dry air, but the sporophytes, with their waxy cuticles, corky bark and woody xylem are more able to conserve and distribute water within their bodies. It is interesting to reflect that this distinction is not based on a difference in genetic information content because all that differs genetically is the number of sets of chromosomes. The role of oxygen, which diffuses ten thousand times faster through air than through water, may, however be crucial. This is because all those relatively impermeable linings and coatings that protect sporophytes from water loss also impede access of oxygen - and even chemically incorporate oxygen in the process their formation.

There is a way, however, in which this alternation of plant generations, as well as the examples of animal metamorphoses discussed earlier, provides only a rather restricted capacity for phenotypic attunement with variable contextual circumstances. They lack versatility because the distinctive phases occur in a specific sequence, e.g. gametophyte -> gametes -> sporophyte -> spore -> gametophyte and larva -> pupa -> adult -> egg -> larva. There is therefore no scope for changing form to correspond with locally unpredictable changes of circumstances. If a particular phase does not encounter circumstances in which it can thrive, subsequent phases cannot be produced, no matter how suitable conditions might be for them. This has had great practical significance in controlling ‘pest’ organisms, for example, because it is only necessary to target one life cycle phase to eliminate the remainder. Mosquito adults can be targeted via their larvae, by spraying detergents onto the surface of ponds and pools.

More versatility is possible through having multiple developmental options, each of which can be attuned with particular circumstances but does not have to arise from any other in a set sequence. Where such options are expressed as distinctive, determinate body forms, they have been called ‘alternative phenotypes’. There are many examples. There are protozoa that develop big or small mouths depending on the size of their prey. There are parasitic wasps that do or do not possess wings and bushy antennae depending on which host their larvae grow up in. There are butterflies that have different colours and body patterns depending on the time of year at which they emerge from the pupa. There are the castes and morphs of social insects that differ in the way their body boundaries expand depending on how the larvae are fed.

In many plants, varied developmental options can be expressed in different parts of the same, interconnected system. For example, ‘heterophylly’ is a common phenomenon in which different leaves on the same plant can have radically different forms depending on when and where they are formed. Leaves developed in strong sunlight (‘sun leaves’) tend to be thicker but narrower and held in a less horizontal orientation than those produced in shade (‘shade leaves’). Many aquatic plants produce highly dissected or

strap-shaped leaves underwater, but leaves with broad blades upon or emerging out of water. In ivy, the leaves on flowering stems are unlobed, whereas those on non-flowering stems are lobed. The lobed leaves have tributary-like patterns of venation, with wide-angled, erratic branches of many different widths, whereas the unlobed leaves have distributary-like patterns of branching.

Structures that originate developmentally as leaves can also undergo a variety of transfigurations that suit them for different roles. The different parts of flowers, the sepals, petals, stamens and carpels are all modified leaves. Leaves produced at the base of flowering stems are known as ‘bracts’ and can sometimes be brightly coloured like petals. Leaves and parts of leaves can be modified into the coiling tendrils of climbing plants, the protective scales around buds, the storage leaves of bulbs and the spines that deter herbivores. Some of the most extraordinary leaf-modifications occur in plants that extend their supplies of nitrogen by capturing and digesting small arthropods – butterworts, bladderworts, sundews, venus fly traps and pitcher plants.

The indeterminate tubular systems of plants and fungi, from which determinate offshoots such as leaves arise, can themselves exhibit an array of alternative forms. Transitions between these forms can occur gradually or abruptly and may generally be brought about by changes in boundary permeability, deformability and internal partitioning. In plants, slow-dense and fast-sparse branching patterns also occur and have respectively been regarded rather militaristically as representing ‘phalanx’ and ‘guerrilla’ formations. Plant root systems are often divided into relatively highly branched, absorptive ‘short roots’ of limited duration and less branched, indefinitely extending, conductive ‘long roots’. Equivalent alternations occur between stoloniferous and rooting stages of plants like strawberries and the nomadic and settled phases of animal societies.

The versatility of fungal mycelia becomes evident as soon as a spore takes up water and nutrients, so expanding equally in all directions at first and then

breaking symmetry with the emergence of one or more indeterminately expanding, protoplasm-filled germ tubes. Alternatively, a unicellular pattern may be maintained for greater or lesser periods, as in yeasts.

Once hyphal tubes have formed, their internal space may remain continuous (‘coenocytic’) or become internally partitioned by valve-like septa. They may branch in a tributary-like or distributary-like pattern. The branches may diverge to form a radiating system or converge and fuse (anastomose). Whereas some parts of the system grow in close contact with the nutrient source, others become sealed off or emerge beyond the immediate sites of assimilation. The branches may remain diffuse or they may aggregate to form protective or reproductive enclosures or cable-like migratory structures. Whilst some parts of the system continue to expand, others degenerate.

The biological value of such a changeable dynamic structure becomes clear whenever fungi are observed growing in heterogeneous circumstances. For example, in moist woodland soil, networks of mycelial cables interconnect the roots of neighbouring plants as well as decaying wood or leaves.

The processes leading to the formation of such networks have been revealed by experimental studies made at Bath University in which fungi were grown in a ‘Matrix’ of twenty-five1 cm square plastic chambers containing alternating nutrient-rich and nutrient-poor media. Each chamber in this Matrix was connected to each of its neighbouring four (or three or two for peripheral chambers) by a narrow gap in its containing partition, cut just above the level of the growth medium, through which the fungus could grow.

To begin with, hyphae within a nutrient-rich chamber expand out radially, branching profusely. Upon encountering a gap leading into a nutrient-poor chamber, they converge together before surging out into the chamber like water flowing through a gap in the boundary of a dam. A similar pattern of convergence and surging outwards follows when growing through gaps into neighbouring nutrient-rich chambers, but is accompanied by dense proliferation of branches.

Once connection had been made between nutrient-rich chambers neighbouring a nutrient-poor chamber, some remarkable patterns of redistribution emerge in the latter. In one fungus, *Coprinus radians*, small toadstools develop. In the Magpie Ink Cap, *Coprinus picaceus*, cable-like parallel arrays of hyphae form along the routes connecting between the gaps leading into neighbouring nutrient-rich chambers. These cables form in a way reminiscent of a lightning strike, with growth spreading both outwards and backwards from each end to meet one another. Moreover, they form in directions not only ‘with’ the original outward flow of the expanding colony, but backwards, ‘against’ the flow. In this way an extraordinarily beautiful communications network forms, purely through the ability of the fungus to vary its boundary properties in accord with local circumstances and hence gather in, distribute and redistribute its energy supplies between places of plenty and places of shortage.

Perhaps of all these patterns of redistribution, the one that strikes me most powerfully is the development of the cable-like connections along paths of exploration that ‘successfully’ link the openings between neighbouring chambers. In this way the fungus both amplifies and consolidates the path of greatest opportunity through which its communications can be sustained and enhanced. It forms an autocatalytic (self-amplifying) channel of communication through which *flow progressively decreases resistance to flow* and increases the persistence of the structural boundaries that both emerge from and guide the flow, as in the banks of a river. I think such autocatalytic flow is a hallmark of cumulative learning processes that engender increased powers of recollection - in a word, ‘memory’. I feel the fungus is showing us how we can and do learn. Indeed, similar kinds of processes, leading to the amplification of ‘synaptic connections’ along particular pathways, occur during maturation of our own human brains.

There is, however, an implicit danger in such self-amplifying processes. They only remain viable as long as the opportunity terrain in which they are occurring does not change - which is impossible in the long run. Hence, as the

communication channel becomes more and more entrenched and persistent, so the possibility to alter course in altered circumstances becomes reduced - the channel becomes a ‘rut’, an ‘addictive’ pattern to which energy supplies are diverted until and unless its boundaries begin to degrade. Fungi show us not only how to learn, but also how to get out of a learning rut - to unlearn - and hence take the process into new territory by allowing the solvating power of space to degrade redundant informational linings.

In another set of experiments, started some years before the ‘Matrix’ studies, mycelium growing actively on a suitable food source (e.g. a wood block) was inoculated into a tray of soil, and one or more uncolonized ‘baits’ were placed some distance away. The fungi spread from source to bait by means of a variety of distinctive patterns or ‘foraging strategies’ that differed between species in ways that were clearly related to their natural habitats.

Not only were the same kinds of redistribution processes observed as in the ‘Matrix’, but it was also clear that these processes depended to varying degrees on the ability of non-connective mycelium to degenerate and pass on its resources to connective mycelium. Death was playing an important part in the efficient redistribution of energy through the mycelial collective. Only the *least* autonomous, *most* interdependent explorative and communicative channels were conserved, whilst others yielded their internal resources to their neighbours as external supplies dwindled.

One of the most graphic illustrations of the iconoclastic role of death as a way of sustaining the explorative potential of fungal colonies is found in ‘fairy rings’. These rings consist of an annulus of spreading, explorative mycelium, which is superseded in turn by an ‘assimilative’ zone that actively digests and absorbs nutrients from its surroundings and a degenerating trailing margin where hyphae die off as the colony continues to expand, periodically forming mushrooms. Here degeneration of the centre of the flow-form network and release of its resources to supply the growing margin and mushrooms is vital to the expansion of the system. In the absence of such degeneration, expansion stalls and there is ‘gridlock’.

So, it seems that in flow-form networks there is a place both for holding on and for letting go. Too much holding on results in gridlock - an overly retentive system that gets caught up in the density of its own self-integration. Too much letting go leads to dissolution and a loss of capacity for learning. The present is an inclusion of past and future in which neither can have sole claim upon the life of dynamic phenotypes as they negotiate their ever-transforming context. What does this imply for our understanding of the fundamental nature of evolutionary processes? . I will reflect on this question in the next chapter.

Chapter 6

Evolutionary Creativity

‘And when you make the inner as the outer, and the outer as the inner, and the upper as the lower, and when you make male and female into a single one so that the male shall not be male and the female (shall not) be female, then shall you enter (the Kingdom).” - Jesus of Nazareth (Gospel of Thomas)

Imagine your inside as a local depression in the variably permeable and extensible skin of a giant, dynamic airbed, full of other local depressions, both great and small, each including and being included in others. Then you may understand your local evolution to be inextricable from the simultaneous evolution of all Nature, everywhere, and your complex self-identity as both in and of your natural fluid dynamic neighbourhood.

What Is the Difference Between Evolution and Revolution?

By now, it may be apparent that the answer to this question is anything but straightforward! All our observations of natural populations and communities combine with our personal experience to inform us that life cannot just boil down to simple stories of how A gets to B. Yet this is exactly how the story of evolution continues to be told. Why? What is it, which so constrains our view that we can see no alternative, in spite of our intuition? How does this constraint prevent us from understanding what lies in the heart of evolutionary creativity, to the extent that we may seek to eliminate it from our selective attention? Or is that a leading question that I cannot ask if I am to remain objective? Perhaps you have already formed a view. Is this view straightforward or circumspect, superior or inferior? Does it make sense?

At the heart of these questions lies a fundamental difference between two distinctive perceptions of change. One of these perceptions can include and transform the other perception, whilst the other perception cannot. One of these perceptions makes sense intuitively but cannot be conveyed using definitive logic and language *alone*. The other perception *only* makes sense in terms of definitive logic and language, but by the same token is easily communicated in these terms and so has an extremely powerful allure. The predominance of the latter perception is what takes the '*r*' of '*receptivity*' out of 'revolution', and reduces this process to a linear sequence of 'cause' and 'effect'. Here, one 'thing', 'action' or 'event' leads to the next 'thing', 'reaction' or 'event' as paradoxically dislocated entities in space and time.

So, how does this difference in our perception of change arise? I have been preparing for this question through some preliminary explorations and by providing relevant biological examples and information in previous chapters. Now I want to take the exploration further and deeper, so as to show in the rest of this book how the way we perceive evolutionary processes, wittingly or unwittingly, profoundly influences our psychological, social and environmental welfare.

Linear Perspective - The 'Square World', Static View of Change

A straightforward view, which forms the basis for what many people may think is the only rational way of looking at things, is literally what you see when you use your binocular eyesight to look beyond the end of your nose. This is the view captured by those artists who use classical perspective to introduce an illusion of depth into a two-dimensional picture. It has been greatly reinforced through the development of photography and the large proportion of our lives that many of us spend in front of projection and TV screens.

For this illusion to work, things far away are portrayed smaller than they are close up, and everything converges to a vanishing point at the horizon of the observer's field of view. This horizon is seen literally as a *horizontal* straight

line fixed within an actual or imaginary rectangular frame of reference. Some artists will actually hold up a rectangular frame in front of a scene they are depicting, or, like Vermeer, use a *camera obscura*, or nowadays simply take a photograph as an aid to setting it in the ‘correct’ proportions. They need such aids because it feels so uncomfortable and needs an effort of will to close the scene down in this way at odds with our full sentience and experience. To draw things in perspective means drawing them as we know that they are not - I find I actually grit my teeth when trying to capture natural form in this way.

We all know it’s an illusion, don’t we? Things don’t really get smaller as they approach the horizon and the horizon is neither a straight line nor the end of the world, but rather the place where the world’s curvature dips beyond our eye line.

But it’s a very powerful illusion, because the imposition of a fixed frame upon natural curvature seems to give us mastery over our destiny. Not only does it enable us to know where we stand in relation to others and where others stand in relation to us, but it also helps us to detect and measure movement as a shift in the position of an object across the frame. We may look out of the window of a house and see the position of a bird shift across it as a record of its flight. And we can look out of a train window and see the position of a tree shift across it as a record of our own journey. In other words the frame can be used both as a space frame, informing us about the position of an object, and as a time frame, informing us about its/our velocity - the rate of change of its/our position.

Such fixed framing has therefore become central to many kinds of rationalistic endeavour. It is so deeply embedded in our way of life that we rarely stop to question its validity. Even when a gravitational feeling in the pit of our stomach reminds us that our objective eyesight alone cannot distinguish between whether it’s us or what we’re observing or both of us that’s shifting relative to the other, we can carry on regardless, assuming we know which is right.

With this viewing frame fixed in place, the world outside our inner world assumes a very particular appearance. The absolute Euclidean straight lines or planes at the edges of the frame exclude the presence of an elsewhere beyond their confines in a way that no curve could do. This is because a receptive concavity (cup or saucer) viewed from within simultaneously and reciprocally implies an intrusive convexity (dome) viewed from without, but flatness appears the same both from one side and the other. Only absolute flatness can *define* the limit of an entire, independent, realm of space or object, dislocated from any other. Ultimately this flatly defined realm may be stretched in the imagination to infinity to take in the Universe as an objective, self-centred entirety or *whole*, with nowhere else capable of being envisaged.

Correspondingly, anything perceived within the flatly defined frame is regarded as present whereas anything not evident in it is regarded as absent. Everything in the frame hence appears as a set of discrete objects in a constant background of empty space with which they have no connection and by which they are isolated from others. Anything formerly absent that is now evident in the frame is perceived to come from nothing or nowhere. Anything formerly present that is now absent is regarded as annihilated.

Events or things in this scene of entrances and exits appear to follow one after another in a linear sequence, which suggests they are each other's cause and effect - action and reaction. This sequence can be construed as a set of rigidly defined freeze-frames, which, when run together as in a cine film appears to recreate the movement evident in the original scene. This movement, however, is illusory because it consists of discrete steps isolated by gaps that only our imagination can jump to regain the fluidity that has been lost by excising the spatial continuity (excluding the middle) between each frame. In reality, there is no way in which the continuity between frames can fully be restored once they have been isolated, just as there is no way in which Humpty Dumpty's geometry can be regained once shattered. Curved geometry cannot be created from linear fragments, however infinitesimally small they are made, notwithstanding the great pretence (useful as it is) of Newton and Liebniz's calculus. Nature is neither singularly cubical, nor filled

completely with cubical singularities. Without a leap of faith to round it up, each discrete time frame is eternally stuck, with nowhere to come from and nowhere to go to.

Since this linear sequence of events has had the spatial continuity knocked out of it, it can be run backwards equally well as forwards - as anyone who has used a cine film projector will be familiar with - and this fundamental reversibility correspondingly applies to all Newton's supposed 'Laws' of Motion. Many natural processes like cracking an eggshell, hatching a bird and of course, death, appear however, to be *irreversible*, suggesting that time is *unidirectional*, like an arrow in flight. This uncomfortable difference between the real and the abstract has naturally been the subject of much concern. But without relaxing the intellectual imperative to contain nature within an imaginary frame that fixes both space and time, the only way of accounting for irreversibility has been to envisage yet more fragmentation of an already fragmented picture. Correspondingly, all unidirectional change, even that which appears like biological evolution to be creative, has become regarded as fundamentally degenerative or 'dissipative' - the outcome of an inexorable increase in universal disorder or 'entropy'. Such is the ultimate fate of a whole with no neighbourhood - it can only change by decaying. Such is the perverse conclusion of a perspective that imposes cubical fixture *around* and upon a dynamic scene: it models cancerous degeneration - the *de-evolution* of diversity - and calls this 'evolution'.

Creation, Selection and Falling from Grace

It's not only irreversible change, however, that is difficult to account for in a fixed Euclidean perspective. There are also the questions of how *any* change, any movement is possible and how the Universe as a whole and all the whole things in it could arise in the first place. By its very nature, anything complete in itself, with its own fixed centre, is primarily static. It can therefore only be moved or come into being through the agency of a powerful force situated

somewhere ineffable, utterly beyond itself - a force that by definition is *super-* or *extra-*natural.

It is this paradoxical requirement for super- or extra-natural agency, which currently irreconcilable creationist and Darwinian views of the origin of species ironically have in common. What one view attributes to an authoritative and judgemental deity or ‘intelligent designer’ who worked for six days before resting, the other attributes to a selective agency or ‘blind watchmaker’ working over hundreds of millions of Earth years to forge order from chaos. Notwithstanding their disparate time scales (which some people account for simply by lengthening the definition of a ‘day’ into a geological era), both views are correspondingly founded upon the space-excluding assumption of the discreteness of material objects that is implicit in the fallacy of the excluded middle. Both views have engendered enormous human suffering, from ancient realms to modern, through the emergence of the Vampire Archetype and the negation of loving receptivity by hegemonic power.

Perhaps in these terms the Genesis story of the ‘Fall’ can be understood as an allegory for the origin of our human culture of discontent through the imposition of a definitive way of seeing that alienated us from nature and one another. This imposition corresponds with a transitional phase in human cultural history, around 6000 years ago, when the drying out of North Africa and the Middle East was associated with the emergence of a domineering, warlike, misogynistic mentality. This mentality was quite unlike that of earlier human communities as well as some indigenous cultures that have retained their sense of natural proportion to this day. With it came a shift from living harmoniously in close attunement with natural neighbourhood to living exploitatively, in opposition to and seeking dominion over other life.

It was as though the objectivity of our eyesight and tactile senses was finally allowed to overrule our sense of gravitational inclusion. The effect, especially amongst males, was to invert our sense of proportion and so transform our relationship with nature from dependant to bully, like a son egged on by his father who takes to abusing his mother. Whatever definitive ‘Knowledge’

strengthened this inverted sense of proportion became sought out as ‘good’ and ‘positive’, whereas whatever fluid ‘Understanding’ threatened to undermine it was rejected as ‘evil’ and ‘negative’. Light was abstracted from and given superiority over Darkness. Word was abstracted from and given superiority over Void. Male was abstracted from and given superiority over Female. Mind was abstracted from and given superiority over Body. Intellect was abstracted from and given superiority over Emotion. Matter was abstracted from and given superiority over Space. Man was abstracted from and given superiority over Nature. God was abstracted from and given superiority over Man. The Devil was abstracted from and given inferiority under God. Death was abstracted from Life, and 6000 years of paradoxical, war-riddled, psychologically, socially and environmentally destructive nonsense followed, culminating in the horrific human sacrifices of the twentieth and early twenty-first centuries CE.

Those who tried to intervene to heal the splits were seemingly ignored or misrepresented and made martyrs to the cause that they sought to transform. And so our woes perpetuate. But they really don’t have to! *All* that is needed to restore our sense of good neighbourhood is for our awareness of receptive Mother space - variously alluded to in different cultural traditions as ‘Holy Ghost’, ‘Tao’, ‘Brahman’, ‘Buddha Nature’, ‘Maasauu’, ‘Wankan-Tanka’, ‘Tirawa’ or ‘Kwoth’ - to permeate this scene of absolute insanity and soften its over-hardened edges.

Non-linear Roundabout - A Dynamic Natural Inclusion

When receptive space is included in our understanding of dynamic natural geometry, the paradoxical, adversarial view of life and evolution that arises from adopting an exclusively linear perspective begins to dissolve and transform. We shift focus from seeing nature as external *selector* to seeing nature as universal *receptor*, a dynamic accommodation of ourselves. We cease thinking in terms a judgemental external agency operating upon discrete, internally driven objects within a fixed frame of space and time.

Instead we think in terms of *natural inclusion* of relational flow-form(s) in a continually transforming, ever-present, dynamic field of creative possibility where there are no absolute beginnings or endings, only relative openings and closings. Non-attunement within this flow-field - *going against the grain of nature* - engenders attrition and turbulence, like moving a box-shape through water, which may be felt as discomfort or discontent until and unless accommodation is made. Opposing such discomfort, by trying to square the cyclic, serves only to amplify it. Living and evolving imply receptivity and responsiveness to changing circumstances. They are about *thriving* in open-ended dynamic relationship not *surviving* in suspended animation within permanently sealed containers. *Survival* implies *dormancy*, a kind of 'living death' or 'sleep', by which many life forms *temporarily* sustain themselves through conditions of hardship. By the same token, living and evolving are about *fitting in* as dynamic inclusions of the flow, not being *fitter than* other 'survival machines'.

Evolution correspondingly entails the thriving of the fitting as they inspire and expire in relational dynamic attunement, not the survival of the fittest individual units that refuse to relinquish their prescriptive structure as they compete with one another in a fixed arena for bodily supremacy and immortality. The evolution of *one* cannot be dislocated from the evolution of *all*: the evolution of one *is* the evolution of all and vice versa. In the same sense that one cannot depress a particular location in an airbed without the rest rising, *all evolution is simultaneous spatial relational co-evolution*, a process of receptive-responsive dynamic balancing or resonance. One cannot meaningfully speak about the evolution of anything other than all nature. The all is not just *everything. All* is *everywhere*, a dynamic inclusion of space. It is therefore a contradiction in terms to define the transformational process of evolution, as Darwin did in the subtitle of his most famous book, as 'the *preservation* of *favoured rac*es in the *struggle* for *life*'. Such prescriptive definition of evolution is indeed a great lie, a product of the fallacy of the excluded middle and Newtonian mechanics, which has made victims of the great masses of the people, not least in the gas chambers of Auschwitz.

All in all, the receptive-responsive inclusional view of dynamic natural geometry renders the need for an external selective agency or designer to explain evolution unnecessary and counter-creative. Such geometry is, by its very nature, self-evolving. ‘Nature’, ‘evolution’ and ‘creativity’ are words that express the same underlying reality of receptive-responsive, space-including, dynamic neighbourhood flow-form.

*C*urvature in this dynamic natural geometry is *primary*, due to the inseparable receptive and responsive relationship of electromagnetic and spatial, ‘male’ and ‘female’ aspects of universal flow-form. There can therefore be no absolute definition within this geometry of up or down, inner or outer, one or other. There can only be a simultaneous mutually distinguishing dynamic *c*onfiguration of *c*onvex (dome shaped) and *c*oncave (*c*up- or *s*aucer-shaped spatial realms. Linearity and Flatness are static *secondary products* rather than *fundamental ingredients* or *precursors* of this geometry, as evident in the hexagonal close-packing of neighbouring identical spheres, the frozen forms of crystals and the parallel sides of a cylindrical palm trunk arising from its dome-shaped tip.

Non-linear reception and response subsume linear action and reaction. Two-way dynamic attunement subsumes one-way adaptation. Time is a dynamic inclusion of continual transformation, inextricable from space or energy. Synergistic and parallel processes abound as all is steered through all, reciprocally resisting and yielding. It is possible for a neighbourhood of dynamic phenotypes to evolve co-creatively in tune with their living space through varying the permeability, deformability and continuity of their unfixed boundaries. The kinds of possibilities that this co-evolution may entail can be anticipated to some extent, in much the same way that we can anticipate various kinds of weather pattern. But there is no way in which they can be accurately predicted in other than the very short term and narrowly specified circumstances.

In following sections I want to reflect on how this co-evolutionary neighbourhood is capable both of revolutionary transformation on the grand

scale and of sustainable attunement at local scales. I want to show how this capability arises through the ‘play’ of the neighbourhood’s dynamic boundaries in relation to the availability of oxidizing and reducing power.

Child’s Play - A Huge Adventure

Why do we have children? Why do we need them? The way adults answer these questions inevitably has a huge influence on their attitude to family planning and upbringing. And these attitudes will in turn influence the attitudes of their children, providing much scope for particular cycles of behaviour to become entrenched.

Predominant in modern culture continues to be the notion that children are our means of ‘reproduction’, a way of replacing, amplifying and ideally perfecting the defunct and dying models of the generations that produce them. Along with this notion comes the idea that children must be as much like their forebears as possible – only better. Great effort is therefore expended on transmitting the information accrued by previous generations through disciplined schooling based on well-defined standards and curricula. Departures from these standards are subjected to corrective procedures, whereas conformity with these standards is rewarded. And when what is judged to be a particularly good standard model comes along, both by way of educational and genetic instruction, the desire is one way or another to make ‘more of the same’, i.e. to clone it.

What gets overlooked, however, is that unlike ‘clones’, children, as the offspring of sexual coupling between male and female cannot be regarded evolutionarily or educationally as ‘reproductions’ – more of the same! Rather they are wonderfully diverse *recreations*, emerging from the varied recombination of DNA from their parents within the watery context contained by their bodily boundaries, which relate dynamically with the circumstances of their environmental living space. The abiding characteristic of these diverse recreations is that they *play* as they explore and experience the ever-

changing shape of their spatial context. In this child's play, the possibilities for serendipitous evolutionary discovery and creativity are endless.

The evolutionary importance of the capacity to explore playful possibilities is evident in a phenomenon long recognised, but little understood by biologists, which is known technically as 'neoteny'. This phenomenon, the retention of juvenile characteristics by adult forms, is believed by many to have brought about some of the most dramatic innovations in the evolution of life on Earth. For example, the monocotyledons - predominantly narrow-leafed flowering plants like lilies, grasses and palms are thought to have evolved in this way from broad-leafed ancestors (dicotyledons). The entire line of back-boned creatures or 'vertebrates', including human beings, is thought to have evolved from the larval stages of sea squirts. We human beings are thought to be neotenous apes. We live through many years of childhood, growing very slowly before attaining adulthood and even then retain a playful curiosity and imagination, if we allow ourselves to, which is at the heart of our inventiveness. Many of our domestic animals are thought to have endeared themselves to us through their child-like characteristics of affection and malleability. We owe so much, it seems, to the playing field of our evolutionary childhood. Yet we continually seem to try to suffocate it at birth. Why?

The fact that we human beings tend to dismiss our childhood experience as little more than a flight of fancy and costly preparation for adulthood, when our real life's work begins, may be the product of the psychological as well as bodily changes that accompany adolescence. Ironically, these changes are often represented as the *onset* of conscious awareness. But actually, I think they represent the *rationalization* and consequent *imposition of closure* upon our wider consciousness of void space, through which we make our universe and its contents seem more definite, describable and predictable than they really are. Although these changes may be essential to our adult ability to be 'better informed' and so care for, protect and educate one another, their influence can become abusive if we use it to impose closure upon and belittle our intuitive powers and the variable reality of dynamic Nature. They do not, in

themselves, bring the kind of wisdom that the Greek philosopher, Heraclitus, described as the *understanding* of how all is steered through all.

These psychological changes both reinforce and are reinforced by the cognitive illusion that we all become increasingly susceptible to during adolescence. As we approach adulthood, especially in traditionally male roles, we seek to *see more clearly* as our means of finding, catching and grasping food, making our way through the world, and avoiding and protecting ourselves and our loved ones from danger. We therefore tend to become more and more dependent on our *eyesight* to inform ourselves about the world around us. By the same token, the role of our other senses diminishes, along with our emotional responses, as our skins thicken and harden and our nervous systems become inured and habituated to the uncertainties of our outside world.

In this way we literally lose touch with reality, whilst claiming to have a greater grip on it, as we strive for independence. This is because our binocular vision, whilst giving us the seeming definition and depth of field by which we can sort one 'thing' out from another, also narrows our focus to whatever lies in front of our noses. We lose sight of spatial context and begin to see the world as an assembly of hard-lined, independent, solid objects surrounded and isolated by emptiness. It is as though we acquire a subtle kind of knife, which we use to cut 'figures' free from their contextual 'background', so that they appear to move independently *through*, rather than reciprocally *with* space. Even when we perceive interconnectedness, we tend to envisage this explicitly as a 'web' of hidden 'threads of meaning' rather than as communicative channels of included space.

Only if we somehow manage to retain or reclaim and *value* our juvenile sensitivity to our outsides, alongside our more informed view, so that our *seeing includes our feeling*, can we gain the kind of open-minded wisdom that Heraclitus spoke of. We may do this in a variety of ways, all of which tend to mark us out from others in modern society as 'unusual' or, more disparagingly, as 'abnormal' or even 'insane'. We may retain strong spatial connections

between our left and right brain hemispheres, a feature said to be characteristic of dyslexics and women. We may maintain a low availability of the neurotransmitter, serotonin, in our brains, a feature said to be characteristic of ‘sufferers’ from ‘obsessive-compulsive disorder’ (like me - as well as some more famous people, thought to include Charles Darwin, Howard Hughes, Winston Churchill, John Bunyan, Saint Therese, Samuel Johnson…, for which reason it might more aptly be called ‘openly creative disorder’!). We may deliberately induce a low availability of serotonin by taking hallucinogenic drugs, meditating, or trepanning (drilling holes in our skulls), as with Gurus and shamans. We may gain a sense of inner-outer reciprocity through experiencing the buoyancy of bodies immersed in fluid space. We may gain an all round view by gathering together around a common space in circles like those of aboriginal and pagan cultures, and sharing our unique local perceptions, so that a holographic image of our situation emerges collectively.

But, meanwhile, the orthodox preclusion of such perspectives by the compulsive closure that divides the world *absolutely* between *something* or *nothing* (matter *or* space) has constructed an enormous edifice of mathematical, scientific, philosophical and governmental space-excluding logic. And we impose this logic upon the child-like creativity that issues from the wild uncertainties of the void that we try so hard to avoid.

Natural Life History - A Local Initiative

Although its significance seems not to have been appreciated, there is a widespread recognition even in conventional evolutionary biology, that not all life forms rush equally madly to reproduce and spread themselves in advance of others. Natural communities are populated both by ‘hares’ and ‘tortoises’ - creatures that sprint through their lives and other creatures that sustain a more durable potential in the longer run. The former kinds of creatures have been described conventionally as ‘r-selected’ and the latter as ‘K-selected’, in

accordance with what is known as the ‘logistic equation’ of population growth - which I’ll return to in Chapter 8.

It’s the unglamorous tortoises of this world that show us there is more to living a sustainable life than relentless growth in competition with others. But despite the supposed influence of the Galapagos on his thinking, neither Charles Darwin nor his many adherents seem really to have appreciated this as they have persisted in defining evolutionary ‘fitness’ in terms of rates of reproduction. Consequently there is a perception that there is a need to reproduce and compete all the more intensively as population numbers increase and resource availability decreases - a perception that corresponds all-too-closely with behaviour in discontented human societies. This perception is, however, incompatible with the slowing down and resource pooling through self-integrative processes that is needed for sustainability, which actually occurs in natural communities under such circumstances.

Correspondingly, in natural communities there is often a ‘succession’ from predominantly rapid-growing, fast-spreading, short-lived life forms in early phases of development following a local disturbance or enrichment, to more durable life forms in later stages. This can be seen for example in sand dunes, disturbed soil, in newly emerged volcanic islands and at the margins of lakes and pools. It leads to the formation of the grasslands, moorlands, heathlands and forests that comprise the main terrestrial communities of distinctive parts of the world - depending on the different climatic conditions prevailing at different altitudes and latitudes. These communities tend to become more complex in their structure and diverse in their composition as they develop. Innumerable life forms come to live and grow within, upon and alongside one another over diverse spatial and temporal scales in dynamic evolutionary neighbourhood.

These transformational processes occur both within and amongst the diverse life forms as they attune with their changing circumstances by varying the permeability, deformability and continuity of their dynamic boundaries. In early phases, the emphasis is on proliferation (often by non-sexual means) within

deformable, permeable boundaries (i.e. ‘self-differentiation’). In later phases, self-integrative processes of boundary-sealing, boundary-fusion and boundary redistribution enable the effective and efficient conservation, pooling and exploration for resources and sexual rejuvenation that sustains the community in dynamic balance.

Elemental Interplay - The Chemistry of Ancient Wisdom

How, then, are these transformational processes induced and manifested? There is a way of approaching this question that brings the ancient idea of the four elements of Earth, Air, Fire and Water (all as dynamic inclusions of the fifth element of Space, according to some Eastern philosophical traditions) into correspondence with our modern knowledge of chemistry. This approach revolves around the reciprocal coupling of photosynthesis and respiration, which I mentioned in Chapter 3, along with the ‘dual’ aspect of oxygen, which I mentioned in Chapter 4.

Fundamentally, there are four ways in which life forms respond to oxygen as both energizer and destroyer of living form. These relate directly to the distinction between ‘hares’ and ‘tortoises’ and their dynamic boundary properties.

The first kind of response is characteristic of life forms that proliferate rapidly in circumstances of plenty. They burn chemical fuel by combining it with oxygen to form carbon dioxide and water through the process of aerobic respiration. This provides chemical energy, but as fuel supplies diminish there is an increase potential for an oxidative crisis culminating in degeneration and death unless they switch into an energy-conserving mode.

The second response prevents oxidative stress by quenching destructive free radicals and active oxygen species with ‘anti-oxidant’ molecules and enzymes. This is characteristic where cells are relatively protected from

absorbing excess oxygen, for example in water where the gas diffuses 10,000 times more slowly than through air.

The third response is to impede oxygen diffusion into cells by means of relatively impermeable coatings. This is characteristic of cells and organisms exposed to air in terrestrial habitats, and often actually involves the chemical incorporation of oxygen into the coatings themselves.

Fourthly, oxidative degeneration is allowed or induced. This occurs in those situations where death serves to feed, protect, structure and transform life, as described in Chapter 5.

All in all, here can be seen the fundamental way in which the contextual responses of life forms to the dual aspect of oxygen have shaped their evolutionary course. These responses induce boundaries to open, seal, fuse and degenerate, so enabling energy sources to be gathered, distributed, conserved and recycled as circumstances require.

Chapter 7

Beyond objectivity

“Such axioms [of object existence] would be utterly meaningless to a being living in a world in which there are only fluids.” - Henri Poincaré

"I wish we could derive the rest of the phaenomena of nature by the same kind of reasoning from physical principles; for I am induced by many reasons to suspect that they all may depend upon certain forces by which the particles of bodies, by some causes hitherto unknown, are either mutually impelled towards each other, and cohere in regular figures, or are repelled and recede from each other; which forces being unknown, philosophers have hitherto attempted the search of nature in vain; but I hope the principles laid down will afford some light either to this or some truer method of philosophy." - Isaac Newton

"but it is not to be conceived that mere mechanical causes could give birth to so many regular motions ... this most beautiful system of the sun, planets, and comets, could only proceed from the counsel and dominion of an intelligent and powerful Being." - Isaac Newton

“Why waste words? Geometry existed before the Creation, is co-eternal with the mind of God, is God Himself (what exists in God that is not God himself?); geometry provided God with a model for the Creation and was implanted into man, together with God’s own likeness - and not merely conveyed to his mind through the eyes” - Johannes Kepler

Questions of Value Judgement: So What, Who Cares and What’s Love Got to Do With ‘It’?

Throughout this book, I have been trying to express an understanding of life, environment and people, which I think is available to (almost) anyone and corresponds with all our ordinary personal experience of life and our loving relationships with friends and family. As I see it, this understanding really is no more and no less than common sense - quite literally nothing ‘extra-natural’ or ‘out of the ordinary’. It can help us out of the collective and individual addiction to conflict that so many of us are exposed to whilst we maintain the extraordinary facades that constitute the heavyweight baggage of modern culture. These facades obscure what could and should be so obvious to us in developing an appreciation of the creative nature of our evolutionary dynamic neighbourhood and complex, receptive-responsive self-identity. Moreover, they include our definitive use of language, as may be apparent from the roundabout way in which I have struggled to convey my meaning in the previous sentence without reducing it to a simplistic, monosyllabic, linear sequence. They are founded in the extraordinary, nonsensical idea upon which many of us have been hooked in spite of ourselves for millennia - that nature can be divided up into discrete, fully definable objects ordered about by external force or internal drive. This idea has been reinforced by a restrictive scientific view that many have come to believe in and substitute for ‘Divine Presence’ as the only rational way of understanding the world and our place in it. But science itself has provided evidence - as Newton himself appreciated - that the substitution of definitive local knowledge for universal awareness cannot provide this understanding. Ironically scientific understanding and its application can therefore be made *more* comprehensive and comprehensible by making it *less* definitive and *more* realistic, through including what has widely been omitted from its consideration and methodology.

So, now I want to ask what difference a non-definitive, non-extraordinary understanding could make not only to our approach to scientific enquiry, but also to the way we live our lives? Does it mean that we have to change our whole way of thinking about the world and one another in order to address the environmental, social and psychological problems that appear to confront us at the beginning of the twenty-first century CE? Can’t we get along just fine

with what has seemed to serve us so well for thousands of years up till now? Yes and no, you might be thinking.

I want to reflect on these questions by asking two further questions that I think reveal much about the sources of human content and discontent in what we may consider to be ‘desirable’ or ‘undesirable’:

1. What do you/we think human nature and non-human nature are really like?
2. How would you/we really like human and non-human nature to be?

If the answers to these questions are the same, we/you will feel *content* and strive to defend the *status quo* against any contrary idea, which we/you may well regard as a threat to your/our happiness. If the answers differ, we/you may feel oppressed or vulnerable and strive to change or escape our/your situation.

Conflict arises when one person, group or aspect of our psyche’s idea of what needs to be preserved coincides with another’s idea of what needs to change. Correspondingly, one person’s freedom fighter may be another’s terrorist, or one person’s protective overlord may be another’s oppressive tyrant. It all comes down to questions of *definition*, and of which definitions most please or displease the definer’s contrary desires for liberty and security. Here’s the rub:

1. Any act of definition sets up the potential for conflict between opposing definitions.
2. Any act of definition may actually be in opposition to the indefinable nature of nature and human nature - *in which form is a dynamic inclusion of space* - so setting us at odds with one another and our living space in an indefinite vicious cycle that can spiral into holocaust.

At this juncture, it may be helpful for me to reveal one of many interrelated problems that I have been struggling with personally for much of my life, which directly led me to try to develop and communicate my understanding of inclusionality. This problem bears all the hallmarks of a classical ‘rumination’,

of the kind that is nowadays widely attributed to a psychological condition known as ‘obsessive-compulsive disorder’ (OCD), from which I both benefit and suffer.

The problem takes the form of a tantalizing question, which appears answerable but whose definition fades from view the closer that it is approached. It is also an unwanted question that is prone to induce a deep sense of shame and guilt, associated with a loss of self-esteem in the questioner, which gets in the way of its resolution whilst making this resolution all the more imperative. This is because it is a forbidden question within the cultural context of its asking.

If I am to put it very starkly, the unwanted question that has troubled me is 'what is wrong with eugenics - the idea that humanity can be genetically improved by selective breeding?' At its root, this question translates into 'what is wrong with Darwinism?' 'What is wrong with seeking to enhance evolutionary fitness by preserving what is genetically ‘good’ and eliminating what is genetically ‘bad’? It is a culturally unacceptable question - at least that’s how it has felt to me - on two counts. Firstly, it smacks of fascism and so is seriously politically incorrect in the wake of Nazi Germany. Secondly it questions the most powerful idea to emerge from biology in recent centuries - an idea that many of us have come to apply without question to all forms of life, though we may balk at its more extreme applications to human beings.

This question has been especially significant for me because I have felt a continuing inconsistency between my sense of loving compassion for all nature and the way I have been ‘educated’ to regard others and myself in the context of a Darwinian survivalist mentality. I haven’t been able to resolve it by thinking ‘we are all one and the same’ or by dismissing it purely on the emotional or moral grounds, unsupported by sound reason, that ‘it’s not nice’ or ‘not good’. I have been only too aware that personally I don't view everyone and everything 'equally'. I am attracted by some and repelled by others and as a naturalist I can distinguish between an immense variety of forms of life. How can this square with 'egalitarianism'? Moreover, is it really so nasty and

immoral to strive for a better future through unpleasant means? I couldn't simply and inconsistently (as many people appear to me to do) allow my head to rule in one context and my heart to rule in another, according to cultural convenience and acceptability. I needed a resolution that made sense *both* intellectually and emotionally – which dissolved the 'clot' between 'head' and 'heart'. For the divorce of rationalistic reason from emotion in modern culture is one of the more notable sources of discontent.

My difficulty has been exacerbated by being brought up with extraordinary expectations (and associated extraordinary doubts) about my own ability, working in an academic context where favourable and unfavourable comparisons are the order of the day. I made the dire mistake of working my socks off to please my father and reassure myself by gaining a triple first degree in Natural Sciences at King's College, Cambridge, only to discover that this was no preparation for a secure, happy life. Sometimes getting what you think you or others want brings some very unwanted side effects! The expectations simply compounded into the idea that I should pursue a career of one extraordinary accomplishment after another, even if this was to the detriment of my personal and family life, the end justifying the means. I was even exposed to the horrible suggestion that like some calculating genius I ought to select whom to marry depending on who would offer the best genetic prospects – just as non-human organisms are supposed to do according to neo-Darwinian theories of mate choice!

Eventually I couldn't endure living any longer with these expectations and doubts. I longed to be 'just ordinary', 'get real' and let go of my quest for extraordinary accomplishment. After many years of striving, I withdrew from my biological research and tried to learn to live with the consequences of being regarded by others and myself as a failure - a fate that I had tried my utmost to avoid. I found this experience very difficult and besides I needed some sort of income, so I tried to reinvent some kind of academic role for myself, being unable to find anything more ordinary to which I was suited.

I applied myself with increasing urgency to developing ‘inclusionality’ as an antidote to the toxicity of our modern culture of discontent, which I perceived to lie at the root of my own and many others’ suffering, not to mention the eugenic question. But as I try to communicate this understanding, I find myself banging my head against enormous resistance and incomprehension. Once again I seem to be striving for extraordinary accomplishment. But now I am not doing this in order to satisfy expectations and gain reassuring acclaim from others - not that I would mind receiving more recognition and support! Rather I am trying to share an awareness that I think could be very helpful to us all, notwithstanding the opposition I encounter. I am trying to convey what is essentially a non-extraordinary understanding in a culture that is hooked on the really extraordinary idea that ‘solidity is real’ and ‘space is nothing’.

I have come to recognise when someone 'gets' what I am trying to express from what they say in response. This is often along the lines of 'Oh my God, this is so obvious, but it turns our objective understanding of the world upside down. We've been defining nature and ourselves in a grossly disproportionate way. How on Earth can we communicate something so immense in a community that can't see it but so needs it? Do we have to rewrite all the textbooks?' Alternatively, there may be a suggestion that it’s nothing new - that it’s been with us implicitly all along in the works of sages, mystics and prophets through the millennia. Agreed, but then how come we’re still locked in this culture of discontent? Why is the understanding that could unlock our addiction to conflict so difficult to communicate more widely?

It is like seeing a hologram emerge from what appears like a splatter of fragments of colour, as in a 'magic eye' picture. Its importance cannot be over-stated. Inclusionality isn't, to my mind, 'one view amongst and alongside many'. It is the 'mother of all views', off-putting and arrogant as that may sound to someone who doesn't get or is unacquainted with it. But is it really so arrogant and off-putting to experience and want to communicate the humility of a view of nature as receptor rather than selector, a spatial source of love in the vital presence of material absence? Is it not more helpful to view nature as a receptive source of encouragement for all life even if not all can be readily

accommodated, rather than as an exclusive and forceful judge who pitilessly takes down unworthy specimens? The question is how can we help ourselves to see this loving receptivity of nature through all the baggage that we place in its way?

Part of my frustration is that I can show the hologram, but I can't make people see it through the clutter that both obscures it and from which it is formed. When someone doesn't 'get it', even though they may really want to (part of the problem), their frustration often turns into an accusation that my communication 'isn't good enough', along with a focus on its 'style' rather than its 'content'. I am often accused of being too academic and aloof for ordinary human beings to engage with and comprehend - of being very ‘abstract’ rather than ‘solidly’ planted in human experiences and social realities. Can you imagine how this feels to me?

It’s so easy in a culture that sustains the paradoxical idea that we are self-centred individuals driven by internal agenda and external force (or vice versa) to regard our problems as indicative that there is ‘something wrong with us’. There is some flaw in our make up as performing objects that renders us paradoxically both blameworthy and helpless. I wasn’t good enough to sustain an extraordinary academic research career. Now I may not be good enough to communicate my understanding in simple language to ordinary people.

But with inclusionality came my recognition that what is wrong with eugenics is that it is founded in the assumption that we can discriminate between objects of different 'value' or 'worth', extricated out of dynamic context like local depressions abstracted in fixed form from an air bed. What is wrong with eugenics is that it assumes that there can be something wrong *with* a person, *independent* of their dynamic situation, which can be annihilated without repercussion. Inclusionality provides both reasoned (intellectual) and emotional (heartfelt) grounds for this recognizing this fallacy - indeed it dissolves the differentiation between objective logic and 'irrational' emotion. With inclusional understanding comes the realization that 'a problem *for* me

arising from my dynamic situation (context) is not necessarily a problem *with* me due to a fault in my internal design (content)'. This enables me to work on the problem rather than feel in its thrall and obliged to others to help me out - a feeling that I feel sure all kinds of ‘addicts’ experience when they are told there is something ‘wrong’ with them.

This question of 'value' and its comparative attachment to 'things' is deeply rooted in modern culture. In a rationalistic worldview, 'things' can indeed be evaluated in terms of their desirability as 'better or worse'. They can be singled out and favoured or rejected as independent wholes. Here I am reminded of something about a popular book about mushrooms and toadstools that upset me a lot when I first read it, and still does so in many ways, epitomizing as it does, the way we can value and devalue others and ourselves through objective judgement. The book contained a short description of the characteristics of each species of fungus illustrated. At the end of each description was a comment about edibility. One of the adjectives used was *worthless*.

By contrast, in an inclusional view, where all is spatially and dynamically included in all over all scales and there are no discretely definable objects, what is 'fitting' can have many and varied expressions (appearances and behaviours/phenotypes) depending on context. It is iniquitous and makes no sense to attempt to single out and evaluate some aspect of reality as 'better' or 'worse' than any other in terms of its absolute desirability as an independent object, because such abstraction 'out of context' is physically impossible. All has incalculable worth as a vital inclusion of all, regardless of its desirability from a detached perspective. There is no such 'thing' as a good, bad or worthless 'person', because no person is an isolated object. On the other hand, it may be possible to differentiate between harmonious and dissonant personal expression in terms of what orients with and what sets itself against natural neighbourhood - sometimes through the very desire to discriminate objectively between better and worse. It may be possible to enhance 'practice' ('doings'), but not to improve people (doers). Personally, 'I' don't want to and can’t make myself a 'better person', complete with historical

baggage, but I would like to learn through my experience how I might respond receptively in my dynamic situation in an evolutionarily sustainable way.

So, there are no good guys and bad guys in Nature, only good guise and bad guise. That which is judged objectively to be better or worse in the eyes of Man may be invaluable in the eyes of Nature. Desirability may vary but love is unconditional. Desirability may be no *real* measure of worth.

In following sections I intend to follow up the implications of accepting that all form is a dynamic inclusion of space, and so not capable of absolute definition, by addressing the following questions:

1. In what ways can and do we impose objective definitions upon nature and ourselves?
2. What are the social, psychological and environmental implications of such imposition?
3. Is such imposition realistic or helpful and, if not, how may we grow beyond it?

Mathematical Definition and Beyond - From Box World to Flow Whirls

Elementary mathematics, the stuff we are exposed to from our first day of schooling that constrains our formerly unadulterated pleasure in playful enquiry into and understanding of nature, is founded on two great definitive abstractions: two great *lies*. *Euclidean geometry* imposes a three-dimensional frame upon the infinite possibilities of space and *arithmetic* dislocates figures from their spatial grounding. At a stroke, commonly reinforced in my living memory by a stroke of the cane of corporal punishment meted out to those of us who can’t or won’t conform with expectations, we have our imagination knocked out of us, never to return if we want a successful or quiet life.

Elementary mathematics treats nature as a fixed *whole* that can be subdivided into *sub-wholes* that can be re-assembled by simple *addition* to

reform the whole. This is the basis for the linear methods of analysis that underpin so much of our working lives and transactions. It's fine and useful so far as it goes as long as we don't take it so far as to think it provides us with a way of explaining, controlling and predicting the evolutionary *behaviour* of all nature, including human nature. But we take it too far when we regard the sub-wholes as purely material ingredients of nature and so omit space from consideration by treating the receptive 'presence of absence' as 'nothing' or 'void'. In doing so we alienate ourselves from our own experience as inclusions of space and so lose sight of the source of our complex local and non-local self-identities in fluid dynamic neighbourhood. We set everything, including ourselves, against the grain of natural process. We try to force nature and ourselves to comply with our mathematics rather than *vice versa* and suffer when our predictions fail to account for the inherently unpredictable implications of our imposition as we break down socially, psychologically and environmentally.

If we want to have a mathematics that corresponds more closely with real life experience and helps us to understand our creative potential as well as the implications of opposing natural flow, then we need a different kind of mathematics from what most of us are schooled in. This different kind of mathematics includes space in its representation of natural form and dynamic geometry. It liberates us 'beyond the box' and immerses us 'into the flow'. I will discuss further how it may be developed in Chapter 8.

Scientific Definition and Beyond - From Particles to Stream

In its quest for definitive certainty, by way of concrete fact that all observers can agree to regardless of their unique situation, rationalistic scientific method attempts to isolate the objects of its study from the circumstances in which they are being observed. The objects are in effect stripped free from dynamic context so that they can be independently observed from a distance, as though through some impenetrable partition that alienates them from the

observer(s). Although such objectivity is commonly portrayed as ‘dispassionate’ or ‘unbiased’, it is actually the most prejudicial form of enquiry imaginable, coming close to Inquisitorial interrogation where the kinds of answers *abstracted* may be misleading, to say the least. The inquiry invariably *begins* with the *selection* and *extrication* of a *sample*, which is placed within some actual or theoretical *limiting boundary* or *reference frame* and then subjected to various kinds of experimental manipulation. A piece of nature is *excised* and brought under scrutiny within the *imposed framework* of the sampling grid, laboratory, containing vessel, experimental apparatus or mathematical construct.

The underlying hope of this kind of inquiry is that the *small picture* it provides of the part realistically represents the *big picture* of the *whole* from which the part was abstracted. Some hope!

It’s rather like trying to represent a river by scrutinizing the contents of a cup dipped into it. No form of enquiry based on the deliberate ignorance of spatial context can comprehend the behaviour and properties of a complex, dynamic system. True, *comparison* of the properties of water contained in a cup with those of the river may yield valuable *insights* into the dynamic possibilities of the latter and how these are affected by isolation within a fixed boundary. But to extrapolate from what can be defined within a fixed container to the uncertainties of the open field makes nonsense. Whatever certainty we may gain about the properties and behaviour of our isolated sample or system, comes at the expense of profound uncertainty about the applicability of our conclusions to the wider dynamic context. Through imposing definition upon a complex flow-field, what is vital to the dynamic form of this field is excluded, resulting in stasis, whereupon it can appear via dissection to consist of discrete particles. But this is an artefact of the imposition, which leads to an inverted understanding of natural process in which the incoherent fragments become regarded paradoxically as fundamental ingredients of the whole.

A more comprehensive kind of scientific enquiry therefore needs to include, alongside analytical method, approaches that can take the observer beyond the immediately explicit, measurable and countable into the deeper realm of the implicit where all is spatially included in all. One way or another the observer needs to immerse in the dynamic natural situation in which both he/she and what is being observed are included. Then the fixed particles melt into the stream of nature, a current in which all remains clearly distinct and distinguishable, but never collapses into the discreteness of isolated forms.

Ecology in its deepest sense as the study of pattern, process and relationship over all natural scales therefore demands the inclusion of some kind of field trip to experience how it feels to be included in the situation of study. If you really want to understand the ecology of, say a forest, can you really do so whilst, like increasing numbers of modern 'remote-sensing' scientists and students, you are sat at a laboratory bench, reading a book in the library or viewing a power-point presentation in a lecture theatre? Don't you need to walk into the scene you are observing? Moreover, even if you do walk into it, can you really experience its full complexity if, like some forest ecologists I know, you enter only on isolated occasions, fully clothed and booted so as to insulate yourself from its prickles and temperature and humidity gradients? Don't you have to *live* in the forest as one of its uniquely situated indigenous inhabitants? Don't you have to recognize that the full picture of the forest cannot be seen from your unique standpoint alone, but can emerge through sharing your perspective with others, as in an indigenous 'sharing circle'?

Of course, there are practical difficulties in the way of our gaining such subjective experience of immersion, especially if the situation of interest is far removed in distance or size from human scales. But that doesn't mean that we should lose sight of the value and relevance of such experience, or fail to acknowledge the limitations of our understanding if we don't or can't gain it. Also, even if we are *physically* unable to immerse ourselves in the situation we are studying, this doesn't mean we can't *imagine* what it is like, both individually and collectively.

Our ability to imagine situations is a most wonderful human facility, yet the way we use it can exaggerate and stifle as well as enhance our awareness of possibility. Ironically, it is the fear of ‘fantasy’ - the subjective creation of an imaginary reality - that compels objective scientists to impose imaginary limits upon nature and isolate themselves from what they are observing, with all the potential for misconception and loss of insight that I have described earlier.

Those innovations of science that transform our understanding of nature may often if not always depend on feats of imagination that have very little to do with hard fact and analytical method. They have much more to do with intuition and empathy - the related abilities to gain insight by drawing diverse strands of personal experience mentally together so that they fall into an identifiable pattern, and to imagine how it feels to be in the situation of another. These abilities have always been very important to me. Nothing gives me more pleasure than to recognize a pattern or recurrent theme emerging in my mind from what on first sight seems like a clutter of disparate information. This is no more and no less than the kind of process all of us are capable of when recognizing a human face notwithstanding its many variations in expression. In my case I also use it in being able at a glance to identify and name several thousand species of fungi, plants and animals. Also I often joke when giving lectures about fungi by asking members of the audience to imagine being a fungus - like I often do! But it is just that kind of imagining that has led me to ask some of my most productive research questions. Why on Earth should we exclude such imaginings from our methods of enquiry?

It is also true, however, that if we allow our imagination to run completely free from material constraint it can - as I know from my OCD experience - dream up the most unlikely catastrophic and euphoric scenarios and make these seem probable if not inevitable. Such dreaming is all too evident in the conspiracy theories and doom and bloom-laden prophecies that are currently mushrooming in our culture. To make creative sense of nature, our imagination needs to work in partnership with our informative senses, just as nature itself can be understood as a co-creative inclusion of electromagnetic and spatial field.

How, then can we combine our imaginative and informative facilities in our scientific enquiries in a way that can make sense and enhance understanding and creative possibilities? My suggestion is simply to include much that currently gets excluded from objective enquiry so that the latter can be subsumed and transformed but not entirely replaced. Let's allow ourselves to dream and play with imagery. After all that's how August Kekulé von Stradonitz dreamed up the structure of benzene in his mind whilst dozing on a bus, and Watson and Crick fiddled about with jigsaw pieces representing the molecular structures included in DNA until they formed a beautiful spiral staircase. Let's include art and feeling and subjectivity and love and receptivity to others' viewpoints, wherever they may come from in our Science. All in all, the scientific community might gain deeper understanding of nature if it saw itself as a dynamic neighbourhood gathering complementary insights from diverse, uniquely situated perspectives, instead of a gathering of conformists seeking consensus in a single objective view, abstracted out of context.

Linguistic Definition and Beyond - From Literal to Lyrical

"I think its true that one gains a certain hold on sausage and haddock by writing them down" - Virginia Woolf, A Writer's Diary, March 8, 1941

As may already be evident, one of my great difficulties and frustrations in writing this book has been a nagging question: 'how can I express inclusional understanding verbally without re-setting the trap that precludes this understanding?' At the heart of my difficulty is the 'fact' that the English language is by its very nature and origins definitive in its structure: it consists primarily of nouns, pronouns, verbs, adjectives, adverbs, prepositions and conjunctions. Such structure reinforces the idea that nature can be defined and described unambiguously and that we can be sure of our meaning by referring to an authoritative dictionary. We fix our understanding of nature by fixing the meaning of words and insist that we all agree to abide by the same

objective usage as if we were all viewing the same standard world from the same standard standpoint. We expect others' usage of language to conform to our own, and when it doesn't many of us are inclined to lose patience and become unreceptive if not hostile. The trouble is that such conformity isn't possible in an unfixed nature where heterogeneity abounds and all perspectives are unique. To try to impose such conformity not only removes the opportunity to enrich our understanding through the sharing of complementary viewpoints but is also ironically a barrier to communication and source of profound conflict and incoherence.

In trying to communicate through the language barrier I have myself been walking a tightrope balanced between striving for clarity and accessibility on the one hand, and avoiding the danger of conforming to others' fixed preconceptions on the other. I have gone to great lengths (which will naturally be invisible to the reader) to avoid language that allows the mind to default to definitive thought patterns, which isolate 'things' in discrete boxes of space and time. For example, I avoid words like 'cause', 'effect', 'does', 'consequence', 'right', 'wrong', 'good', 'bad', 'select', 'object', 'thing', 'definite', 'unit', 'solid', 'fact', 'competition', 'co-operation' etc except where I am querying their application. I often resort to expressing the same idea in more than one way, because I recognize that every person's use and understanding of language is unique. I use metaphor, nuance and *double entendre* to help induce the reader to read 'between the lines' and not take what I am saying absolutely literally. I am aware that for some readers, prepared to relax into the flow and listen out for my underlying intention without getting hung up on my inevitable idiosyncrasies, this is fine. I have the same approach when listening to or reading others' words as they endeavour to share their meaning with what can only be verbal outlines. I recognize the difficulty and do not get angry when they don't use language as I do - though I may point out how I think particular language can be subject to varied interpretations, sometimes far-removed from what the speaker or writer intends. The same verbal language in different contexts can have radically different meanings, and this applies especially to the difference between speaking from a fixed objective perspective or an inclusional awareness of situation.

All the while, however, I am aware of an impatient voice saying something like ‘keep it simple, stupid’ and ‘why can’t you use plain language that everyone can understand?’ I am dismayed by this voice, and even more dismayed by witnessing the extraordinary intolerance that many people seem to have for one another’s expressions. I view this intolerance as a symptom of our cultural lack of receptivity, our unwillingness to see beyond the superficial to deeper meaning. I don’t want to ‘keep it simple, stupid’ (KISS), if this means ‘keep it simplistic and stupid’ (KISAS). I’d like to ‘keep it naturally simple’ (KINS), but I’m aware that what comes naturally can seem very unfamiliar in a culture habituated to the short, sharp shock of objective expression and sound-byte.

Nowhere is the objective desire for conformity more evident than in ‘scientific language’. Here is how biology students at the University of Bath are instructed to develop their skills in this form of communication, prior to writing up their final year projects.

‘Scientific writing should be precise, clear, concise and straightforward. *Few write naturally in this way*, but most can train themselves to do so. It is difficult to write well scientifically so do not be alarmed if drafts of your report are much altered and improved by your supervisor…

The ‘Complete Plain Words’ (HMSO) is invaluable and should be compulsory reading for all scientists. It contains much good, sensible advice. Some that applies especially to scientific writing is given below:

4. In choice of word prefer the familiar to the far-fetched, the concrete to the abstract, the simple to the circumlocution, the short to the long and, less firmly, the Saxon to the Romance.

5. Avoid superfluous words: “in fact” is usually unnecessary. Suspect terms such as ‘with reference to’ and ‘in the case of’. They are often replaceable with single words. Phrases, which are all too common in

American writing, such as ‘visual unattractiveness’ for ‘ugly’, should be cut down to size.

6. Scientists tend to use jargon; replace it if possible by plain words. Foreign phrases can be useful but use them only when there is not an acceptable equivalent in English. Letters and words in language other than English should be underlined (= italics in print).

7. Construction of sentences is a large subject that can only be referred to briefly in these notes. For a scientist, the main objective must be precision and clarity, and this usually means short, simple sentences or clauses. Also, use the active rather than the passive form and the direct rather than the indirect expression.

Oh dear, I think I’ve just failed my biology course, by following my inclination to the lyrical as a far more natural expression of dynamic inclusional neighbourhood than the literal! I want to use language to help open up meaning, not to close it down within fixed definitions.

Political, Educational and Cultural Definition and Beyond - From Fortress State to Welcome Home

As I illustrated in Chapter 1, the variety of ways in which objective definition has been deeply embedded in modern culture as a source of rivalry if not enmity between one and another is extraordinary. Politically the world is largely subdivided into nation states with central governments and artificial boundaries sustained by military power and regulated internally by police force. Although democratic voting elects some governments, various forms of dictatorship and corruption are widespread, and nowhere is truly democratic governance for all by all established other than in autochthonous sharing circles. Educationally, standard curricula, regular examination and the

principle of training students as performing objects to maintain the trappings of the status quo hold sway over the intention to lead into greater, more creative, receptive and responsive awareness of natural neighbourhood. Culturally societies are divided into factions that do not understand or communicate with one another, whilst huge resentment is induced by the potent cocktail of an unshakeable belief in individual human rights and purpose combined with the widespread abuse of human dignity. A deep sense of individual and collective injustice is inflamed, not assuaged, by moral outrage. Confrontation of all kinds seems to be written in prescriptively to human social contracts, at the expense of an ability to welcome and accommodate others and their human needs.

As has been my recurrent theme, I think that both the source and potential solution of such prescriptive confrontation can be found in the distinction, but not absolute incompatibility, between two forms of philosophical enquiry and explanation. One form of enquiry and explanation has roots expressed by Heraclitus and indigenous cultural psychology, the other has roots in the thinking of Parmenides, Aristotle et al and 'the Fall'. One can embrace and transform the other, just as 'non-linearity can encompass linearity'. The other cannot.

In drawing attention to this distinction, and to the creative possibilities of one form of enquiry embracing whilst transforming the other, I am not speaking as someone with great philosophical scholarship. Nor am I speaking as someone intent on winning an argument or claiming ownership of a singular understanding that I wish to impose upon others. I am speaking as someone who has come through personal experience and naturalistic enquiry to develop and articulate a form of awareness of nature and human nature that I think could help enormously in living in more loving, respectful and sustainable relationship within our natural neighbourhood. I want to share this awareness, which at heart is extremely simple, unextraordinary and unprejudiced by prescriptive value judgement, based on regarding all form as distinctive flow-form - a fluid dynamic inclusion of space, not an axiomatically definable occupier of space (discrete individual object).

As I have researched the enormous implications of inclusional awareness, I have found these to align with - whilst not being an explicit source for - my own moral values arising from a wish to help minimize avoidable suffering and maximize avoidable joy in whatever way that is possible and not counter-productive. I can't pretend to understand what all these implications are, so I want to help others - and be helped myself - explore these possibilities. In embarking on this co-enquiry, my intention is to help one another see the hidden assumptions we are making and the implied complications (incoherence) of making such assumptions where they oppose natural dynamic processes. I also wish to reveal the co-creative possibilities that can arise from letting go of these assumptions and assuming a more natural relationship.

But, as I have said, I find myself greatly challenged in this exploration by those who construe my intentions as hostile to and suppressive of their own enquiries. What is the source of this difficulty? I suspect it goes much deeper than immediately meets the eye as a visible bone of contention. I think it is rooted, in our perception and experience of reality and the way an egotistic psychology may both give rise to and be reinforced by logical systems that are prescriptively confrontational.

A way in to understanding potential sources of contention between the two forms of enquiry and how one enquiry may embrace whilst transforming the other is to ask, 'what is the source of a river and what is the source of all rivers?' When tracing the source of a river analytically, it is usual to identify the tip of one of the tributaries as the point of origin. This is classical reduction into a linear historical narrative from a defined starting point. The choice of tip may depend on a kind of competition to decide which one appears furthest away from the mouth of the river on a Cartesian map, with the winner being declared as source. But this ignores all the simultaneous contributions being made to the river by all the other tributaries. It also ignores the source of rainwater in sky and sea and its
channelling through the dynamic body of landscape. Ultimately the source of

a river is *everywhere*, and all its locations in the curved surface space of Earth are simultaneously both sources of and sinks for flow.

How odd and disproportionate it is, then, to single out the tip of a tributary as the 'head of a river', the point from which all flows without precedent. It is even odder, when it is appreciated that this 'point' is not fixed, but is continually displaced, along with all the other tributary tips, by headward erosion of valleys in the opposite direction to the water flow as they reach back into landscape to form a
basin. As adjacent basins expand, they come to meet one another along a ridgeline or 'watershed', so that the flow in each is sustained within a distinguishable 'territory'. These territories or basins are hence emergent from, not prescriptive of the flow that sustains them in fluid dynamic neighbourhood as inclusions of space, distinct but not discrete. They correspond with the natural territories formed by all kinds of life as they attune their behaviour and growth in accord with local circumstances. But they are quite unlike the prescriptively bounded domains circumscribed around fixed points of governmental control characteristic of many modern human cultures, which are a recipe for unsustainable conflict and power struggle between mutually unreceptive neighbours, self-defined as self-contained 'objects'.

This odd disproportionality, this paradoxical 'singularity' enshrined in the aloneness of the 'number 1' and 'free-willed' 'I' alone self that is nonetheless buffeted around by external forces beyond its control, lies at the heart of the prescriptive confrontation that bedevils human systems of governance and logical enquiry. It is based upon the abstraction of 'content', as discrete 'objects' out of spatial context, commensurate with the definition of fixed initial conditions and end points along a linear historical time-line that excludes from consideration all outside its own paradoxical self-definition. This is not to deny individual identity and responsible role in social formations. It is to question the view of rationality that holds that 'I' can exist as a discrete, autonomous, free-willed individual, to do whatever he or she chooses, regardless of context.

All systems of enquiry that begin with an axiomatic definition of 'initially discrete objects' or 'initial conditions' are of this prescriptively confrontational nature. The objects can only 'compete' or 'co-operate', because they are isolated from one another at the start, fundamentally through the abstraction of space from matter, which is characteristic of the fixed-point-centred geometry of Euclid.

Such systems of enquiry thereby prescriptively confront natural dynamic process. When they encounter systems of enquiry based on natural dynamic processes sourced everywhere (as per inclusionality) they regard these as confrontational and 'alternative', as an imposition upon their own right to self-definition. It is like a tributary tip declaring itself independent from the Universe and deserving equal rights along with its fellows. It is like George Bush balancing the US economy against the World, as though the World is an alternative to the US economy.

Inclusionality is not an alternative to rationality; it concerns the everywhere that dynamically includes the somewhere: the universal 'Mother' space.

So, is it wise to be prescriptively confrontational? Can we soften the boundaries of exclusive rationality? Can we allow our perceptions and experience of reality to transform? Only if we let go of our individual and collective devotion to objectivity as a worthwhile goal.

Chapter 8

Challenging Unpredictability

Inclusionally, we are OF Nature, a continual transformational process in which the destination IS the journey, rich in complex dynamic experience of the kind that we can all recognise in our everyday lives but tend through rationalization to reduce into discrete factions and fractions, devoid of space.

Bamboo and Cast Iron

‘What is the difference between working with bamboo and cast iron?’ This question brings out the distinction between natural form and artifice. It also brings out the difference between natural dynamic geometry and abstract geometry and the reason why the latter is often preferred to the former whilst greatly restricting creative expression and incurring great environmental cost.

Bamboo grows naturally as a dynamic inclusion of living space, fuelled by sun, earth, air and water. We only have to harvest it in order to include it in our dwelling space. We can build houses from it, complete with furniture, matting and drapery, as well as fashion plumbing systems, Pan pipes and xylophones that communicate through its resonant internal spaces. It is flexible, versatile, strong, comfortable and biodegradable. The only problem is that it never comes in exactly the same form and so is useless for any kind of precision engineering or uniform mass production. Its intrinsic variability is both its strength and its weakness.

Cast iron can be moulded into precise forms that can be mass-produced and incorporated into machinery. But the raw ore has to be mined, purified and

melted at considerable cost, and the manufactured product rusts and is brittle, cannot be degraded biologically and is fit only for its intended purpose, after which it becomes junk.

For many people, the most unwelcome aspect of natural form, as a dynamic inclusion of space, is its lack of cast-iron certainty. This leads to the idea that natural form needs to be forced into shape and made to behave consistently, if not dispensed with altogether in favour of something more robotic in its mechanical performance and handling of information. Ultimately we may apply this thinking to ourselves, with all the distressing implications that I discussed in Chapter 1.

In not coming to terms with natural uncertainty we may not only overlook all kinds of creative possibility but also make all kinds of trouble for our living space and ourselves as we seek to oppose, restrict, control and get round it in whatever definitive way we can. We may even come to regard obedience to prescriptive Laws to be essential to the ‘natural order’ of ‘things’, and conduct our philosophical enquiries accordingly.

Science, mathematics, language and social organization have, as I have said, played their part in trying to define uncertainty out of existence by imposing rigidity and conformity upon naturally fluid dynamic geometry. In this chapter, however, I want to explore how these human endeavours can be transformed by incorporating the fundamental source of uncertainty into their theory and practice.

Including Uncertainty in Mathematics – Statistics, non-linearity and Fluid Logic

Stochastic and Deterministic Uncertainty. Once it has been admitted that the concrete world of discrete numbers and three-dimensional geometry cannot account completely for natural variability, dynamics and irregularity, two contrasting orthodox mathematical approaches have been developed that

tacitly allow space to loosen up the fixed order of things. Both are equally unrealistic in their initial suppositions, and each is usually regarded as the antithesis of the other. When conjoined as complementary partners, however, they may be capable of a dynamic synthesis that more closely represents natural flow-form.

The first approach is known as *stochastic* or, more familiarly, statistical. Here, the default condition of nature in the absence of any constraining or ordering influence is *pure randomness* or *maximum entropy*, an utterly incoherent set of absolutely independent occurrences anywhere and anytime. It is as though space, as a separator, so thoroughly permeates coherent informational structure as to break it up into an infinity of particulate singularities in a sea of emptiness. For any kind of coherent form to emerge in this sea there has to be some way of confining where and when the singularities are most likely to occur - i.e. limiting their ‘degrees of freedom’ - within a particular region known as a ‘probability distribution’. A very common example of such a probability distribution is a ‘bell-shaped curve’ or ‘normal distribution’, with the highest frequency of occurrences beneath the apex of the bell and the lowest frequency at its flared edges.

Statistical form is therefore a pattern of constrained randomness, whereby the location of a chance individual occurrence cannot be pinpointed with absolute certainty, but the likelihood or probability with which it will occur can be calculated according to the frequency distribution. The departure from concrete certainty or ‘error’ that arises from spatial separateness can hence be accounted for or ‘tamed’ within safe limits (a ‘margin of error’), *assuming* that the distribution itself remains fixed. This assumption *cannot*, however, be made in an evolving system.

Whereas *stochastic* modelling therefore assumes the intrinsic *freedom* of a multiplicity of discrete occurrences, which are nonetheless confined within a set distribution, *deterministic* models assume a *secure* set of *initial conditions*. These conditions completely prescribe the *fate* of what is treated as a single individual or collective entity as a *whole*.

The two kinds of models hence epitomize the paradoxical doublethink, arising from absolute objective definition, which maintains that individuals are internally motivated free agencies that can nonetheless only be shifted from their current position or trajectory by the imposition of external force. This is the doublethink that entraps itself in an endless dialectical opposition between nature and nurture, one and many, good and evil, light and dark, wave and particle, one and other, male and female, inside and outside, left and right, up and down, matter and space, positive and negative etc. By excluding the middle between *fixed (static) alternatives* (*states*), it is incapable of comprehending the *dynamic synthesis* of natural *flow-form*. So, how can this dynamic synthesis be made, mathematically?

Singularly enough, some insight into the possibility for dynamic synthesis may be gained through a *loophole* in the paradoxical geometrical and numerical definitions upon which deterministic mathematical models are founded. Explorations through this loophole have already opened up a huge new field of mathematical research over the last forty years or so, known in its various guises as non-linear, dynamical systems, complexity and chaos theory. As yet, the implications of discoveries in this field for science and society generally have not been adequately appreciated, least of all in evolutionary biology. The loophole that I describe has not been recognized for what it is, as an opening into a new worldview, nor has it been widely realized that even this view is too constrained by rationalistic definition anywhere near sufficiently to reveal the vast creative potential of nature and human nature.

For a long while, it was assumed that *only* stochastic models could provide a *measure of uncertainty* in natural form and behaviour. This is because in ‘ordinary’ circumstances, providing that all the initial conditions are precisely known, deterministic models yield fully predictable behaviour corresponding with Newton’s Laws in which there is direct equivalence (linear relationship) between ‘cause’ (input force or action) and ‘effect’ (output reaction). When the force applied in these models exceeds a certain ‘threshold’, however, beyond the capacity of their boundaries to respond smoothly, they can behave ‘non-

linearly' and ultimately in such an irregular way as to give the appearance of randomness, even though this behaviour is supposedly fully pre-determined. Such irregularity has been called 'deterministic chaos'.

To get a mental picture of how deterministic chaos can arise, I find it helpful to imagine a balloon, whose rubbery skin is full of holes. As fluid is transferred from outside to inside the balloon, so the holes in its inflating surface enlarge and release more and more contained fluid. The boundary expands until, providing the rate of input is sustained, a balance is reached. Here output and input are equal and the surface is held stationary in *dynamic equilibrium*. If, however, the rate of fluid input exceeds a threshold amount, then the counteraction between the tendency of the balloon to expand as it gains fluid and to contract as it loses fluid through its enlarging holes, sets up a repetitive oscillation between alternative surface distributions. This oscillation, or cycle of 'waving correspondence', increases in complexity as input is raised further. The number of oscillations between repeats doubles and redoubles until yet a further threshold is reached. The balloon boundary then reconfigures apparently erratically and without ever repeating itself, like a fibrillating heart or turbulent body of fluid.

This imagery corresponds with the patterns predicted by what are known as non-linear equations, at the heart of which can be found the loophole of interrelated paradoxes that I mentioned earlier. The first of these paradoxes concerns the aloneness of the *singularity* that we call 'one'. 'One is one and all alone and ever more shall be so' - in the words of the traditional song, 'Green Grow the Rushes, O'. So, by what magic or sleight of hand, can two lonely ones *ever* make two?

'One' is *primarily* a number *dislocated* from its spatial relationship with other - its *neighbourhood* - and so 'isolated' as a fully discrete, independent unit or whole. This dislocation becomes apparent when we multiply it by itself and get the same as what we started with. No matter how many times we multiply it by itself all we get is a reproduction, a clone - more and more of the same. No other numbers behave in this way, even though we regard them as being

composed entirely/purely of ones. Two, for example makes four when multiplied by itself, implying that it is in some way more than just two ones - i.e. a *couple*, not *isolated* by but pooled *together* in space. This is known as an ‘emergent property’ of ‘two’, contrary to the linear ‘law of superposition’, which states that a function of *a* plus a function of *b* should equal the same function of *a+b*.

There is a profound inconsistency here. It is as though a one-way filter has been inserted between one and all the other numbers, as well as between progressively larger numbers, such as 2 and 3, 3 and 4 etc, when these too are treated as independent wholes isolated by rather than pooled together in space. Through the imposed closure arising from the fallacy of the excluded middle, ‘one’ has been deprived of its common space or neighbourhood in which it relates with others. ‘One’, in other words, has been de-contextualized. A world consisting entirely of independent ‘ones’ can therefore only be utterly incoherent or random unless ordered by some externally imposed force. This is the root of the fallacy that unless individuals are subjected to some form of ‘Law and Order’ imposed by a governing body, the result will be anarchy.

In this estranged, de-contextualized world of abstract singularities, only material content counts. Conventional numbers, then, are *figures isolated from their common ground*, a representation of *pure* material content, strung out along a linear scale from the very small to the very large and both positive and negative on either side of the ‘absence of presence’ known as ‘zero’. At the very small and very large ends of this scale are some very weird constructions known as infinitesimality and infinity, which make no sense at all in relation to the finite entities found elsewhere along the scale. Infinitesimality is the limit to which finite content can be subdivided, but is smaller than the smallest finite number that can be counted. Infinity is limitless content, larger than the largest finite number that can be counted. Both infinitesimality and infinity are, however, inventions made necessary to *jump the gap* of the exclusion zone constructed around ‘one’ by assuming it to be alone.

The second paradox concerns what is meant by ‘negativity’. Somehow we are always inclined to regard negativity negatively - as ‘something undesirable’ that *takes away* or *subtracts* from positive and therefore entails ‘loss’ from what otherwise might have been. This negation of negativity has produced the desire to eliminate or exclude negativity: a profound act of denial and suppression that I call ‘false positivism’. A positivism that distinguishes greater from lesser, more from less and always regards the former as better than the latter, oblivious of the *receptive* spatial context from which it has alienated itself. A cancerous or vampiric, self-cloning, material supremacy and orthodoxy, which imposes itself upon its neighbourhood in the concretely certain belief in its own perfect ‘goodness’.

But, what, really do we mean by positive and negative and is it truly better to be one and not to be the other? That is the question that reveals our double standards when we isolate space from our consideration and focus only on its material information as suitable content for our quantification. For then it really is only the material that we take into account, whilst disregarding how this material relates with the space that it inseparably includes and is included in. And it is in this one-sided accounting only for the material that our habitual notion, enshrined in conventional theories of economic ‘growth’, emerges of ‘progress’ as a process of positive acquisition along a straight path stretching inexorably towards infinity. Negativity is then seen as a kind of ‘anti-material’ influence that slows and, if ‘large’ enough, may even reverse progress along this path. Negativity in this light appears as *less than nothing*, less than zero, which cancels out positive. What on Earth could *that* mean, I remember wondering during my Primary School lessons, because it seems to make no sense at all - *something less than nothing*? And, years later, it still makes no sense to me, if used in purely material terms.

The problem here lies in that as soon as we only take account of material quantities in our summing up of the world and universe, we run headlong into the paradoxical brick wall of the ‘singularity’ or ‘completeness’ of ‘One Alone’ as a discrete unit. Something that has nothing to relate to and thereby caught up in the loop of axiomatic self-reference revealed by the Cretan Liar paradox

and Gödel's Theorem. We can't think beyond the box we have constrained our logic within and so reduce the world to a set of independent building block units that we put together and take apart as if nothing else mattered. We get 'zero'- nothing - as an absence of material presence when we subtract one of these units from another, but then how we get either of these independent units in the first place is a deep mystery. We find ourselves flipping back and forth between having something *or* nothing whilst lacking any connection between the two.

The problem resolves as soon as it is appreciated that Nature is, at root, a dynamic togetherness - not a static singularity from which negativity subtracts material content. The tangible and intangible, responsive and receptive aspects of Nature are *inseparably coupled*, with each both shaped and being shaped by the other in a universal dynamic relation of figure with ground, information with space. This inclusional appreciation implies a very different meaning for 'positive' and 'negative', so that rather than being treated in effect as 'material' and 'anti-material', they become regarded as counterbalancing potentials on either side of 'zero'. This zero is hence not a material absence, but rather a place of dynamic balancing. It is simultaneously a source and a sink where informational and spatial both zoom out and zoom in from in a loop of one with the other. It is the seat or gravitational centre of the complex self-identity that combines inner whirl with outer whirls over all scales through its dynamic boundary, like the 'eye' of a hurricane, a flow-form that cannot be abstracted from its atmospheric context.

It may help to envisage the implications of this coupled relationship more clearly by thinking of a pair of weighing scales. To each pan is added a 'weight' of exactly 1 gram. The pans remain level with one another. So in one sense we have a combined positive weight of 2 grams. But in another sense the presence of the weight on the left hand side of the scales counteracts the presence of the weight on the right hand side so that their net effect on the position of the balance beam is zero. So, we could legitimately write 1 + 1 = +1 -1 = 0, depending on how we view the situation. Here, then, positive and

negative are purely relational concepts relating to complementary reception and response on either side of a dynamic fulcrum.

The pivotal role of boundaries as dynamic, co-created, co-creative intermediary places reciprocally coupling the inner and outer callings of complex selves was effectively recognised almost two millennia ago in the T'ai Hsüan Ching of Yang Hsiung. As with 'inclusionality', the T'ai Hsüan set out to acknowledge a vital presence ('Jen') coincident with and communicatively balancing between emergent dual polarities (Ti and T'ien). These polarities were akin to the reciprocally coupled Yin and Yang of the I Ching. The latter, however, become extensible into explicitly qua-*ternary* logic through the co-creative, co-created presence of a dynamically balancing, intermediary agency, like a river bank, embodying local (inner) as an inclusion of non-local (everywhere) in a complex coupled identity.

This complex coupled identity is therefore no numerical 'singularity' or 'one aloneness'. It does correspond, however, with the 'zeroids' or 'loopholes' that lie at the heart of the wonderfully creative, literally mind-stretching 'transfigural mathematical' systems of 'fluid logic numbers' and 'zero spirals', devised by my Nigerian friend, Lere Shakunle, which I will return to later. It also relates to the contemporary ideas of 'quantum loop gravity' and self-contradictory 'dark matter' and 'dark energy' (respectively as inwardly and outwardly situated space), but these are beyond my scope for discussion here.

Chaos and Fractured Geometry.

Meanwhile, to return to non-linear equations, these *artificially* create a loophole and complex couple out of conventional numbers by containing 'negative feedback' terms as 'power functions' that disobey the linear law of superposition. These terms restrict a trend for amplification towards infinity when the equations are repeatedly iterated (i.e. when their solutions or outputs are 'fed back' as inputs to calculate a further output). In other words, these equations generally simulate the counteraction between explosion

(resulting from iteration) and implosion (due to increasing resilience to/ dissipation of further input), much as in the leaky balloon.

A well-known, relatively simple example of a non-linear equation on these lines is the 'logistic difference equation'. This equation relates the actual number of entities (x) as a proportion of the maximum possible number (1) in a current 'population' to the number of entities in the next 'generation' (x_{next}) in terms of the net rate of reproduction (*r*) per head of population as follows:

$$x_{next} = rx - rx^2$$

where x varies between zero and 1.

Here, the potential for increase in x, due to the reproductive drive, *r*, resulting from resource acquisition is countered by the negative feedback term, rx^2. When this equation is iterated (i.e. when the output x_{next} value is used repeatedly to input the next x value) from some low initial positive value, the rx^2 term increasingly inhibits the increase in x. When x is equal to $1 - 1/r$, representing the 'equilibrium population size' or 'carrying capacity' of the population, there is no further expansion.

For values of *r* between 1 and 3, the equilibrium population size ranges from zero to 2/3. The increase in x from low values either leads directly to attainment of the equilibrium value if $r<2$, or, if $r>2$ to a series of progressively smaller fluctuations (i.e. 'damped oscillations) above and below the equilibrium value. For values of $r<1$, x becomes zero.

For values of $r>3$, however, the population is driven over a threshold where it becomes unstable. Here it is unable to attain a single equilibrium state (known as a 'fixed point attractor in 'phase space'), unless arriving by some infinitesimally small chance at exactly the requisite value of $1-1/r$, and instead subdivides or 'bifurcates' into a series of alternative states. Here, as *r* is increased, x values come to oscillate around first two, then four, then eight … 2n values in a so-called 'period doubling' cascade. At $r = 3.57$, deterministic

‘chaos’ first becomes evident, as x values vary non-repetitively and at $r = 4$, all x values between 0 and 1 become possible.

Some fundamentally important conclusions can be drawn from these properties. Firstly, in counteractive systems that are ‘forced’ hard enough, long term behaviour becomes fully unpredictable (or, rather, predictably unpredictable) due to their “sensitivity to small changes in initial conditions” that become amplified by feedback. Secondly, those systems that proliferate most freely, i.e. with the highest r values, are the ones most prone to instability – to ‘boom or bust’. Thirdly, what appear to be statistically uncorrelated variables are not necessarily independent.

An understanding of how this complicated behaviour arises can be obtained by plotting the solutions generated by iterating non-linear equations on a map whose co-ordinates define the state of the system (i.e. its displacement and rate of change) in ‘phase space’. By joining the positions produced on this map by successive iterations, a kind of ‘fate path’ or ‘trajectory’ is derived, which describes how the characteristics of the system change as energy is fed through it. This trajectory can show a variety of behaviours depending on the condition, known as an ‘attractor’, towards which it is drawn. The simplest attractors are ‘fixed point’ attractors – equilibrium states that once arrived at cease to change. This is the condition for the logistic equation with $r<3$. In cases where damped oscillations occur, the trajectory spirals around before reaching the fixed point. Where the trajectory cycles repetitively around two or more values, the attractor is known as a ‘limit cycle’. Where the trajectory wanders non-repetitively, but nonetheless never exceeds certain bounds, the attractor is known as a ‘strange’, ‘chaotic’ or ‘fractal’ attractor.

Note here that the ‘chaos’ produced via the logistic equation is described as ‘deterministic’ because all the ‘initial conditions’ are fixed and there is a pre-set limit that the system cannot exceed. The system is effectively contained within a fixed boundary and its behaviour *can* be predicted with complete certainty so long as the initial conditions are known *precisely*. The fact that in reality the initial conditions can never be known precisely, and even tiny

changes in initial conditions can be amplified by feedback into huge changes in behaviour (known as ‘the butterfly effect’), makes the behaviour unpredictable in the long run. This unpredictability or uncertainty is not, however, regarded as ‘stochastic’ (i.e. due to randomness in ‘open space’) because the system is fully defined.

Notice the inconsistency here. In fact the system depends on the presence of open space because energy has to get inside from outside in order to drive the system and this energy can be dissipated through ‘negative feedback’ (expanding holes in the balloon model). Space has got in through the loophole – the supposed determinism is in the modelling assumptions using discrete numbers, not in the model itself. The non-linearity results from the inclusion of space in the gaps between 0 and 1 and 1 and 2. In fact that’s what non-linearity most fundamentally implies – the dynamic inclusion of space in universal form. And in real systems, as I described in Chapter 6, such non-linearity is primary, not a secondary product of forcing a primarily linear system.

There are three further reasons why the balloon model is both limited in itself and exposes the limitations in current non-linear mathematics.

Firstly, as already mentioned, it starts with a ‘given’ set of ‘initial conditions’ – a fixed amount of ‘material’ in the balloon’s skin, a fixed ‘holeyness’ of the skin and a fixed rate of input: in effect a self-contained, fixed set of Rules imposed for all time. The story begins in an instant with no historical or future contextual influence. But what if more material can be added to the skin as the balloon expands, or if its ‘holeyness’ can be altered as its circumstances change? We would then have a truly dynamically bounded or indeterminate system of the kind widely found in real life, like a growing fungal hypha, tree, blood vessel or nerve cell.

As an example of a real life system, let’s consider a fungal hypha growing in wood. The wall of this tube-like structure has a deformable, dome-shaped tip, which elongates as wood substance is effectively transferred from its ‘outer

space' through gaps to its inner space. Like a river eroding its way into landscape and depositing sediment, the hypha opens, closes and follows paths of least resistance (spaces) in close correspondence with its inseparable dynamic context. Branches form in this system whenever input exceeds throughput capacity to existing points of deformation on its informational boundary. These branches may form in a tributary-like pattern at or near sites of input, or in a delta-like pattern remote from these sites. Initially they are 'dendritic' (divergent from one another) and so linked 'in series', such that their internal (hydraulic) resistances to throughput (current) combine additively. But the branches can also fuse ('anastomose') when their self-created holey envelopes coincide, converting a dendritic pattern into a parallel-distributing network with hugely increased internal conductivity. Now the system can produce mushrooms, transcending its previous limitations and operating on a greatly amplified scale, like a river in flood or an erupting volcano supplied by anastomosed larva channels. We see here, then, how the variable fluidization of its boundary enables a dynamic system to *evolve*, both changing and being changed by its dynamic context and scale of operation.

The second limitation of current non-linear mathematics exposed by the balloon model, is related to the first as it concerns the problem of imposing a discrete time-scale, independent of space. This problem is implicit in the use of algebraic formulations based on an underlying system of discrete (independent) numbers. The simulated dynamics are then necessarily referenced to sequential time (hence the term 'feedback'), even though it is clear from the balloon example that the reciprocal transformations in inner and outer space, through their convex/concave dynamic interfacing, are *simultaneous*. As the surface informing inner and outer space moves in response to input or output, so *both* inner *and* outer space reconfigure.

The third limitation is that the balloon example concerns only *one* inner space, outer space and informational boundary. In reality, as far as the human imaginative eye can see, it is clear that informational boundaries are nested in many-layers, essentially in triplicate. Every inner space within an outer space

is also an outer space enveloping an inner space of smaller scale, from sub-atomic to universal.

The mutual correspondence of ever-transforming inner and outer via necessarily incomplete and hence ‘holey’ or permeable, intermediary domains, implies a fundamental dynamic geometry of Nature. This geometry extends from microcosm to macrocosm and differs radically from the hard-line abstractions of Euclid. It is primarily non-linear or curved, due to the inductive receptivity of spatial attraction, giving rise to spheres, ellipsoids, spirals and tubes.

Linear structure emerges secondarily from this geometry, as in the cylinders formed by trees or the hexagonal arrays formed in honeycombs and the regular surfaces of crystals. This natural geometry is also ‘nested’, with smaller domains contained within larger domains. The simplest form of expression of this geometry would be a set of concentric perforated spheres, but has the potential to become extremely complex

The nearest approach that conventionally fixed-framed mathematics has made to this natural fluid dynamic geometry of ‘nested holeyness’ is known as ‘fractal geometry’. This was made famous by Benoit Mandelbrot, as a way to describe structures whose boundaries, unlike Euclidean surfaces, appear progressively more complex/irregular, in ‘self-similar’ patterns, the closer they are observed. Almost anything we look at in nature from clouds, to snowflakes, to river valleys, to ferns, to trees, to lungs has this property, which makes them immeasurable in terms of discrete units of length, area and volume, because how much you see depends on how close you are. For example, the length of the coastline of the Isle of Wight seems much less to an astronaut orbiting the Earth than it does to a mite crawling around its many indentations. At infinitesimal scales of closeness, the length is infinite.

The problem of quantifying fractal structures can be solved by relinquishing the Euclidean idealization that dimensions can have only integral values of 0, 1, 2, 3, 4 etc, and allowing them also to have fractional (hence ‘fractal’)

values. The fractal dimension of a structure can be calculated from the equation:

$$M = kr^D$$

where M is the material 'content' of a portion of the structure, r is the radius of the field in which this portion of content is contained, and D is the dimension. D can readily be found from the relationship between the logarithms of M and r for different fields of view. If the structure is homogeneous, then D will have an integral value. If it is heterogeneous, D will be fractional.

The description of a 'strange' attractor also as a 'fractal' attractor relates to the fact that fractal patterns can be simulated mathematically by iterating equations in the way that I described earlier. A famous example is the 'Mandelbrot set' itself, which appeared in many guises as a colourful modern mathematical art form in the late twentieth century. This set is made by mapping the distribution of points in the 'complex plane' that do not result in infinity when iterated according to the rule, $z \rightarrow z^2 + c$, where z begins at zero and *c* is the complex number corresponding to the point being tested. Here, a 'complex number' is a number that consists of a combination of a 'real' and 'imaginary' component, the latter being a derivation of, *'i',* the square root of -1. The complex plane is formed in the space defined by placing all 'real' numbers, from -∞, through 0, to +∞ along a horizontal line, and all 'imaginary' numbers, from -∞*i*, through 0, to +∞*i*, along a vertical line, and using these Euclidean lines as co-ordinates. In effect, it represents a way of increasing the 'possibility space' for numbers as discrete entities to inhabit, from one to two dimensions.

The remarkable feature of the Mandelbrot set is the extraordinarily complex boundary that occurs between points within and points outside the set, in effect between an inner attractive space of zero and an outer attractive space of infinity. Such complex boundaries formed between neighbouring attractive spaces or 'attractors' have more generally been referred to as 'fractal basin boundaries', and are clearly at least analogous to the complex boundaries of

natural process geometry. The conventional abstract mathematical representation of such complexity, however, *begins* prescriptively with the implicit or explicit Euclidean or numerical *definition* of contents and containers as complete *wholes*, hence retaining paradoxical singularity and replacing their *simultaneous* reciprocal relationship with *sequential* 'feedback'. Natural geometry, by contrast, implies intermediary, incompletely definable realms (dynamic boundaries) through which inner and outer spatial possibilities are reciprocally and *simultaneously* coupled and transformed by one another. Endless creative possibility emerges.

Fluid Numbers and Dynamic Geometry: The Mathematics of Love.

Finding a way beyond the paradoxical restrictions of discrete numbers and fixed geometry has been the endeavour of Lere Shakunle's 'Transfigural Mathematics', which I mentioned earlier. As I have slowly come to understand it for myself, this is based on making sense of One and Many simultaneously as *both* the same *and* different, without contradiction, rather than giving rise to the nonsensical paradox that comes from one-sided abstraction. It has the following qua-*ternary* or inclusional features, which distinguish it radically from orthodox mathematics:

1. Implicit space, as a vital presence of material absence is inextricably included within, around and through the explicit linings that give dynamic form (i.e. flow-form) to distinct features or 'configurations' of all kinds.
2. This space is where 'infinity', far from being an expression of limitless material presence (content), is located as a realm of indefinite inductive potential or *'receptivity'* applied via its linings, which fold inwardly and outwardly over all scales of magnitude.
3. Spaces on either side of a lining attract in opposite/complementary directions, which can be represented as positive and negative (omega and alpha) depending on their relative situation.

4. These complementary attractions are mediated and dynamically balanced through the space of the lining itself, which hence lies at the heart of inner-outer relationship and cannot be reduced to a finite Euclidean point-centre.
5. All numerical features formed through this dynamic balancing process have both local (finite) and non-local (infinite) aspects combined via their intermediary linings.
6. Zero is the condition where complementary attractions are exactly balanced, rather than an absence of material presence (content).
7. All ‘contents’ are locally lined expressions of non-local spatial ‘context’ and cannot be separated therefrom.

This purely mathematical description correspondingly relates to the dynamic inclusion of electromagnetic field within and by gravitational field to produce dynamic flow-form. In terms of numbers, it replaces the idea of these as singular ‘units’, with that of ‘threesome-onesome couples’ of inner with outer through intermediary domains - the latter being the locations of the ‘zeroids’ or ‘self-identities’. Correspondingly, the conventional number, 2, is identified transfigurally in terms of its nearest neighbours (which it respectfully emerges from and is in the process of becoming) as ‘1,2,3’. Similarly, the conventional number, 3, is identified as ‘2,3,4’ (which includes 2).

In this way, all numbers are included together in fluid relationship, as aspects of one another, distinct, but all of the same fundamental form, unlike binary systems, where 0, 1, 2 and infinity are fundamentally different and inaccessible to or from one another. The symbol of the cross, (+) is seen as the loving inclusion of receptivity (-) with informational lining (I), so that ‘+’ and ‘-‘ no longer cancel one another out, but are like solute and solvent combined in solution, where one is an inclusion of the other. ‘I’ is transfigured through love (-). The huge mistake of false positivism has been to confuse ‘+’ with ‘I’ and so to alienate ‘-‘.

The geometry that emerges from and underlies this numerical representation is full of inwardly and outwardly flowing spirals. ‘Male’ receptive responsiveness combines with ‘female’ responsive receptivity in forming an

inner zeroid. This coupling has the form of Lennon and McCartney's phrasing: all you need is love, love, love is all you need. Perhaps this is the mathematics of love, the mathematics of the included middle that liberates us from the loveless contradiction of the excluded middle.

Including Uncertainty in Science – Reconciling the Living Light with the Loving Darkness

Just as mathematics can transform both itself and its representation of nature through the incorporation of immaterial space into its figurative forms, so science can transform its methods of investigation and understanding of evolutionary processes through the dynamic inclusion by and of darkness of and by light. In other words, science needs to question its perfectionist mathematical and philosophical assumptions so proudly enshrined by the space-excluding Enlightenment, and take account of its own findings implicit in relativity, quantum mechanics and fluid flow. Science needs to fluidize the absolute dividing line that it has drawn between subject and object, observer and observed. Thereby science can gain a more realistic view of the intrinsic uncertainties that lessen its ability to predict the future in a less perfectly objective but more perfectly evolutionary world than is currently realized.

To allow and encourage this transformation is not a sign of weakness that will lessen the influence of science in a world hungry for perfectly predictable, good behaviour that will somehow magically provide both freedom and security for all its denizens. It will be a sign of the maturing humility and honesty of science and scientists to include, reflect and communicate about the predictable unpredictability of nature in an accessible way that makes sense of our dynamic neighbourhood rather than attempts to confine it in concrete factual 'knowledge' and Laws. It will signify recognition that 'good behaviour' can never be the property of an individual, to be compared unfavourably with others that don't have it, because no individual can be independent of context. It will mark a descent from the rationalistic, 'high achiever' pedestal of perfectionism from which science has sought

imperiously to wield its authority, into the real world of the living, loving and dying. Here it can receptively and responsively take pride not in itself but in its place, helping to dissolve the grounds for human conflict and allow social, psychological and ecological understanding to grow. All that is necessary is for science to respond receptively to itself as one of its subjects and appreciate the contradiction that comes of drawing hard lines between what it is and is not.

Including Uncertainty in Language – Poetic Licence

Mocking Bird

Brick walls unite in solidarity
Or so I've heard
When their foundations
So absurd
Secured upon the very Word
That cuts their souls adrift
Feel the solvent waters
Lapping at their sound construction

I came across
One Such A Wall
Long and Straight
And Very Tall
Commanding the Waters
To Divide or Fall
And join the Ranks
Above It All

I tried to reason
Softly
With the Wall
To allow some flecks a passage
Through its façade
So that it could flex
In resonant communion
Of One World With Its Other
A mutually corresponding Identity
Incompletely defined

But my words rebounded
In mocking echo
A harshly edited reflection
Of my dejection
A judgement of scorn
Not gladly borne
Beyond
In dynamic Synthesis

I saw a bird
Bestride the Wall
Glorifying in the Sunder
Of It All

Looking first this way
Then That
Preening its coat of many colours
Calling Out
In strident language

Don't you know
You stupid Fool
That Love's reception is not cool
When this is what It is
To be or not to be
Where It's At

The bird's forked tongue
Flickered freely
As it cast its spell
Of false dichotomy
Upon the nature of its source
In all around

I heard a rumbling
Far below
Some undercurrent
Of the Flow
In swirling eddies
Round the pillars
That Underpinned
The Wall's hard lining

So that it began
To Quake
And crumple
Stirred Up
By the shaky ground

Alarmed
The bird took flight
Into the open sky
Beyond the Wall

It wheeled and spiraled
Above my head
Dancing on some unseen softness
That brought it safely back to ground

To pick its way
And feed on life released
Amongst the rubble
That once had stood
In the way of One World and Its Mother

Until I caught a glimpse of being caught
In its glassy eye's reflection
And found
At last
A sign
Of welcome

All mocking gone

Including Uncertainty in Politics, Education and Cultural Identity – From Light Supremacy to Silent Majority

Hand in hand with the honest maturation of our mathematical and scientific underpinnings, through the inclusion of space in natural dynamic geometry, can come a far more sensitive appreciation of our social, psychological and ecological circumstances, which can transform our governmental and educational practices. Instead of continually seeking to assert freedom and impose security in an effort to dictate our future prospects, we can learn to attune with our natural neighbourhood as it evolves. This means that it is OK to change our minds as our understanding grows, a practice that most politicians and educators are exceptionally fearful to follow as they seek to impose and protect their authority.

Essentially, we can allow ourselves to relax the definitions by which we have sought to control our destiny and thereby renew the possibility of receptive-responsive relationship with the world from which we have excluded ourselves like a cancer spreading through the body of its own birth. To manage this, however, will require that we let go of the fear of darkness that many of us, especially in cultures of Indo-European or Aryan origin, express in varied guises as a hugely disproportionate desire for ‘Light Supremacy’. This desire manifests as a positivistic dominance of the ‘loud minority’ over the ‘silent majority’ aspect of Nature that seems to undermine its security. It can take overtly racist, elitist and misogynistic forms, cloaked in a semblance of ‘doing good’.

I liken this fear of the unseen darkness to what a salt crystal might feel with the approach of water, seeming to threaten the solid certainty and very existence of its boundaries, whilst in reality bringing it into solution where it can relate receptively and responsively with others. Faced with the uncertain certainty of expiration from our bodily boundaries, we, many of us, can become profoundly attached to whatever barriers we can build or imagine that will ensure our absolute independence as free agencies and/or our collective security. We encapsulate our egos and neighbourhoods in survival structures and confuse this suspended animation or dormancy with real life, resenting and opposing whatever appears to threaten our solid façades. We become

obsessed with the need for completeness and closure, and reinforce this obsession with the objective logic of the excluded middle that defies connection between inside and out.

We cannot see beyond or through the false dichotomy of ‘either you are with me or you are against me’. We devize a paradoxical mathematics that treats matter as ‘something’, which counts, and space as ‘nothing’, zero. We regard ‘positive’ as ‘good’ and ‘negative’ as ‘bad’, through confusing the *receptivity* of spatial solvent with a subtraction that removes rather than vitalizes solid solute, and in this way create the paradoxical ‘double negative’ of false positivism in which two wrongs make a right. We fail to see the symbolism of the ‘plus’ or ‘cross’ sign as ‘I’, ‘ego’, transfigured with the space of loving receptivity and so made responsive to its natural neighbourhood as a vital aspect of itself.

We continue to treat ‘light’ and ‘darkness’, as discrete electromagnetic and gravitational fields rather than vital inclusions of one another in the dynamical oneness or bothness of energy-space. And we try to lock life and love outside of our dislocated individual bodily selves.

How can all this be remedied? Perhaps by individually and collectively accepting and learning to love darkness, what Carl Jung called our Shadow Archetype, recognizing that its receptivity is vital to life, love and evolutionary creativity. Only by mentally alienating ourselves from darkness and regarding it as fearful void do we imagine it to be evil and in this way terrorize ourselves.

Chapter 9

Managing Life and Environment

‘Ultimately, it is land -- and a people's relationship to land -- that is at issue in "indigenous sovereignty" struggles. To know that "sovereignty" is a legal-theological concept allows us to understand these struggles as spiritual projects, involving questions about who "we" are as beings among beings, peoples among peoples. Sovereignty arises from within a people as their unique expression of themselves as a people. It is not produced by court decrees or government grants, but by the actual ability of a people to sustain themselves in a place. This is self-determination’ - Peter d’Errico

‘It is inconceivable, that inanimate brute matter should, without the mediation of something else, which is not material, operate upon, and affect other matter without mutual contact; as it must do, if gravitation, in the sense of Epicurus, be essential and inherent in it. And this is one reason, why I desired you would not ascribe innate gravity to me. That gravity should be innate, inherent, and essential to matter, so that one body may act upon another, at a distance through a vacuum, without the mediation of anything else, by and through which their action and force may be conveyed from one to another, is to me so great an absurdity, that I believe no man who has in philosophical matters a competent faculty of thinking, can ever fall into it’ - Isaac Newton

‘This dream of domination has henceforth lost all legitimacy and persists for no other reason than our 'mental inertia'. An historical epoch has come to an end and we struggle to conjecture what is going to succeed it. Isn't the need truly well overdue for us to draw on the lessons of the past and recognize

where we now are? I would say that a problem is posed to us by allowing ourselves to remain within the framework fixed by this work: to understand the findings of 20th century science. By 'to understand' I intend this; not to constrain our understanding to the step-by-step reasoning of physics, but to be able to put these findings into the context of an interpretation of the world. From this point of view, it is necessary to recognize, in my opinion, that we have not understood (Not 'we', the specialists, but 'we' the educated public). 'Chaos' and also 'relativity' and 'quantum mechanics', for example, remain for all practical purposes impenetrable to the educated view. It is necessary, I believe, to acknowledge with Emmanuel Levinas that we are participating in the end of a certain way of understanding. Will we know how recognize this? Will we know how to discern the characteristics of another way of understanding, larger and less constraining? Therein lies another story that is in the process of unfolding'

- François Lurçat,

Inclusional Implications of the Boundless 'Fifth' Dimension: Curing Cosmic Cancer

Perhaps it was unwise of Mother Space, in her everywhere-Divine Wisdom, to enable any of her diverse local expressions to become aware of its awareness of itself. But if there is to be creativity at all, any possibility of life and evolution, maybe such possibilities must also be entertained. The trouble is that such a form of expression could develop a Mind of its Own to declare itself an independent entity and so make an enemy of its neighbourhood, setting the scene for invasion of its birthplace, determined to take over vacant possession.

Maybe it was this declaration of independence, through an ever-hardening belief in its own free will or purely internal purpose as 'first cause' of its own actions, associated with its ability to make absolute judgemental choices, that brought about the Fall of One such a form from Merciful Grace. The difficulty

lay in its *declaration*, as an abstraction of its Mind *alone*, not the *actuality* of its inescapable inclusion in interdependent relationship by and of All, space included. For, by no stretch of imagination is this form truly able to act or be acted upon as a superior or inferior object independent from its dynamic situation. It cannot be an absolute, independent singleness. Every man like every form is no more and no less than a transient island of flow, continuous through and undersea with every other, a distinct identity but never a discrete entity.

The declaration of independence was the product of a partial and idealistic vision, which led this one such form mentally to Box reality securely and paradoxically in a finite, three-dimensional Euclidean frame stretched to infinity, whilst vaunting its own free agency. By the end of the second millennium CE, life in this frame was painfully overheating. Was there no escape from the pressure cooker? What could this form *do* about it? Could this form, for so long the World's plunderer now save the World from depredation? What kind of transformation would such a noble act of rescue take? Would it be some wondrous new technology and/or legislation, of the kind that this form was so good at inventing, again and again, in the nick of time, as crisis loomed? Then there could be some great collective sigh of relief, followed by a return to die-hard habits to await the next crisis of exploitation. Or, perhaps, as one of Man's star mathematical performers suggested, it was already too late: it was now *time*, through the ultimate technological *fix* of *space* travel, to move on like a virus to other host planets, leaving the wasteland of His own vacant possession behind.

But there always was, is and evermore shall be a *loophole*: a window into and out of the solid confinements of the 'Adverse Square Law', through which the unbounded presence of space everywhere melts all into coherent, fluid dynamic relationship. An eye of the needle through which to ask not how to shift the world from a disastrous course, but how to help the world transform our sense of individual, active-reactive self-identity into receptive-responsive neighbourhood. A loophole at the intersection of Vertical ('I') with Horizontal ('-') outwardly recurving planes, to form an electrogravitational *centre of*

inference: a centre of dynamic balance in the core and spread through the surfaces of all tangible, primarily non-linear form, a zero-point source and receiver of all through all, distributed everywhere. A core of pure spatial relationship, continually reconfiguring, and hence utterly different from the fixed-point control centre of Euclidean geometry upon whose illusory existence so many principles of human governance have been founded. One place and many where apparently *opposing* sides are conjoined and transformed into complementary dynamic partners via the inclusion of light in darkness and darkness in light, in vastly unequal proportion. One place and many corresponding with the notion of 'space' as the '5th element' in Hindu philosophy, which both includes and is included in the 'melted elemental forms' of 'Earth, Air, Fire and Water': a boundless ‘fifth’ dimension transcending the three-dimensional singularity of frozen space and extraneous time.

Once ‘seen with gravitational feeling’, this boundless dimension utterly transforms and revitalizes understanding of how we may manage our lives and living space in a loving and sustainable way. Here boundaries are understood as co-creative, co-created zones of *differentiation,* mutual respect and complementarity, not severing divides between conflicting sides in opposition. It is the implications of this transformational understanding of our natural, dynamic human neighbourhood for the way we may live in harmonious, respectful, co-creative evolutionary relationship that I wish now to consider in this opening ending chapter.

The Vitality of Imperfection - From Abstract Concrete Blocks to Natural Evolutionary Neighbourhood

As may be apparent from previous chapters, I think that the notion of evolution by natural selection is an oxymoron, a paradoxical ‘concrete block evolution’. When we accept and work with this notion, we assume the role of obstructive ‘concrete blockheads’ intellectually out of touch with our feeling, receptive-responsive hearts. It is a truly compassion-killing notion, Hell-bent

on replacing natural, fluid-dynamic diversity with concrete monoculture. It is a model of *cancerous degeneration*, not co-creative innovation. Set within an abstract, 3-dimensional Euclidean frame, a cubical cubicle filled to completion with independent cubical singularities, it leads inexorably to the notion of an ideal form of individual 'unit of selection' - the 'fittest' competitor within a rigidly walled niche. This in turn gives rise to the idea of perfecting individuals by selecting out those traits that don't conform to a prescriptive set of standards - an idea that has become deeply entrenched in human educational and regulatory systems. It comes inevitably with an intolerance of those who in one way or another are judged by fixed standards to be 'not good enough' - 'imperfect' in some way. Such intolerance can lead to great cruelty and great distress as we impose rationalistic notions of perfection and imperfection upon others and ourselves in a conflict-ridden anti-culture of discontent, as I described in Chapter 1. We actively seek out, punish and attempt to eliminate whatever we find fault with, whilst glorifying what we perceive to be flawless in a culture of blame, shame, claim and gain.

Not only is this concrete block view of evolutionary perfectionism deeply distressing to those judged not good enough, but its rigidity results in the exclusion of the enormous creative possibility of bringing diverse, complementary relationships to bear as we navigate the ever-transforming world of our natural, fluid dynamic neighbourhood. It is radically *counter*-evolutionary; a bastion set against change other than its own proliferation and concomitant destruction of diversity. It makes no sense in an ever-reconfiguring, non-linear, space-including context where the evolution of one cannot be dislocated from the evolution of all, and *vice versa*.

There is therefore very good intellectual reason for feeling compassionately that what we might deem in a perfectionist framework to be a design fault in human nature, our vulnerability and proneness to 'error', which comes through the inclusion of space - darkness - in our make-up, is actually vital. It is an aspect of our nature that enables us to love and feel love and so work co-creatively in dynamic relational neighbourhood, celebrating and respecting rather than decrying our diversity of competencies and appearances.

Correspondingly I think there is a need for us to grow beyond the obsessive perfectionism that is evident in our present educational and administrative systems, governed by fixed, objective, rules, regulations and standards. There is a need to recognise that there can be no such thing as an ideal, fixed, individual form that all can aspire towards. Evolutionary perfection can only be a property of all in dynamic relationship, not one in isolation. *The exception that seeks to rule* can only create turbulence, not perfection. Our educational and administrative systems need to help us learn how to flow, by including and loving the very source of irregularity that makes us imperfect as independently performing objects but perfect as dynamic relational - receptive and responsive flow-forms. The standards that we tend to encase ourselves in need to be allowed to come alive: to flex and transform as ever-reconfiguring guide-linings in our ongoing evolution. In this way we can be naturally intelligent neighbourhoods, not artificially intelligent, concrete blockheads.

So, how can such ever-reconfiguring guide-linings be formulated and communicated through our educational and administrative systems? What kind of leadership is required? Is the very idea of leadership one of the die-hard habits that keep us stuck in concrete?

Powerboat Leadership and Sailboat Craftsmanship

There is a form of leadership that does not call for a careful, creative and reflective consideration of possibilities viewed from all angles by all concerned. Rather, it demands conformity with its own vision and specification of destination. In the absence of others' agreement, it carries on regardless with whatever *action* it has planned, convinced in its own mindset that this is the 'right *thing* to *do'*. Any leader of this ilk, whether elected by a supposedly democratic majority or not, considers him or herself to have a prerogative to do what they *know* to be best for the world, regardless of context. Moreover, by exercising their moral imperialism in the face of opposition they demonstrate the strength of their authority, a resolve that historical narrative

will, they imagine, in due course affirm and celebrate. But events often don’t exactly turn out as predicted. The real life and death situation on the ground is far more complex and non-linear than envisaged. The effects of intervention in complex situations aren't so certain in the long run. The ensuing tragedies are never more heart-rending than when a leader decides to declare war upon his neighbourhood.

This is a style that I think is all too commonly the *sole* form of leadership recognized in human organizations: a product of prescriptively definitive (rationalistic) thinking and action that places deterministic power at control centres or hubs. It amounts to what might be called *authoritarian*, *dictatorial*, *proprietorial* or, as my friend Ted Lumley puts it, *powerboat* leadership. It entails leadership towards a set destination of a fleet of individuals that have declared themselves independent of their natural situation by dint of strapping an outboard motor of technology on their backsides, which creates one Hell of a wash of collateral damage for those caught up in their turbulence. It is the kind of leadership provided by *some* so-called experts, gurus, presidents and ministers whose actions primarily serve individual self-interest, whereby an individual or elite lays down the law or 'codes of conduct' for others to follow, regardless of circumstances.

Personally, I would *hate* to provide, or be accused of providing this kind of leadership, even though I have found it to be expected of me as a professional academic responsible for initiating students and non-academics into 'good theory and practice'. There is another style of leadership, or perhaps more aptly, *craftsmanship*, that I do, however, feel more comfortable with and indeed aspire to, as a *cultivator* of creative space for myself and others to air our views and benefit from shared experience. This is what might be called *Arthurian* (after King Arthur and the Knights of the Round Table), *co-educational*, *non-proprietorial* or, as my friend Ted Lumley puts it, *sailboat* leadership. Such craftsmanship is based on learning through experience how to attune with natural processes, in a way that others can learn from. This is what I try to bring to my role as a University educator. I have found through experience that all students except those relatively *few* most fearful for their

qualifications and future prospects come to *love* and greatly appreciate this approach as a source of guidance for their creative and critical development.

Now, as the supposedly 'United Nations' of humanity contemplates its 'next steps', in the face of seemingly global environmental crisis, the question of which, if either, of these forms of leadership is wiser seems very important. Here, it is not a question necessarily of 'which is better?' in an 'either/or' sense, but how can these styles best be balanced? I accept that *pragmatically*, given the current predominantly concrete mindset of our culture, there may need to be at least some 'powerboat' leadership by way of technology and legislation to help us on our way. But I would want to ensure that it doesn't become exclusive and is balanced by a good and perhaps increasing dose of 'sailboat' leadership.

How does anyone in this situation who seeks leadership or has leadership thrust upon them, see their role? Do they see themselves as co-cultivators of creative space for wise enquiry? Does they see themselves as Directors and Proprietors of organizations? Is wise leadership something definable that we can be *instructed* about via the 'right kind of training' in a real or virtual Institution? Is wisdom perhaps identifiable with love, some indefinable presence that we can open ourselves to and co-cultivate?

I want now to explore in general rather than specifically detailed terms how different perceptions of leadership, power and geometric influence affect approaches to three kinds of life management. These respectively set out to regulate, apply and mimic living processes.

Management of Living Processes

Here I am concerned with efforts to intervene directly within the boundaries of a living system to improve, regulate or remedy its operation. As in subsequent sections, I will focus on three main kinds of themes. Firstly I will consider

whether the approach is one that imposes upon or brings out the potential of the system. Secondly I will examine whether it uses artificial contrivances or draws upon inherent pattern-generating capabilities. Thirdly I will reflect on the extent to which it seeks immediate solutions to problems without regard to possible repercussions.

Why Harness a Horse? Do we wish to impose control over the animal, to put its potentially erratic ways in check and make it do what we want? Or are we seeking a way to gain access to its horsepower, a means of communication that opens up the scope for many and varied partnerships? Our responses to these questions will hugely influence the design of any harness we might manufacture. They are worth thinking about because they indicate the attitudes we bring to any kind of management that seeks to draw power from or remedy a natural system. Ultimately putting on some kind of harness is the way that we influence the boundary properties of the system. But does this harness constrain or facilitate? Does it confine movement or does it allow freedom of movement? Does it make possible new kinds of movement? Does it impose or release pressure?

Artificial or Natural? To begin with, is the harness just referred to artificial or natural – and, indeed, what really distinguishes artificial from natural? Perhaps a good way of thinking about these questions is by reference to ourselves. Down the ages, there have been many ways in which we have sought to enhance what we can do by embellishing our basic bodies with varied forms of clothing, tools and housing. In so doing, we have greatly extended our phenotypic range. Moreover, some of us continue to entertain longings for immortality through reconstructing ourselves from a set of bionic replacement parts that dispense with the vulnerability of our flesh and blood. We might have artificial limbs, artificial hearts, artificial guts, artificial circulation fluids and digitized brains. But would we lose some vital aspect of ourselves in the process? Could there come a time when Human Being becomes pure Machine, alienated like Cybermen or Daleks from our natural context and inhabiting a world populated by biomachines of our own making?

Personally I doubt whether such a time or such a world could ever be possible because of the intrinsic limitations of non-biological materials and processes. Time and again bioengineers attempting to design an artificial heart, or suchlike, experience the problems of assembling devices that no matter how precise or intricate fail to work in the long run because of their inability to keep in tune with a changeable context. Imprecision is a vital ingredient in the attunement of living systems with their context, and it is now widely recognized, for example, that an irregular and complex heartbeat is healthy, whereas a regular, predictable one is deadly. The best substitute for a living mechanism or process may ultimately be another living mechanism or process of the same kind. It may be better in the long run to grow than to make replacement parts.

Once again, the fundamental issue here is the kind of attitude that underlies the thinking that we bring to bear on the problem. This time the question of attitude concerns the light in which we view living substance. Do we see the latter as something that needs to be replaced with something more dependable? Do we idealize it as something with mystic powers that must be good in the long run and must remain pure, uncontaminated by the human quest for knowledge and control, if it is not to turn against us? Or do we try, in all humility, to understand it both from inside out and from outside in, finding ways to relate to and augment its possibilities by merging its boundaries with the human-made?

Human beings are, after all, expressions of nature and so any things we make are also, in a sense, expressions of nature, even though we might regard them as artefacts. Would we call a snail’s shell, a beaver’s dam or a bird’s nest ‘artificial’? No. Why treat what we might make as any different? In the end it is not the question of the distinction between natural and artificial that is at issue, but rather the relationship between what is within a natural system and what the system makes of the world through transformation. Is this relationship complementary or adverse, such that one gains at the expense of the other or both lose out? Do human beings become enslaved, liberated or

rendered useless by their own constructions? Do other life forms gain or lose power through their interactions with human beings?

How about human institutions, organizations, industrial, agricultural, horticultural and arboricultural systems - how natural are they? Again, the question is not so much how natural they are, but how well attuned they are with natural fluid dynamic processes. Do they relate dynamically with the flow or do they stick out like a sore thumb or blot on the landscape? Clearly, most if not all fall into the latter category due to their walled in security, fixed point-centred design, formal structures and strictures, adversarial governance and majority-favouring bias. All in all they make splendid systems for the culture of dis-ease and energy-inefficiency.

Short term or Long Run? The idea of empowerment through fusion of the self with the self-made or indeed non-self-made is implicit in the concept of the ‘cyborg’ – that synthesis of the human and the machine that we have all become due to the now virtually seamless relationship between our selves and our accessories. It is also implicit in the very idea of interdependence between the insides and outsides of dynamically bounded systems and hence evolutionary creativity. So to attempt to ignore or prevent it is both unrealistic and to forestall our evolution. On the other hand, to think that its outcome can be fully circumscribed in advance, or that this outcome will necessarily prove to be beneficial is foolhardy in the extreme.

In an inherently unpredictable context, short-term gain may very possibly turn out to be long run pain, and vice versa. Like a marathon runner we may come to regret our initial unsustainable burst. For example, making cars, boats, trains and planes as high-powered extensions of our selves may well take us to exotic destinations, but it may also damage our environmental context and bring in its train all kinds of compulsive drives that disturb our peace and unsettle our relationships.

Faced with such uncertainty, perhaps the best we can do is to follow what has become known as ‘the precautionary principle’ and keep a weather eye open. We should neither assume that all will be fine nor indeed that all will be devastation, but rather tread carefully, continually alert to possibilities and prepared to question the outcome of our endeavours – whether we really are getting what we want or need. Do we, for example, really need to live longer and longer, thereby denying scope for rejuvenation? Do we want the things we make to last forever? What will we do with them when they have reached the end of their useful life? Is built-in obsolescence a sensible way of maintaining employment? Do we really need more food production to fill an ever-burgeoning number of mouths that increase in direct response to supply? Or, rather, do we need better quality and distribution of food to sustain the population we already have, whilst preventing those disparities that divide us into obese and malnourished? Do we need more roads to carry more vehicles over longer distances, or more effective local distribution programmes? Is it good to become locked in to the virtual reality of computer networks whilst losing sight of the real world in which we live? Are our relationships between ‘self’ and ‘other’ turning out as we might wish, or are they leading into unforeseen restrictions and misadventure?

Here, I have little personal doubt that the greatest threat to human and other quality of life comes not from attempting to manage our environment, which is quite ‘natural’ in its own way, but in the arrogance of ‘assuming control’. Sadly, this is the arrogance that has become increasingly characteristic of a kind of science and technology that alienates itself from its context by not allowing for relationship and concerns itself, like an ephemeral life form, only with the short-term exploitation of plenty. This is the arrogance that preens itself as ‘objective’ and ‘value-free’ and ‘pragmatic’, whilst casting aspersions on any attempts to be more inclusional or long-sighted. This is the arrogance that assumes it will be fine to breed and plant monocultures, apply herbicides and pesticides, remove habitats, alter growth parameters, feed sheep’s brains to cattle etc on an unprecedented scale, only to be found out by disease, malnutrition and environmental destruction. It is this arrogance that has finally, if belatedly, aroused public concern of the kind recently expressed in the

adversarial debate about the development of genetically modified organisms in which DNA is transferred, ‘unnaturally’, across species boundaries. The public is right to be concerned, if not about the technique itself then about the context in which it is being applied in a state of wilful ignorance. But to allow the alienating approach of some scientists to be a reason to alienate science, to assume that the entire scientific endeavour is tainted and should therefore be thrown out, would be to discard the baby with the bath water. There is much that is good and creative in the baby if it is nurtured in a condition of questioning awareness. But for good nurture, it is vital to grow beyond our current obsession with time scales.

When, in order to impose control, we lose sight of their deeper, contextual, flow-form nature, we render all organisms, including ourselves, clockwork automatons, driven by the abstraction of time. Our lives become frantic – a mad rush to ‘achieve’ more and more in less and less time. In our haste to get better all the time, to become more efficient survival machines, we begin dispensing with what doesn’t appear to fit with our abstract future projections. In attempting to cut costs, by excising or disregarding those needy aspects of ourselves that we deem too costly – requiring care and affection – we cost ourselves dear in the long run, forsaking what’s vital to both our individual and collective quality of life. Our lives become arid, unsustainable wastelands as we forsake the connectivity and fluidity that enables us to attune with our ever-changing living space. That is the madness of being driven by abstraction – we end up getting nowhere fast, like the demented Red Queen of ‘Alice Through the Looking Glass’ and neo-Darwinian evolutionary theory.

It all has to do with how we regard what we call 'efficiency' and can confuse this with other measures of ‘performance’ such as efficacy and productivity. When we measure efficiency in terms of speed or productivity, what we and other organisms 'do' in a fixed *time* frame, we lose sight of the *energy* cost of increasing performance. Correspondingly, we lose our compassion both for ourselves and for our neighbourhood when we rank one another as 'clockwork machines', regardless of context. Taken to extremes, we can literally kill one another and ourselves in our pursuit of the savings that we envisage to be the

basis of evolutionary fitness and social and commercial success. In the latter case we equate 'time' with that other great abstraction of space-excluding logic, 'money'. This is the essence of unsustainable life styles.

In nature, 'efficiency' is more about ‘ergonomics’ – conserving energy – than the ‘economics’ of human productivity in discrete intervals of abstract time. And conserving energy is about inner-outer attunement - correspondence of content with context. The distinction and relationship between 'time costs' and 'energy costs' is evident in the difference between a 100 m sprinter and a marathon runner. The former cuts time costs by disregarding energy costs, allowing a short high performance run, but consequently cannot sustain him or herself for the long run. The latter minimizes energy costs by attuning inner with outer context (unless you're collapsing in sweltering heat) and so has the stamina to keep going and go further and faster in the long run, which includes space.

So 'short-term’ economic management, based on cutting 'time costs' at huge energy-cost, in a high performance dash spurred on by relentless competition is grotesquely wasteful and unsustainable. We might 'get there fast' but can't stay there. A homogeneous community selectively constituted in the short term solely of high performance dashers through the discarding of those judged 'not good enough' is dysfunctional in the long run. Yet that is what our focus on time management in modern human organizations is producing. By contrast a community where there is a place for all kinds, operating and communicating over diverse functional, spatial and temporal scales, guided by the relative (but not absolute) opening up and closing down of opportunity can keep going indefinitely. If it can keep going indefinitely, there is no absolute time frame to judge the collective or individual performance of its membership within. Such is the nature of the natural communities and ecosystems of Earth's Biosphere. Such could be the nature of sustainable human communities attuned with the natural economy of conserving energy rather than obsessed solely with saving time. They could be places for compassion, work, rest and play. Places for acknowledging one another's unique idiosyncratic contributions as complex flow-form selves with inner, outer and

intermediary aspects, both in the short and in the long run that includes the space that is inseparable from time, which is inseparable from energy. Places where death feeds life rather than where we feed death with life to serve our obsession with perfecting ourselves as clockwork machines.

Managing With Nature – Putting Living Process into Practice

By their very nature, living systems can manage as well as be managed. Here, what can be done with, rather than to, living systems is contingent upon the kinds of special properties discussed in an earlier chapter regarding the example of bamboo, and how these properties are harnessed, as discussed above.

Biomaterials Depending on circumstances and type, biomaterials can have the advantages (or, from another perspective, disadvantages) of flexibility, heterogeneity, convertability, resilience, digestibility, degradability, renewability, aesthetic appeal and low environmental and economic cost of production. They are not uniformly reproducible or permanent. They are not suitable, therefore, for industries in which compatibility of components depends upon an exact match with prescriptive specifications that do not change. On the other hand biomaterials may be the appropriate wherever precision is not called for and may indeed be ineffective in the longer term, leading to inevitable deterioration of performance. In fact it might be appropriate to question how much longer precision engineering, with its attendant high production and maintenance costs and lack of margin for error, can continue to hold sway as understanding of and demand for dynamically responsive systems grows.

Bioproduction As I have said, the great thing about biological systems is that given adequate nurture, they grow. All we have to do is ensure that they get what they need and they will elaborate a wondrous array of physical and chemical forms. All that creative potential, all that sophisticated wizardry of molecular, cellular and community structure is at our fingertips, without us

having to make or assemble any of it! All we have to do is learn how to apply this creative potential to our own needs. But there comes the rub! We have to understand the relationship between their needs and ours and between what they can do and what we can do. To begin with we need to know our selves and their selves from inside-out and from outside-in. Without such knowledge, without such understanding, our relationship is liable to be superficial, unproductive and abusive. Indeed, that is how our current relationship may stand – a long way short of fulfilling its potential.

The pharmaceuticals industry illustrates the issues at stake. Following upon the long tradition of herbal remedies for ailments, the discovery of penicillin triggered an enhanced appreciation of the biosynthetic power of organisms and how this power might be harnessed for mass production. Natural product discovery became the order of the day, and much effort was invested in devising the best methods for large-scale cultivation of producer microorganisms in particular, culminating in the design of complex, submerged liquid ‘fermenters’. The latter are, in effect, large, stirred tanks containing growth medium in which conditions of aeration, nutrient supply, mineral ion content etc are precisely monitored and regulated in order to optimize production.

At first all seemed to be very well, with the success of the natural product discovery and production systems contributing in no small measure to the expansion of some pharmaceuticals companies into the multinational organizations that they are today. New products and new producer organisms were regularly discovered and cultivated.

Nowadays, however, the future for biological production of pharmaceuticals is seen by many as much more bleak and threatened by the quicker, more ‘precise’, more ‘controllable’ methods of ‘recombinant chemistry’ and purely chemical manufacture. Organisms, if they are valued at all, are used more as ‘leads’ in the discovery of biologically active compounds than as agencies for production of these compounds. Faced with the vagaries of biological production, required to be competitive in the short term, disinclined to

innovate or replace old plant with new plant, lacking a deep understanding of why, when and where organisms produce compounds and what to do about it, the industry becomes conservative. It falls back on what it thinks it already knows about.

This situation may partly have arisen because the methods for discovery and production that at first were so successful are not suitable for the vast majority of potential producer organisms. In fact these methods of ‘high throughput screening’, whereby large numbers of candidates are tested over a short time scale, and submerged liquid fermentation, which favours rapid proliferation as dispersible units rather than interconnected systems, favours organisms with ephemeral traits. Little opportunity is allowed for a candidate organism to develop and display its full range and repertoire. As in human societies dominated by short-term economics, ‘late developers’ are rejected before they’ve had a chance. A huge potential like that below the exposed tip of an iceberg languishes untapped, beyond conscious apprehension. The importance of self-integrative processes and of dynamic contextual boundaries that both create and respond to heterogeneous conditions via a complex, free-radical chemistry dependent on the balance between oxygen and fuel supply, is overlooked.

But there are more problems for the pharmaceuticals industry than those of understanding the potential and needs of producer organisms. These additional problems relate to our understanding of our selves, of our own needs, and what unexpected repercussions and ‘side-effects’ might arise from incautious use of biologically active compounds. Bitter experience has made us wise after the event, forcing us to recognize that the seemingly incisive ‘magic bullet’ of the chemically purified ‘wonder drug’ might not be as precisely targeted within the complex, fluid dynamic systems of our bodies as we might have expected. Moreover, the target can fight back through drug-resistance – in fact we encourage it to do so through the drug over-use that creates the space, the new context, for the innovative microorganism, virus or cancer cell to move in. In effect the agent of disease brings about its own evolution by eliciting a human response that changes the context. This kind of

repercussion, or co-evolutionary resonance, is in fact relevant to any human attempt to control a living, responsive system by biological or other means, and so needs to be borne very clearly in mind. The way to counter it is through cautious integration of a multiplicity of complementary approaches. Consciously or unconsciously, this has been, and may yet increasingly once again become the way of many empirically based remedies.

Biodegradation As well as being productive, biological systems also have ways of being destructive, ultimately breaking down even the most elaborate physical and chemical structures into small molecules. This destructive power is often regarded as a problem when it affects materials of practical value to people. These materials include the food we eat, the fabrics we wear, the structures we house ourselves in, the glass we see through, the machinery that we equip ourselves with and the fuel and lubricants that power and service that machinery. They also include the cosmetics that we make ourselves up with and the medicines we treat ourselves with. In fact, given appropriate conditions of moisture, temperature, aeration and nutrient supply, just about anything we use can be rendered useless by other life forms, and the economic losses resulting from such ‘biodeterioration’ are enormous. The best way of minimizing this deterioration is by prevention, through understanding the needs of the causal organisms and not allowing these needs to be met: for example if we don’t want timber to decay, we keep it dry or non-aerated.

This very same destructive power of living systems that can engender such losses when allowed to occur in an inappropriate context is, however, vital to the sustainability and rejuvenation of natural ecosystems and to our own efforts to dispose of, remedy or recycle waste or hazardous materials. Such beneficial application is termed ‘biodegradation’, and, having only recently developed much environmental concern, we are no doubt at the bottom of a very steep learning curve as to how to make best use of it beyond keeping a compost heap in our back yards. As ever, the aim should be to understand as much as possible about the context in which the needs and potential of the

degrader systems can be met. Then it may be possible to develop new or improved approaches to fertilizing soils, reducing pollution damage, revitalizing water, producing foods and medicines etc.

Following Nature - Imitating Natural Process

Look carefully enough and it is generally possible to find a biological precedent for just about any human discovery or invention. Examples range from the sonar equipment of a bat or dolphin to the magnetic compass of a migrating bird or bacterium, the microscopic hearing aid of a parasitic fly and the genetic manipulation of its host by a crown gall bacterium. It doesn't take much wit to appreciate the likelihood that there could be a great many more innovative forms of engineering to be copied from the living world – this is the growing interest of the field known as 'biomimetics'. That is, there could be if only we knew how to look for them and recognise them when we see them. Perhaps a good place to begin is simply through being aware of the problem-solving, opportunity-finding capacity of living systems, and hence to look to those systems for insight whenever we encounter a problem or opportunity.

But first, a word of caution may be necessary. It is widely considered, as a by-product of neo-Darwinian thinking, that the solutions to problems found by living systems are 'optimal', i.e. the best possible product of cost-benefit analysis. If that were so, however, life would have stopped evolving significantly long ago. But it hasn't. Life continues to change and to be changed by its dynamic context. It works within the constraints and through the opportunities opened up by the dynamically bounded watery medium in which it is expressed. So, in looking to life for insights into how to do what's 'best', it's important to realize that this 'best' may only be 'best' in the context of a specific set of boundary properties that may change. If this context-dependence is not understood, there is a danger that our search may be limited to specific, 'right or wrong' applications closed off from the possibilities embedded in the indeterminacy of living systems. Indeed it may be that it is

this indeterminacy and resultant capacity to bring about and cater for change that might be most opportune for us to emulate.

Design for Responsiveness and Resilience By emulating the capacity of life forms to vary their boundary properties of deformability, permeability and continuity according to circumstances it may be possible to increase our ability to design versatile, resilient systems that are not rendered dysfunctional or outmoded by changes in conditions.

Design for Innovation, Renovation and Efficiency By incorporating self-integrative processes, it may be possible to produce creative designs with capacities for learning, recall and efficient switchover from dissipative, assimilative structures to energy-conserving distributive and redistributive structures.

Design for Decommissioning By emulating the ways in which living systems degenerate and reconfigure we can design structures that don't become disposal problems.

Life-cycle review By taking account of all the energetic demands of a design throughout the dynamic trajectory from its inception to its decommissioning, rather than at a snapshot in time, a more inclusional picture of its environmental impact can emerge.

Epilogue 1 - Ten Characteristics of Inclusional Enquiry

1. It seeks understanding of nature and human nature and does not attempt to set these apart.

2. It is unprejudiced and hence in a sense un-objective, based on considering all available evidence from all available perspectives.

3. It recognizes the restrictive nature of any fixed, uniquely situated perspective in which an observer is distanced from the observed.

4. It does not isolate reason from emotion or give precedence to one over the other.

5. It corresponds with and is therefore not set in opposition to natural dynamic processes and geometry, thereby obviating conflict and paradox.

6. It does not, except as an analytical tool, impose an artificial rectilinear frame upon nature or regard linearity as precursive to non-linearity.

7. It does not, except as an analytical tool, deliberately exclude or ignore some vital aspect of nature for the sake of convenience.

8. It recognises that all form is a dynamic inclusion of space - not an occupier of space - and so is not definable in absolute (axiomatic) terms in an unfrozen world.

9. It recognizes that all is included in and influenced by all - content is inseparable from context at any scale.

10. It includes love.

Epilogue 2. Ten questions and answers about my understanding of 'inclusionality'

1. Alan, you've developed what many people might regard as a revolutionary way of understanding nature and human nature, especially considering where you're coming from as a biological scientist. What on Earth has possessed you to think like this?

Well, I suppose that at the very heart of my soul is a feeling that I am indeed possessed, not by some evil demon, but by the Life and Love of Nature, which I can regard both as Divine Creativity and as Evolution, Everywhere, without contradiction. Creativity is amongst us, not beyond us.

I therefore feel myself to be not apart from Nature but a fluid expression OF Nature, a flow of creative possibility - at least on a good day! This feeling brings with it an extraordinary sense of empathy for all life. I love to use and communicate this empathy in my work as a biological scientist, artist and educator as I imagine myself inside the variably extensible, permeable and transient skin of the life forms I study in order to appreciate the world from their viewpoint. I commonly ask students to ‘imagine you’re a fungus, like I often do’ and they giggle delightfully. But my request is serious as well as humorous - because I think that only through this kind of empathy is it possible to gain real depth of understanding of our natural human neighbourhood. I have found it to open up huge vistas of opportunity for new kinds of research enquiry, which, amongst other things have led me to depart radically from orthodox Darwinian explanations of biological evolution.

This feeling of possession BY Nature is very different, of course, from the desire for ownership of and dominion over Nature that has been characteristic of much human thought and ambition for thousands of years, perhaps traceable to an original Fall from Grace. Even today, as we face the potentially catastrophic implications of this desire in environmental, social and psychological crisis, we tend to ask not ‘How can we help the World to Save Us?’ but ‘How can we help ourselves to save the World?’ We, by which I mean many of us, still imagine that somehow we’re high performance automatons fully in charge of and therefore fully responsible for our own destiny, as if we’re each independently driven by some internal command

centre, regardless of our dynamic situation. That, for me, is the kind of thinking that gets us into a global mess, not what gets us out of it.

2. How can what you call ‘inclusionality’ help us out of global crisis?

First I should perhaps emphasize that you really don’t need to be incredibly clever or sophisticated academically to understand inclusionality. In fact, being too academic, as people often say that I am, can be a real obstacle to understanding and communication.

Inclusionality is in many ways a very obvious, very simple, common sense awareness, which corresponds with our everyday experience of life and our relationships with one another and the world about us. It is also consistent with modern scientific findings implicit in relativity, quantum mechanics and non-linear theory. All it amounts to in physical terms is envisaging all form as flow-form, a fluid dynamic inclusion - not an occupier - of space, which cannot be completely defined in an unfrozen world. In other words, life isn’t permanently fixed in discrete boxes and neither is love.

What proves difficult is seeing this natural simplicity through all the clutter of abstract logic, detailed information, academic scholarship, technological wizardry, financial game-playing and environmentally unsustainable activity that many of us have come to take for granted as inescapable and even desirable ingredients of modern civilization. Even more difficult is to see how this simplicity lies at the heart of the complex and unpredictable manifestations of natural dynamic geometry. It involves seeing the implicit spaceyness or holeyness of the WOOD both through and via its explicit and diverse manifestations, the TREES. This spaceyness is what may be described in various cultures and belief systems as ‘Holy Ghost’, ‘Tao’, ‘Brahman’, ‘Buddha Nature’, ‘Maasauu’, ‘Wankan-Tanka’, ‘Tirawa’ and ‘Kwoth’. It is the receptive Mother aspect of Nature, which provides possibility for creative transformation, communication and relationship. It is like the solvent, water, in a solution of salt. When the solvent is removed, the solute, salt, remains as a dry precipitate.

The rationalistic logic upon which modern civilization has largely been founded has had the effect of removing the solvent Spirit from the solution of Nature, by isolating matter from space and regarding the latter as ‘nothing’, an immaterial emptiness devoid of meaning. What is abstracted by this logic is the desiccated material objects that many of us imagine is ‘all there is’ to life and our individual, independent, free-willed selves, deprived of the receptive solvent that pools us together in co-creative relationship. No wonder we find ourselves leading deeply de-spirited, conflicted and paradoxical lives, utterly unable to understand or heal the damage that we inflict upon one another and our living space.

So, to put it very briefly, inclusionality can help by restoring loving receptive spirit to our lives. Hence we can dissolve and overturn the very basis for human hubris and enmity that resides in the either/or logic of opposition, and work empathically - receptively and responsively rather than actively and reactively - together on a programme of renewal, undistracted by the compulsion to conflict amongst ourselves. Just imagine the possibilities of investing the resources that we currently allocate to war and counter-terror, instead to the restoration of our natural neighbourhood!

3. Many people might think that your talk of empathy, shared responsibility and possession BY Nature is foolhardy talk, the kind of irrationally subjective, sentimental projection of human feelings onto Nature that objective reasoning and the Scientific Revolution helped us to escape from. Couldn’t the acceptance of inclusionality make a drama out of a crisis and knock us back into the Stone Age, if not Oblivion?

Well, I have to say that what I think really is foolhardy is to delude ourselves into thinking that we have more control over our destiny and ability to predict the future than is realistic in a complex, ever-changing world without fixed boundaries. This delusion is a product of objectivity, not subjectivity. It comes from thinking that nature is divisible into fully definable material units that can

be singled out from one another, measured and counted out of the context of their natural, fluid dynamic relationships. The naturalist poet, William Wordsworth, recognised this delusion when in challenge to Erasmus Darwin - Charles Darwin's grandfather - he said that 'in nature everything is distinct, yet nothing defined into absolute, independent singleness'. Sadly, however, the significance of this challenge seemingly went unrecognized. And so the delusion that 'life is a struggle for existence amongst absolute, independent singlenesses, in which winners and losers are discriminated through the external force of natural selection' became deeply entrenched in the modern mind. It was an easy concept for this mind to grasp, enthralled as it already was by Isaac Newton's mechanical Laws of Motion based on the logic of the excluded middle, rooted in Aristotle's philosophy, whereby everything either is or is not.

This 'to be or not to be', 'something or nothing' logic, which leads us 'to take arms against a sea of troubles and by opposing end them' is, I think, at the root of human conflict and human tragedy, as Shakespeare's Hamlet might testify. It makes us think more simplistically, not more simply, about natural dynamics - in effect to collapse the natural world of relational flow-form into a concrete world of fixed form securely contained within the 3-dimensional Box of Euclid's abstract geometry of widthless lines and depthless planes. This simplistically straightforward way of thinking cannot adequately represent what it means to inhabit, as we do, the ever-transforming curved surface of a more or less spherical Earth, which in turn inhabits the curved energy-space of the Universe. But we, many of us, continue to act as though it does, whilst using profoundly inadequate mathematical, scientific and philosophical tools of enquiry. And so, in many ways, we force ourselves to bear the suffering that comes from alienation, living out our lives within a concretely constructed reality that we impose brutally upon the fluid geometry of Nature. I think we can escape this alienation by allowing ourselves to develop and express a more empathic, inclusional understanding of our natural neighbourhood.

But here I must emphasize that the kind of empathy I am talking about is very different from the kind of subjective sentimentality and projection of human

emotions that some may imagine. It is about imaginatively letting go of our individual and collective human agendas in order to experience how it feels to be in the place of another. Of course, what we imagine may be quite inappropriate, but as long as we're aware of and ready to experiment with this possibility, what opens up is a much greater receptivity to others. I see this receptivity or openness as what has been largely ignored or even rejected by objective logic. I see it as no more and no less than Love.

So, no, I don't think that the restoration of life and love to our forms of reasoning and enquiry will deliver us back to the Stone Age. I think it will liberate us from the Concrete Age. I think it is vital.

4. Is inclusionality your own idea and have you found that many people agree with you?

No and not yet.

It couldn't be my own idea, because proprietorship is the first notion to dissolve when we accept ourselves as expressions, not owners of Nature. I express inclusionality: she's not my baby - if anything I'm hers. Moreover, there are many mystics, shamans, sages and prophets, even a few philosophers and scientists, who I think have endeavoured to express something similar, although their efforts have generally been ignored, misunderstood, rejected or rationalized. And I didn't develop and couldn't have developed the idea of inclusionality in isolation – my form of expression of this awareness emerged in co-creative conversation with a small sharing circle of others, most notably my friend and regular correspondent, Ted Lumley. Where there is originality in my expression, this arises from my uniquely situated identity as a local inclusion of everywhere, what I call a 'complex self' with inner, outer and intermediary aspects, like a river system whose stream both shapes and is shaped by landscape through its shifting banks and valley sides. This originality includes the label – nothing more, nothing less – of 'inclusionality', which I made up with others' prompting and

acceptance, as an indicator of departure from the division of nature into factions and fractions implicit in the word ‘rationality’.

I have encountered much opposition to and incomprehension of my expression of inclusionality, which has obstructed my ability to communicate with a wide audience. Nonetheless there are some encouraging signs of a gathering momentum. In spite of several efforts to close me down, I have managed to run a final year undergraduate course about inclusionality, called ‘Life, Environment and People’, for six years, to growing numbers of biology, natural science, psychology and management students at the University of Bath. The course includes an invitation to use of artwork to express and challenge scientific ideas in a critical and creative way. With few exceptions, the students have loved and deeply understood it, finding it to have a transforming influence on their lives and career choices. I am beginning to get papers published in journals and books, and have written or almost written two books of my own, not yet properly published. Four PhD theses based on inclusionality have now been accepted in the University of Bath. I have found great receptivity for inclusional thinking in an international educational movement inspired by my colleague, Jack Whitehead’s ‘Living Action Research Theory’.

5. If you admit that inclusional thinkers are in a tiny minority at this time, an exception to the rule, isn’t it too much, even rather arrogant, to expect people to follow you? Aren’t you yourself too exceptional or eccentric a kind of person to make sense to the common man?

Actually, I am no exception to the rule that everyone’s personal situation and life experience is exceptional because no one can inhabit exactly the same locality and so view the world in exactly the same way as any other. What seems to be unusual is my recognition that this exceptionality is not only what shapes the uniqueness of my individual view, but also what all of us have in common, the source of difference or distinct identity through which we can evolve together in a spirit of co-creative neighbourhood.

For many people these differences appear to be what gets in the way of our community feeling, making them feel obliged to conform with some single, objective view of truth that all can be led by and compete to express in spite of their subjectivity. But this pressure to conform can actually be a source of the great over-simplification that devalues our individual experiences and diminishes our ability to contribute to the common good. We miss out on the sense of belonging that comes with love and respect for our differences and in our distress strive instead to join one group or another in which we pretend to be all the same whilst discriminating between ‘you’ and ‘me’, ‘us’ and ‘them’ and ‘here’ and ‘there’. We divide ourselves up into warring factions rather than loving partners cognizant of one another’s unique and complementary perspectives.

What the way of thinking that I am expressing offers to the common man is the liberty to be uncommon, indeed exceptional, and through that exceptionality discover what we really have in common with one another and nature. At the very heart of inclusionality is an awareness of exceptionality and how by pooling exceptionalities together we make exceptional teams and communities, capable of highly innovative solutions to problems through our co-creative agreement to differ. Sooner or later, I feel this awareness has to catch on, so that we can become a majority of non-conformists working together through love and respect for what both distinguishes and unites us in both individual and collective enterprise.

As to the question of whether I expect people to follow me, the short answer is no, but I hope people may be inspired by and able to learn from my mistakes and accomplishments. I merely want to express my understanding as well as I can and offer this to others in a spirit of common passion.

But this question does allow me to make a distinction between rationalistic and inclusional ways of providing guidance to or for others. Rationalistic leadership is based on the imposition of powerful authority and is the predominant form of human governance that we see today, arising from the logic of opposition. It cannot provide true democracy in the sense of

governance for all by all. Rule by elites, even elites elected by majorities, are forms of oppression, not democracy. Inclusional craftsmanship, by contrast, is about the acquisition and communication of skillful practice through learning and creativity within the context of natural neighbourhood as a true democracy, where every learner is simultaneously an educator and vice versa through shared experience. Such opening up of creative possibility for one another is what I like to participate in.

6. Is there anything unusual in your personal background or life experience that has led you to inclusionality?

I guess my story emerged from my early childhood in Africa. During this phase of my life, when I didn't go to school much and roamed a large semi-wild garden full of delights and dangers, I developed an intense love and respect for the natural world. And I saw my humanity as being OF this world, not apart from it.

When, back in Britain, I did eventually attend school and university, the disparity between what I found myself expected to learn and what I felt from my childhood experience could not have been more strident. I sensed a terrible collision between my compassionate feelings and the dogmatic views of human and non-human nature that I was being presented with in science, mathematics, history and religious education lessons. I remember coming home from school one day and writing, 'the world has cancer and the cancer cell is man', an indication of my dismay about the imperialistic thinking of what I sometimes call 'the Vampire Archetype', which declares independence from its host space whilst draining it of vitality.

This collision led to a deep internal conflict between my head, which wanted to excel intellectually and conform with the expectations of my family and peer group, and my heart, which wanted simply to live, love and be loved. Eventually it led to breakdown - or breakthrough - when at what many regard as the zenith of my academic career. I was diagnosed with the quality known

as ‘obsessive-compulsive disorder’ (OCD), for which the standard treatment is ‘anti-empathy’ drugs like Prozac and cognitive behavioural therapy (CBT). This lifelong quality - I refuse to call it a disorder, unless it be openly creative disorder - has led me to search desperately for a kind of understanding that would dissolve what I sometimes call ‘the clot between head and heart’ by including love in logic: in other words, inclusionality.

7. *What would a world of inclusional thinkers look like – would there be less pain and nastiness – for you can’t deny that Nature can be nastily violent as well as lovingly receptive, can you?*

It might not LOOK very different from what we see today, although I suspect there would be less intrusive architecture, agriculture and industry and fewer centres of over-population. But I’m sure it would FEEL different - far more supportive, forgiving, companionable, encouraging and above all, FAR MORE RELAXED, pleasurable and joyful.

That is not to say that there would be *no* suffering, but rather a far greater *resilience* in our ability both individually and collectively to withstand and grow in creative depth of understanding *through* suffering. Suffering is altogether much harder to bear in an uncompassionate society, intent on competitive performance and finding, blaming, punishing and eliminating whatever it views as not good enough, regardless of the fact that no form or behaviour can be independent of the cultural context in which it is expressed. Also, to be empathic and aware of one’s frailties in such a society is liable to be deeply painful and unsettling. It’s sure to have us rushing for whatever anti-empathy device or pretence we can find by way of serotonin re-uptake inhibitors, positive thinking, behavioural therapy and a multitude of addictions, obsessions and compulsions.

Undoubtedly there are violent, destructive and aggressive aspects of Nature, but to view these as a sea of troubles that *opposes* us and must be defeated rather than navigated or calmed can only aggravate nastiness. We end up in vicious cycles, fighting fear with fear, anger with anger, rather than finding

creative ways to transform our situation, recognizing that what we perceive as fearful may also be vital to evolutionary process and loving receptivity. Loving receptive-responsiveness does not defy or deny nastiness; it transforms it through understanding where it comes from.

8. *What's stopping us from accepting our inclusional nature and how can this be remedied?*

Most fundamentally, I suspect it's the fear of darkness. I liken this to the fear of the unseen, mysterious solvent that a solute might feel as the solid certainty of its boundaries are loosened and seemingly threatened with annihilation.

Faced with the uncertain certainty of expiration from our bodily boundaries, we, many of us, can become profoundly attached to whatever barriers we can build or imagine that will ensure our absolute independence as free agencies and/or collective security. We encapsulate our egos in survival structures and confuse this suspended animation or dormancy with real life, resenting and opposing whatever appears to threaten our solid façades. We become obsessed with the need for completeness and closure, and reinforce this obsession with the objective logic of the excluded middle that defies connection between inside and out.

We cannot see beyond or through the false dichotomy of 'either you are with me or you are against me'. We devize a paradoxical mathematics, which treats matter as 'something', which counts, and space as 'nothing', which counts as zero. We regard 'positive' as 'good' and 'negative' as 'bad', through confusing the *receptivity* of spatial solvent with a subtractivity that removes rather than vitalizes solid solute, and in this way create the paradoxical 'double negative' of false positivism. We fail to see the symbolism of the 'plus' or 'cross' sign as 'I', 'ego', transfigured with the space of loving receptivity and so made responsive to its natural neighbourhood as a vital aspect of itself. Hence 'positive' could be regarded as a dynamic inclusion of, not an abstraction from space.

We continue to treat ‘light’ and ‘darkness’, as discrete electromagnetic and gravitational fields rather than vital inclusions of one another in the dynamical oneness or bothness of energy-space. And we try to lock life and love outside of our dislocated individual bodily selves.

How can all this be remedied? Perhaps by accepting and learning to love darkness, what Carl Jung called our Shadow Archetype, recognizing that its receptivity is vital to life, love and evolutionary creativity. Only by mentally alienating ourselves from darkness and regarding it as fearful void do we imagine it to be evil and in this way terrorize ourselves.

9. Are you calling for a revolution?

Yes, but not in the mechanical sense of the turning of a wheel or the overturning and *replacement* of one form of governance or understanding by another. I am calling for a revolution in the sense of a re-evolution, an evolution that includes loving *re*ceptivity in its thinking and framing of reality. I am calling for a *transformation* from the solid fixtures and oppositions of the logic of the excluded middle, to the fluid dynamic receptive-responsiveness of the logic of the included middle, with space incorporated. I feel this transformation is vital if we are to bring our sense of human place in Nature back into more realistic proportion and navigate the psychological, social and environmental troubles that we have made for ourselves through fearfully disregarding the enormity of our immaterial aspect.

10 Where can the re-evolution begin?

Here and now! In fact I might question whether a revolution really can have a beginning, for that idea is itself based on a linear view of history referenced to an abstract time frame. But perhaps, for now, that’s another story to be explored in far more depth than is possible here.

Meanwhile, let's liberate our minds from the mechanistic, confrontational and competitive thinking that binds us in old patterns of being, thinking and acting. Let's transform our scientific, mathematical, artistic, philosophical, governmental, social, religious and educational practices so as to be more attuned with one another and the re-cycling processes of Nature. Let's recall what Leonardo Da Vinci once said: 'Human subtlety will never devise an invention more beautiful, more simple or more direct than does Nature, because in her inventions, nothing is lacking and nothing is superfluous.'

Let's accept our transient no thingness and work imaginatively, common-spiritedly and respectfully together within our natural neighbourhood as our flow-forms emerge and subside!

We might just transform global crisis into a story with a happy non-ending!

Further Reading?

Perhaps, for all that I may talk about my feeling and intellectual comprehension of belonging in the natural community of others I have always been more of a goat than a sheep. This is my paradoxical position in a conformist culture dominated by the view that we are all individuals. Like the non-conformist character at the back of the crowd in Monty Python's 'Life of Brian', I have to stand up and shout, 'no we're not!' For better or worse, and with all due respect, none of my work, not least this book, has ever been intended simply to provide another brick in the wall of academic knowledge, constructed upon the secure concrete foundations of others' enterprise and scholarly exposition and assumptions. I have never been able to work in that way. Rather, I have always felt more comfortable in trying to make sense of my personal observations and experience without placing too much *initial* reliance on others' findings or expectations. I find this is the only way that I can truly appreciate, both creatively and critically, what others express, through finding points in common and points in contrast with my personal experience and understanding. Perhaps it is the only way of true discovery

and rediscovery, without getting bogged down in small print, or perhaps it is just my way. But I have also often found it a troublesome, difficult and lonely way, inviting accusations of arrogance, ignorance and re-inventing the wheel, especially when challenged to cite chapter and verse concerning my 'sources'. I prefer conversation to reading and don't readily recall who has said what, when and where, as I seek neither to find nor claim authority: besides the scholarly literature is stuffed with contradictions. I seek only to share my observations and sense-making in *communion* with others.

What this all means, of course, is that when it comes to providing bibliography or 'further reading', I generally find myself at a loss. Do I provide a great mountain of indigestible material or a resounding echo of emptiness? Do I, in citing any particular work, appear to support its authority, even though I may disagree with it profoundly?

So, here are just a *few* works that I have enjoyed or found challenging in one way or another, as I have worked with the ideas and information described in this book.

P. Ball (1999) *H_2O A Biography of Water.* London: Weidenfeld & Nicolson

D. Boyle (2000). *The Tyranny of Numbers – Why Counting Can't Make Us Happy.* London: Harper Collins.

S. Kumar (2002) You Are Therefore I Am – A Declaration of Dependence. Green Books.

C. Landry (2000*) The Creative City.* Comedia, Earthscan.

W. Pryor (2003) *The Survival of the Coolest.* Bath: Clear Press

R. Spowers (2002) *Rising Tides*. Edinburgh: Canongate Books.

C. Spretnak (1999). *The Resurgence of the Real: Body, Nature and Place in a Hypermodern World*. New York: Routledge.

D. Suzuki with Amanda McConnell (1999) *The Sacred Balance – Rediscovering Our Place in Nature.* Bantam Books

S. Taylor (2005). *The Fall*. Winchester, UK, New York, USA: O Books