A RECURSIVE VISION

Ecological Understanding and Gregory Bateson

PETER HARRIES-JONES

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Gregory Bateson was one of the most original social scientists of this century. He is widely known as author of key ideas used in family therapy – including the well-known condition called 'double-bind.' He was also one of the most influential figures in cultural anthropology. In the decade before his death in 1980, Bateson turned towards a consideration of ecology. Standard ecology concentrates on an ecosystem's biomass and on energy budgets supporting life. Bateson came to the conclusion that understanding ecological organization requires a complete switch in scientific perspective. He reasoned that ecological phenomena must be explained primarily through patterns of information and that only through perceiving these informational patterns will we uncover the elusive unity, or integration, of ecosystems.

Bateson believed that relying upon the materialist framework of knowledge dominant in ecological science will deepen errors of interpretation and, in the end, promote eco-crisis. He saw recursive patterns of communication as the basis of order in both natural and human domains. He conducted his investigation first in small-scale social settings; then among octopuses, otters, and dolphins. Later he took these investigations to the broader setting of evolutionary analysis and developed a framework of thinking he called 'an ecology of mind.' Finally, his inquiry included an ecology of mind in ecological settings – a recursive epistemology.

This is the first study of the whole range of Bateson's ecological thought – a comprehensive presentation of Bateson's matrix of ideas. Drawing on unpublished letters and papers, Harries-Jones clarifies themes scattered throughout Bateson's writings, revealing the conceptual consistency inherent in Bateson's position, and elaborating ways in which he pioneered aspects of late twentieth-century thought.

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Contents

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A long time ago, Paul Buckley, then head of the program *Ideas* of the Canadian Broadcasting Corporation, interviewed Gregory Bateson and, following the interview, planted a seed in my mind. More recently, I am grateful to Mary Catherine Bateson for initial support in this enterprise and for permission both to consult the Bateson archives and to publish material from them. Rodney Donaldson, Gregory Bateson's archivist, has also shared his ideas, given his full encouragement, and provided invaluable aid in giving context to Bateson's publications. He also generously shared – before publication – the contents of his edition of Bateson's later essays, *A Sacred Unity: Further Steps to an Ecology of Mind,* and the bibliography therein.

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Medow of the Department of Economics, York University, and L'Institut de la Vie, Paris, for inviting me to various conferences and giving me an opportunity to share my thoughts on Bateson's work. Each conference proved to be a valuable source of ideas. Peter Timmerman of the International Federation of Institutes for Advanced Studies, Toronto, undertook a critical reading of the first part of the manuscript and made a series of well-taken comments. Thanks, too, to the readers for University of Toronto Press for further suggestions.

My special thanks to Howard and Carol Robertson of Santa Cruz for friendship and wonderful hospitality, which made research visits to the university library in Santa Cruz a great pleasure. And my very special thanks to my wife, Rosalind Gill, as academic companion, for a variety of valuable suggestions in drafting, editing, and making the book more readable, and for unwavering emotional support throughout a long (too long?) project. It is to R.M.G. that I dedicate this book.

A Brief Biographical Chronology of Gregory Bateson

9 May 1904
born, Grantchester, Cambridgeshire, England; son of William Bateson (b. 8 Aug. 1861) and Caroline Beatrice Bateson (b. 1870?)

1913–17
preparatory school at Warden House, Deal, Kent

1917–21
public school at Charterhouse, Godalming, Surrey

1922–6
Cambridge University. Natural science tripos, 1924; anthropological tripos, 1926, under A.C. Haddon

8 Feb. 1926
death of William Bateson (father)

1927–30
anthropological fieldwork among the Baining and Sulka of New Britain and among the Iatmul of New Guinea, where he first meets Margaret Mead

1930
M.A. in anthropology

Adapted from Rodney E. Donaldson, *Gregory Bateson Archive: A Guide/Catalog*, 4 vols. (Ann Arbor, Mich.: University Microfilms International Dissertation Information Service, 1987), 1:5–9

1931–7
research fellow, St John's College, Cambridge. Works on *Naven*, which is published in 1936

1936–8
anthropological fieldwork with Margaret Mead in Bali. Marries Margaret Mead (b. 16 Dec. 1901) on 13 March 1936

8 Dec. 1939
birth of daughter, Mary Catherine Bateson

1940–2
work for the Committee for National Morale (later the Institute for Intercultural Studies, New York City)

1942–3
film analyst, Museum of Modern Art, New York

1943–5
staff planner and regional specialist for Southeast Asia, U.S. Office of Strategic Services (overseas in Ceylon, India, Burma, China)

1946–8
attends first Macy conferences on feedback mechanisms and circular causal systems in biological and social sciences; visiting professor of anthropology, New School for Social Research (New York City) and Harvard University

1948–9
research associate with Dr Jurgen Ruesch at the Langley Porter Clinic, University of California Medical School, San Francisco

1949–63
ethnologist, Veterans Administration Hospital, Palo Alto, California

1950
divorces Margaret Mead and marries Elizabeth Sumner

1951
birth of son, John Bateson

1954–9
director, research project on schizophrenic communication under a grant from the Josiah Macy, Jr, Foundation

1957
divorces Elizabeth Sumner

1961
marries Lois Cammack

1963–4
associate director, Communications Institute, St Thomas, Virgin Islands, working with John Lilly on dolphin communication

1965–72
associate director, Oceanic Institute, Waimanalo, Hawaii, and part-time visiting professor, University of Hawaii. Begins formal work on ecosystems as an extension of his notion of 'ecology of mind'

13 April 1969
birth of daughter, Nora Bateson

1972
publication of *Steps to an Ecology of Mind*

1972–8
visiting senior lecturer (part-time in Department of Anthropology), University of California, Santa Cruz

1976
appointed to the Board of Regents of the University of California

1978–80
scholar-in-residence, Esalen Institute, where he works on a manuscript entitled 'Where Angels Fear to Tread'

1979
publication of *Mind and Nature: A Necessary Unity*

4 July 1980
dies, Zen Center, San Francisco, California

A Note on Reference Style

The reference style in both text and endnotes has been selected to correspond as closely as possible to that of Rodney Donaldson in his bibliography of Gregory Bateson's work published at the end of *A Sacred Unity* (Bateson 1991: 314–36) and to the record management system used by Donaldson in his *Gregory Bateson Archive: A Guide/Catalog* (Donaldson 1987), published by University Microfilms International. It is as follows:

PUBLISHED BOOKS AND JOURNAL ARTICLES

A. Citations of books and articles by authors other than Bateson are treated in the normal manner and refer to section 2 of the Select Bibliography at the end of the book. Viz. (Cherry 1966: 129) refers to: Cherry, Colin. 1966. *On Human Communication*. Cambridge, Mass.: MIT Press.

B. Some books of which Gregory Bateson is author or co-author, or others in which Bateson's ideas are a central component, are referred to in the text many times, so that I have cited them by using an abbreviated title, publication date, and page reference; viz: (*Steps* 1972: 449). The following books are treated in this manner:

Communication: The Social Matrix of Psychiatry. (*Communication.*) By J. Ruesch and G. Bateson, New York, Norton, 1951

Naven: A Survey of Problems Suggested by a Composite Picture of the Culture of a New Guinea Tribe Drawn from Three Points of View. (*Naven.*) 2d. ed. Stanford: Stanford University Press, 1958 (first edition, 1936)

Pragmatics of Human Communication. (*Pragmatics.*) By Paul Watzlawick, J. Beavan, and D. Jackson. New York: W.W. Norton, 1967

Our Own Metaphor. (*Metaphor.*) By M.C. Bateson. 2d. ed. New York: Alfred Knopf, 1972

Steps to an Ecology of Mind: Collected Essays in Anthropology, Psychiatry, Evolution and Epistemology. (*Steps.*) New York: Ballantine Books, 1972

Mind and Nature: A Necessary Unity. (*Mind.*) New York: E.P. Dutton, 1979

With a Daughter's Eye: A Memoir of Margaret Mead and Gregory Bateson. (*Daughter's.*) By M.C. Bateson. New York: William Morrow and Co., 1984

Angels Fear: Towards an Epistemology of the Sacred. (*Angels.*) By G. Bateson and M.C. Bateson. New York: Macmillan, 1987

A Sacred Unity: Further Steps to an Ecology of Mind. (*Sacred.*) Ed. Rodney Donaldson. New York: Harper Collins, 1991

C. Journal articles by Gregory Bateson are correlated with the 'Bibliography of the Published Work of Gregory Bateson,' by Rodney Donaldson, in *A Sacred Unity* (1991: 314–36). References appear as follows: (GB, 1978g[i]: 60) to represent: 1978g(i). 'The Birth of a Matrix, or Double Bind and Epistemology.' In *Beyond the Double Bind: Communication and Family Systems, Theories, and Techniques with Schizophrenics.* Ed. Milton Berger. New York: Brunner/Mazel, pp. 39–64.

Published articles by Bateson cited in this book are listed in section 1 of the Select Bibliography.

UNPUBLISHED SOURCES

The four types of unpublished sources used in this book are drawn from the Gregory Bateson archive in the special collections section of the library of the University of California, Santa Cruz. A fuller description of these sources is given in section 3 of the Select Bibliography. They are as follows:

i. Correspondence: (Letters, 1068–2a/1966) indicates (Letters, file no. – page no./year).

ii. Complete articles file: ('Four Lectures,' CAF 126–B1/1955) indicates (Short title of article, CAF no. – page no./year).

iii. Manuscripts: These are of three sorts. (Bk. Mss., box 6; 1987: 206.6) indicates the number of the book manuscript files, together with the page and the line number of volume 1 of Rodney Donaldson's *Gregory Bateson Archive: A Guide/Catalog* (Donaldson 1987). (Misc. Mss., box 5; 1987: 270) indicates the box number of the miscellaneous manuscripts files, together with the page number in Donaldson's 1987 catalogue of the Bateson archive. Third, the unedited version of *Angels Fear,* the version worked on by Gregory Bateson before his death and later returned to the Bateson archive by Mary Catherine Bateson after publication of the book, appears as (*Angels* UE no. 1). Each item cited from the unedited version is more fully described in section 3d of the Select Bibliography.

iv. Notebooks: (Notebook 39/1967) indicates (Notebook no./year). There were no pagination numbers in the notebooks at the time the material was consulted.

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A RECURSIVE VISION: ECOLOGICAL UNDERSTANDING AND GREGORY BATESON

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Introduction

Ideas, like natural species, can become extinct. How best can we create a science of nature that takes our new sense of ecological impermanence into account? We live in a world desperate to discover a set of rules from which we can derive principles about the environment, and relations between human activity and environment, yet the holistic perspectives we require seem to elude us. This book interleaves three themes: the ideas of the most brilliant holistic scientist of this century; his notions of pattern in recursive, non-linear systems; and the perspective he brings to our ecological predicament.

A few years ago, a discussion of Gregory Bateson's intellectual development, recursion, and ecology would have been a matter of illuminating the obscure by the obscure. Happily this is no longer the case. In recent years there have been a number of books which give context to each theme and explore their overlapping references. Broadly speaking, recursion concerns the way in which events continually enter into, become entangled with, and then re-enter the universe they describe.[1] The layperson interested in recursion and how it emerged from new techniques in science can consult James Gleick's *Chaos: Making of a New Science.* Gleick mentions Gregory Bateson and acknowledges the special role of ecologists in the development of chaos theory as a new science. Yet Bateson is only an afterthought in Gleick's book (Gleick 1987: 243).[2]

David Lipset and Bateson's daughter, Mary Catherine Bateson, have both published biographies which display an extraordinary sensitivity to the relation between Bateson's personal life and the development of his cybernetic ideas (Lipset 1980; M.C. Bateson 1984). Neither biography develops extensively the 'unnamed new science' which Bateson also called an 'ecological epistemology' or 'recursive epistemology.' His writing on this unnamed science was published posthumously. Part of Bateson's thinking about a recursive (ecological) epistemology is published in *Angels Fear* (1987), a book he co-authored with Mary Catherine. Even here much of his argument is implicit. In order to explicate the complexity of his ideas, a review of letters, tapes, and other more formal talks that he gave at the time is required. Several of the formal talks have recently been published in a volume of essays, *A Sacred Unity: Further Steps to an Ecology of Mind* (1991), edited by Rodney Donaldson. Donaldson, who is also Gregory Bateson's archivist, recognizes the importance of this unnamed science by devoting a whole section of *A Sacred Unity* to 'ecological epistemology.'

Another account of Bateson's ideas appears in Morris Berman's *The Re-enchantment of the World* (1984). Berman only had access to published material and wrote before the appearance of two posthumous publications.[3] It will become evident that I dispute Berman's thesis of 're-enchantment' as the central metaphor of Bateson's ecological epistemology and seek to replace it with the notion of recursion. 'Re-enchantment' draws Bateson far too close to the New Age perspectives of environmentalism. Three other important sources on Bateson and recursion are Carol Wilder and John Weakland's *Rigor and Imagination* (1981), Anthony Wilden's *The Rules Are No Game: The Strategy of Communication* (1987), and Brad Keeney's *Aesthetics of Change* (1983).[4]

This book will elaborate Bateson's recursive epistemology in the way that the others have not. I have called this book 'a recursive vision' because Bateson believed that recursion requires, in addition to cognitive understanding, a perceptual and aesthetic 'space' for its interpretation. I attempt to explicate why Bateson's vision emulates a set of ideas about consciousness and also about order in living systems. The larger argument is that the explanatory space of recursion – in Bateson's sense of that phrase – is necessary to any ecological perspective and hence to our own survival.[5]

BATESON AND THE ENVIRONMENT

Modern environmentalists have generally ignored Bateson, but the more environmentalists are forced to move from short-term cost-benefit approaches in Green Plans and to look for an epistemology that justifies planning in the first instance, the more they will return, inevitably, to Bateson. The need to engender well thought out ideas about global ecology requires, in turn, a need for rigorous thinking about interconnection and interdependencies in ecosystems for only with such an understanding can we resolve our massive ecological dilemmas. Bateson's specific contacts with environmentalists were through the counter-culture of the late 1960s. These preceded the more recent formation of environmental advocacy groups, such as Greenpeace, Friends of the Earth, or the radical Earth First! Bateson's reaction to the political aims of the counter-culture movement is part of the story to be told. Nevertheless, with the demise of the counter-culture, Bateson lost influence among environmentalists as a significant intellectual.

One indication of renewed interest in Bateson is to be found in the 1992 publication of U.S. vice-president Al Gore. Gore devotes a whole chapter to one of Bateson's central themes, the assumption of separation between our intellect and the physical world. Gore goes on to argue that the 'cleavage in the modern world between mind and body, man and nature, has created a new kind of addiction ... our civilization is, in effect, addicted to the consumption of the earth itself' (Gore 1992: 220). This addictive relationship distracts us from our connection to the vividness, vibrancy, and aliveness of the rest of the natural world.

The metaphor of addiction is borrowed from Bateson. So, too, is Gore's theme of the 'high price' which our scientific culture exacts by insisting on the supremacy of abstract thought and disembodied intellect over the evident links between mind and body, intellect and feeling, and the whole experience of living. Gore argues for a spiritual resolution of the disharmony in our relationship with the earth. Bateson never could accept this type of spiritualism as a framework for thinking about ecology and humanity.[6] He was born and raised in an atheist household. His recursive vision explores the relationship of ourselves to a natural system whose rules of operation are far less forgiving than those of the Christian Creator of the universe. His epistemology is scientific but at the same time confronts the dominant paradigms of an affluent, technologically serviced society; Bateson calls into question the entire world-view of the science which supports the engineeering ethos of the industrial and 'post-industrial' society.[7]

BATESON AND THE SCIENCE OF ECOLOGY

There is a strong case to be made – which, indeed, I make in this book – that Bateson believed he was living at a turning point both in the history of science and of humanity itself, but that this experience may require lengthy interpretation before the transformation is understood. Bateson argued that to interpret our predicament, we must draw the link between modern ecology and the history of evolutionary ideas. Most people, I suspect, regard the subjects of ecology and evolution as distinct disciplines. Bateson argued that the roots of a transformed, holistic science lie in considering the relations between evolutionary thinking (as a history of ideas about the whole) and ecology. He proposed that their interrelationship becomes amenable once biology, evolution, and ecology are considered aspects of a communicative, rather than material, order. When these relations are formed, the organization of the biosphere itself can be considered as a communicative recursive order.

In Bateson's view, the major source of false perception in ecological science lies in the commitment of twentieth-century science to a materialist perspective, a perspective that has claimed too much for its own theories. The assumption of most physical sciences, one that they carry into their presentations of environmental issues, is that quantitative description is all that is required in explaining environmental phenomena. Bateson argues that quantitative descriptions explain very little. Modern science understands physical forces and their interactions in the universe, but methodological procedures derived from this perspective reduce an understanding of ecological systems to mere descriptions of 'things.' For this reason, quantitative methodology cannot contribute much to an explanation of living systems.

Materialist methods are only suitable for the description of a universe whose very 'thingishness' must, in the end, remain inaccessible to us. Thus, Bateson claims, the extrapolation of the relationship between ourselves and the natural order requires a break with a wide range of scientific and industrial practices and thinking. For example, an ecosystem must be described *primarily* in terms of its informational aspects – and not in terms of its biomass or its energetic capacity to support life. This clearly flies in the face of conventional ecology. Ecological science conventionally thinks of an ecosystem as an aggregated biomass, an energy system whose major features are energy inputs and outputs, so that explanation of environmental order turns on weighing expressions of this physical state of affairs (Odum 1989).

Bateson does not deny a relation between energy and informational components of any ecosystem. It was evident to him that any organic system must maintain a positive energy budget if it is to keep on moving. Yet, he asserts, the degradation of available energy is *not* the primary causal factor in the organization of biological systems. Any investigator of biological systems who concludes that an organism should be measured in terms of its position in an overall energy budget of an ecological system, as a measure of the organism's 'adaptive efficiency,' is mistaken (Letters, 463-4c/1964).[8]

'ECOLOGICAL UNDERSTANDING MUST BE ECOLOGICAL'

Many scientists who have read Bateson remain unconvinced about the validity of his science. A scientist, they feel, should at least put on the clothes of science, that is, undertake quantitative analysis some of the time. Bateson does not do this. Instead, Bateson realized far ahead of his contemporaries that the primary source of error in ecological science lay in false presumptions of an ability to 'control' and to 'manage' ecosystems through quantitative measurement. He took the position that the ecological dilemmas which the Western world faces, or would face in future, stem from this propensity to exert control over nature and from embodying this desire for control in quantitative approaches to ecology.

According to Bateson, this propensity is cultural in origin. Western society's use of tools against the world of nature in order to control nature is a complex predisposition developed over several hundred years of scientific practice. He took up these concerns long before he took up more specific questions of ecology:

> One of the major anti-human fallacies of the scientific community, perhaps especially the engineering community, is the premise that it is possible to have total control over an interactive system of which oneself is a part. Now this is a major pathology in family life, in marriage relations, in organization in general and so forth ... engineering is one of the things which is responsible for the spread of that fallacy in the general population ... but the ideas of fallacies of control in general are one of the major sources of social trouble and individual trouble ... (Letters, 240-10b/1957)

In his own metaphor, incorrect ideas will 'commonly kill the people, leading them to kill each other, or to poison the water which they drink' (Letters, 18-15a/1975). In other letters, Bateson insists that the problem of how to transmit ecological ideas in what seems to be an ecologically 'good' direction is, in itself, an ecological problem. Mainstream science ignores this issue. More specifically, ecological and environmental planners fail to see the runaway implicit in their own position. The premise of human domination over nature leads to a false sense of control, and, in turn, social organization of technology around this false sense of control increases the inflexibility of our response to ecological degradation.

Bateson's justification for his own science lay in his recognition that dominant practices of science are suppressing alternative ecological understanding. In his unnamed new science, or 'ecological epistemology,' all assumptions of domination over nature – hidden or overt – are removed. Here we enter directly into Bateson's prescription for our own survival. *Our own survival depends on understanding that not only are we coupled to our own conceptualization of ecosystems and ecological order, but also to embodiments of our own ways of thinking about them and acting on them.* By this he meant (1) that any statement about order necessarily includes assumptions about how we know and think, and how these assumptions are drawn from the 'environment' of our own ideas, including our ideas about nature; and (2) that 'embodiment' lies not merely in ideas as perceptual and cognitive forms, but in patterns of communicative interaction. Because these patterns of embodiment arise in relationships between people, or in cultural beliefs about the relation between culture and nature, the total pattern of embodiments is often very difficult to discern.[9]

EPISTEMOLOGY AND RECURSION

Readers should be forewarned that Bateson uses the term 'epistemology' in an idiosyncratic manner. Philosophers define the term as a study of the theory of knowledge, or that branch of philosophy which investigates the origins, structure, methods, and validity of knowledge. By contrast, Bateson means by the term the examination of knowledge in an operational sense: the 'how' of knowing and deciding, rather than the 'what' of the origins and validity of knowledge. Thus, both Bateson and conventional philosophy might agree that evolution has epistemological dimensions, but evolution, in Bateson's sense, is a question of how we have decided to view the biological world, and how these choices become a perennial source of both confusion and dogma in biological and social science. In Bateson's view, epistemology does not derive merely from the head of the scientist or the work of the logician. Instead, epistemology is that science whose subject matter is itself. It is the name of a species of scientific study and talk. We set out to study the nature of study itself, the process of acquisition of information and its storage (... along with the study of how epistemology is done).

It follows

that epistemology is the great bridge between all branches of the world of experience - intellectual, emotional, observational, theoretical, verbal, and wordless. Knowledge, wisdom, art, religion, sport and science are bridged from the stance of epistemology. We stand off from all these disciplines to study them and yet stand at the center of each. (GB 1979b; *Sacred* 1991: 231, 232)

Bateson has been criticized on the grounds that he seemed to construe almost everything in epistemological terms and that he continually explained epistemology by epistemology (Dell 1985: 1-5). There is some truth to this, but therein lies a great strength of his writing - construing epistemology in its reflexive form.

Bateson's use of the term 'recursive epistemology' came very late in his life, perhaps during the last five years, although many features characteristic of recursive systems are dealt with in earlier writings. I will explore reasons for his hesitancy, but some of them have to do with the connections drawn today between recursion and chaos theory. Today chaos theory is faddish, with conferences exploring patterns of non-linear and chaotic systems in literature as well as in the biological and ecological sciences. A word of caution is called for. The science of 'chaos' Gleick reported on is a science which explores similarities in repetitive non-linear patterns, and by implication, relations of self-similarity - recursive nesting - in the stable attractors of the system. Bateson's notions of recursion are based on an understanding of 'difference.' As Bateson pointed out on many occasions, the scientific approach to difference is not of the same order as the scientific approach to similarity. Emphasis on difference leads to *patterns*, while emphasis on sameness leads to quantification for there is always the question 'how much sameness?' (Letters, 1519-8f/1970).

PRESENTATION OF IDEAS

It has become usual in recent social science literature to comment critically on an author's style of presentation as much as to examine the propositions an author put forward. In Bateson's case, close attention to his style of argument is completely justified because of its originality. His style of argument is that of working with a large interactive gestalt, which he sometimes referred to as his matrix of ideas.[10] In the course of time, the interactive gestalt with which he worked became larger and larger. It began with fieldwork among small groups of people in Australia and New Guinea, but by the end of his life his interactive gestalt is of relatedness between microcosm and macrocosm, between humanity and biosphere. Many principles of relation and interaction in his matrix of ideas remained constant from the postwar years until his death. Changes in his discourse largely resulted from carrying his matrix of ideas into new contexts, rather than making abrupt shifts of argument.

Bateson gives his own account of how he developed his ideas in *Steps to an Ecology of Mind*, his best-known publication. Yet the unpublished material in the archives at the University of California, Santa Cruz, shows that he was selective, leaving out a long period of mature writing and thinking. I have drawn from unpublished notebooks and letters in order to better understand the flow of Bateson's ideas. The letters are particularly significant in that he often uses this format to develop ideas which appear subsequently in published articles.

Unpublished articles in the 'Complete Articles File' in the Santa Cruz archives are particularly important for the years between 1951 and 1973, years during which Bateson seemed to have no major publication. The reasons for this are developed in chapter 4. Bateson's notebooks are disappointing in the sense that they present no commentary, that is, few thoughts about, or emotional responses to, the questions he was working on. In this respect they violate expectations because notebooks are the working tool of most major anthropologists. Given his strong aesthetic sensibility, one might expect Bateson to have used them as a means for elaboration of personal experience, but in this period of his working life he abandoned this style of note-keeping. Instead of being 'the essential poem at the centre of things,' his notebooks usually express the first draft of a publication or a letter, or a proposal for a book. Only occasionally will a new aphorism, new idea, or new diagram appear.

The original manuscripts of *Mind and Nature* and of *Angels Fear* are also lodged in the archives; they are significant for different reasons. The first is important for indicating what material about recursion was left out of the published book. *Mind and Nature* began as two separate books and subsequently became merged into one. The *Angels* manuscript is interesting for the difference between Bateson's own sequencing of chapters and the sequence which Mary Catherine Bateson prepared for final publication.

CHAPTER OUTLINE

Anthropologists reading this book may find it peculiar that a book on Gregory Bateson gives only brief mention to his early years in anthropology. While Bateson left the discipline of anthropology in the narrow sense, there still remains a profound relation between what he has to say and current directions in this discipline. Bateson himself was of the opinion that while anthropology left him, he did not leave anthropology.[11] Bateson ended his life with the explicit hope that he had fashioned hidden forms of unity between humanity and the biosphere in his recursive epistemology. And if epistemology is the study of how people or systems of people know things, and how they think they know things, then in studying the relation between humanity and the biosphere 'anthropology becomes a critical study of epistemology' (Bateson quoted in Keeney 1983: 13).

Chapter 1 is largely biographical. As already mentioned, personal details of his life, and the way in which these contributed or detracted from his career as a scientist, have been beautifully portrayed in his official biography (Lipset 1980) and in a personal memoir by his daughter, Mary Catherine Bateson (*Daughter's* 1984). The personal memoir covers both her father and her mother, the famous American anthropologist, Margaret Mead. I will draw from both these sources.

The development of Bateson's intellectual biography is continued in chapter 4, which discusses problems Bateson faced with his audience. Throughout his career, Bateson's audience veered between accepting him as a scientist – but one pursuing a science they did not understand – and regarding him as some form of 'guru.' Often his readers or his audience can see that Bateson points towards an entirely different set of premises about a science of ecology, but find it difficult to distinguish his radical thinking about holistic science from the communal or mother-earth spiritualism of the counter-culture – the 'New Age' approach made familiar through the mass media. Bateson rejected the latter as anti-intellectual.

Bateson often begins with very general statements about his epistemology and then proceeds to fit his most recent hypothesis or subject matter into that epistemology (Letters, 955-36b/1966-7). I therefore discuss first some of his fundamental notions of order and process, before proceeding with the chronological development of his ideas. Intermingled with these fundamental notions of order and process are biographical details as to how and why he was attracted to them. Chapters 2 and 3 develop a set of his key notions, the first around problems of order, the second around temporal processes, change, and survival. Chapter 2 begins with a presentation of the circularities of order and non-linear causality presented in one of his best-known essays, 'The Cybernetics of Self: A Theory of Alcoholism.' Chapter 3 concentrates on how Bateson came to consider process in living systems and maps out some of the sources for his discussion of temporality, the place of the observer, and continuity in self-organizing systems.

Chapter 3 ends with a discussion of survival. By survival, Bateson means 'the maintenance of a steady-state through successive generations.' In negative terms, survival meant 'the avoidance of the *death of the largest system about which we can care*' (*Mind* 1979: 220) ... and dilemmas always intrude. The structure and resolution of dilemmas, both human and natural, runs as a constant theme through Bateson's work. The most recent example of a mammoth ecological dilemma is 'sustainable development,' a metaphor around which the United Nations has organized a global debate. The Earth Summit on sustainable development in Rio in June 1992 tried to create a definitive approach towards sustainability through global planning, but with limited success. Bateson organized a conference in 1969 to see if he could get agreement on approaches to ecological destruction, other than those based on management and control. Achieving ecological understanding through the latter, he believed, would always result in dilemma and paradox. Not surprisingly Bateson's own conference ended in failure.

The progression of his ideas on ecology, which constitutes the chronology in this book, begins with Bateson's attachment to cybernetics – the science concerned with circular causal mechanisms and feedback. He approached cybernetics during his forties, in the immediate aftermath of the Second World War. Chapters 5, 6, and 7 discuss, respectively, the science of cybernetics, the matrix of communication from which all living order is drawn, and a communicative understanding of evolution. Chapter 5 discusses cybernetics as a foundational science from which Bateson drew key ideas about organization, causality, and purpose. The subject matter of chapter 6 is his particular transformation of cybernetics into a new science, a science of communication that accords with human experience. From this emerges the famous Bateson hypothesis of 'double bind.'

In common parlance, double binds are thought of as springing from individual dilemmas. Yet Bateson thought of double bind as a dilemma which can occur in a family or in other larger systems. In fact, double binds are embodied in a wide variety of communicative patterns, all of which contribute to the characteristics of this type of dilemma. Every move in a double bind sequence seems to propose *either* extermination by the larger environment *or* the pains of inner disruption. Fear of change in any larger system can bring about hurt and induce the reflexive block typical of double bind. And it is a fear of change in the larger system that makes us all so easily hurt. Bateson always posed double binds as systemic dilemmas of self-preservation that can occur in any context of organizational survival. A further examination of double bind is contained in Appendix 2.

Chapter 7 discusses how he extends his propositions about communicative order to the natural world. In modern day parlance, whether of postmodernism or of deep green politics, the key phrases used to describe this approach would be those of 'decentring' the human subject or indeed humanity itself. Bateson's 'decentring' occurs as a set of ideas around 'co-evolution.' He conceptualized a necessary unity in the relationship between humanity and nature through correcting false ideas in the dominant paradigm of evolution, Darwinism. His theorizing was carried out through his method of *abduction*, which in his view provided that diversity of method through which science might attend to the diversity in ecological order. Bateson believed that conventional approaches combining induction and deduction were insufficient to engender ecological understanding. This theme is examined further in chapter 8, a chapter which also discusses how his conceptualization of 'difference' was generated from reconsideration of his father's arguments about form and pattern.

Immediately prior to and during the writing of *Mind and Nature*, Bateson made significant changes in his understanding of the nexus between order and human classification of hierarchy. Hierarchy in natural order was always a problem for Bateson in that he never meant by that term what others imputed to it. Hierarchy indicated, in his own perspective, a step or a level in natural order; but as he began to introduce the notion of recursive structure, he altered prior notions of hierarchy to accommodate this new form or structural principle. This presented a new set of problems for his epistemology for he felt he could only address structural features in an imaginative field, that of aesthetics.

The reasons for this are spelled out in some detail in chapter 9. Generally speaking, Bateson was convinced that his approach to ecological consciousness via aesthetics was a short-cut to ecological understanding. He thought that aesthetics provided an alternative that was better than ethical discourse because, he believed, ethical questions about intrinsic values in nature would become mired in countless pitfalls.

Chapter 10 deals with the tendency towards spiritualism which seems to arise, almost inevitably, as a result of thinking about vast ecological wholes. He presents the planetary ecosystem in a metaphor of ECO, the ecological 'god' of immanence and necessity that cannot be mocked. Bateson rejects transcendent spiritualism in ecological thinking. The unity of the biosphere should never be a cause for enchainment in a false notion of connectedness whether spiritual or scientific, Bateson argues. Functional connectedness in recursive order is not marked by seamless patterns of interconnectedness. The presence of gaps in recursive looping in ecological systems permits the necessary marking of distinctions and differences.

Without such gaps, recursion dissolves into a mystical concept of interconnectedness. In the light of Bateson's position, it is of interest that some recent papers on chaos theory seem to propose precisely the mystical interconnectedness he warns against – for example, that the movement of a butterfly wing affects total process in the biosphere. Chapter 10 also discusses Bateson's arguments about attachment of the self to system, microcosm to macrocosm, presented in his posthumous publications, *Angels Fear* and *A Sacred Unity*.

HOLISM

With Berman, I agree that Bateson is one of the great seminal thinkers of the twentieth century. Further, his work represents the only fully articulated holistic science available today – one much broader than that of either Carl Jung or Wilhelm Reich (Berman 1984: 190). Bateson is the quintessential 'difference theorist,' who indicates that fallacies of reductionist thinking are always more subtle than they first appear to be. It should be our task to rethink scientific preconceptions about reductionism and control and to search again for the power to bind and to loose that are the building principles of life - the Riddles of the Sphinx as he once termed them.[12]

A deep sense of commission to alter premises and habits of thinking pervades Bateson's work. As he put it, civilization and its leaders are faced with a 'massive change in deep lying premises - a dose of what you call "culture learning" such as no previous culture has ever swallowed' (Letters, 779-3b/1970). If Bateson is right, questions of our survival cannot be resolved through continuing our attempts to manage nature, for all plans for its management are closely linked to desire for its control. Instead, we should begin with 'good ecological ideas' that generate alternatives. Once released from the physics of energy and its transformations, ecology can pay more attention to biological forms, their morphogenesis, and their interrelated configurations. Herein, Bateson believes, lies a major source of good ideas for a different type of ecological theory.

Bateson's ecological understanding, as I show, derives from a theory of consciousness which challenges in a very direct manner notions of rationality established during the Enlightenment. Bateson argued that concepts based on the primacy of human agency, primacy of human rationality, and primacy of human control must be abandoned. Instead, we must build on an understanding of recursive communication, knowledge of which can overcome the divide in our thinking between humanity and nature. We must understand that consciousness itself is a recursive phenomenon, a systemic process subject to relations of its own natural history. Only then can a holistic epistemology emerge, aware of its own propensities to undertake free fall towards reductionism.

1

The Youngest Bateson

BATESON, GREGORY (1904–80): An elusive, Cambridge-trained anthropologist who made his career largely in the United States, Bateson was an interdisciplinary innovator and generalist, with strong interests in philosophy and ecology.

So begins the entry, written by David Lipset, Gregory Bateson's biographer, for *The Social Science Encyclopedia* (Kuper and Kuper 1985: 64). As innovator and generalist, Bateson follows in the footsteps of his famous father, William Bateson, an Edwardian naturalist whose interests ranged over zoology, biology, natural history, and evolution. William Bateson is best known for the positions he took on the debate about evolution at the turn of the century. He was an anti-Darwinist at a time when Darwinism had become orthodoxy in biology.

Though anti-Darwinist, W. Bateson was by no means religious. To the contrary, young Gregory grew up in a family of atheists, a circumstance which caused some family concern when he was packed off to a small Anglican preparatory school, Warden House in Deal, Kent. His mother had to make arrangements with the headmaster that Gregory would conform with the daily ritual of saying the Lord's Prayer so that he would not be faced with the prospect of being caned for refusing to comply. Thus Gregory went to school 'with complete authoritarian approval for conforming to that which I did not believe in' (Lipset 1980: 61). As in the case of his father and his brothers, Gregory Bateson's own non-conformity towards two authoritarian traditions, faith and established science, became a central motif in his writing. Eventually this pattern of non-conformity would produce a unique approach to ecological issues, one which avoids both ecological 'spiritualism' – religious expression added on to environmental concerns – and reductionist approaches to environmental science.

W.B. ... THE EMINENT ANTI-DARWINIST

W.B.'s eminence as a biologist stemmed from his extraordinary discovery of the work of Gregor Mendel, the obscure Silesian monk whose experiments on hybridization in flowers and garden peas led to our modern understanding of genetics. Mendel wrote up his experiments for a meeting of the Natural History Society of Brunn in 1865. W.B. was among the small band of evolutionists who rediscovered Mendel's work some thirty-five years later.[1]

Mendel introduced the notion of *mutation*, an alteration of heritable traits indicating a change in the direction and expression of living forms. Today biologists would describe mutation as a molecular alteration in the nucleus of the cell, a change of the base sequence of DNA. But when Mendel's work was taken up by W.B. and others, mutation was interpreted as a 'discontinuity,' and discontinuity was held to be the primary mechanism for evolution. W. Bateson's translation of Mendel into English brought into scientific vocabulary the now familiar term 'genetics.' He began to espouse formation of a branch of science which would deal with 'Mendelian factors.'[2] In doing so, he became one of the foremost antagonists to the Darwinian interpretation, which, by the turn of the century, had become predominant in the universities of Great Britain.

Darwin's theory of evolution proposed a continuous modification of species on which natural selection worked. W.B. argued that natural selection could not possibly account for the widespread variation of species found on the earth. W.B. doubted that species variation itself was a continuous process; and since evolution without species variation was impossible, he was driven to the conclusion that Darwin's version of species variation was profoundly wrong. Discontinuity in species variation, rather than continuity, was the evolutionary rule, he said, and Mendel's writing could account for discontinuities in evolution through mutation.

Evolutionists were split on the debate between mutationists and selectionists until the 1930s. At that time a number of biologists proposed a synthesis of the Mendelian and Darwinian positions. The neo-Darwinians, as they are called, united Darwin's vision of evolution as the gradual and continual unfolding of life from previous forms with Mendel's discovery of mutation, a change which they attributed to change in gene frequency of populations from one generation to the next. The synthesis proposed that the two views, mutation and selection, were different perspectives of the same phenomenon. This neo-Darwinian synthesis of Darwin and Mendel was dominant in evolutionary studies until the 1980s.[3]

LIKE FATHER LIKE SON?

In honour of his extraordinary rediscovery of the texts of Gregor Mendel, W.B. named his youngest son Gregory. From an early age, W.B. gave his youngest son a deep knowledge of the fallacies in evolutionary theory, and a large range of ideas about alternative approaches. Thus high level questions were part of Gregory's intellectual baggage from an early age. The contributions of his father to the debate on evolution had such a profound effect that Gregory Bateson returned to these high level issues as a matter of course in his contributions to anthropology, communication theory, family therapy, dolphin studies, and ecology.

As might be expected, Gregory Bateson began his student years as a zoologist. When the youngest Bateson decided to switch to anthropology, he announced to his father that while he would always remain interested in evolution and kindred problems, he felt unable to throw himself unreservedly into their study (Lipset 1980: 115). He explained to his father that he had developed a liking for issues of culture, a field in which his father had little interest. Beneath this explanation lay a personal worry. The youngest Bateson worried about being Gregory *Bateson*. Gregory felt that if he were to become a professional zoologist, he would always remain 'the son of W.B.' and would be required to become the reincarnation of his father.[4]

Intellectually, he did remain 'the son of W.B.,' but in a somewhat different setting. The youngest Bateson pursued 'the ideas which my father was groping for,' with deliberate openness. In one of his early papers, he acknowledged that he owed the greater part of his 'kit' of conceptual tools and intellectual habits to his father. He said that a 'mystical belief in the pervading unity and phenomena of the world' given to him by his father enabled him to 'avoid a great deal of intellectual waste' (*Steps* 1972: 75).[5]

As a young anthropologist, Bateson's first major study was of village formation and gender relations in a small-scale society of New Guinea, that of the Iatmul. In his analysis, he borrowed a notion from his father about the biological repetition of parts. Other anthropologists studying exactly the same phenomenon developed models of village-splitting based on the atomic analogy of fission and fusion; Bateson assumed that the power to divide is a fundamental attribute of living systems, and that the pattern of division and differentiation would in some way be associated with the control of symmetry. His father had pursued this very issue in his *Problems of Genetics* (W. Bateson 1913).[6]

In a paper written in mid-age, 'A Re-examination of Bateson's Rule' (*Steps* 1972: 379–95), Gregory Bateson takes up the discoveries of his father concerning symmetry – known as Bateson's Rule – and reinterprets them in the light of information theory. At one level, the paper is a technical note on how new science can solve older questions about rhythm and symmetry in biological phenomena, but at another level the paper is oriented towards his father's views. W.B. believed their further study would produce an 'entirely new concept of the nature of living things' (*Steps* 1972: 379). That entirely new concept in the early twentieth century was the idea that there were the same sort of processes in all fields of natural phenomena which derived from 'essential relations' immanent in living form.

W.B. had tried to show how patterns are immanent in the order of living things – for example, the repetition of form seen in any living organism derived from regularities in growth and organization in variety. He proposed a 'vibratory' or 'resonance' theory of repetition in which organized patterns were compared to the complex symmetrical patterns assumed by particles in response to standing waves on a resonating plate (Chladni figures, as they were known) (Hutchinson and Rachootin, in W. Bateson 1979: xi).[7] What W.B. lacked was a concrete concept which would link pattern and its deformation to correlated variation in all other parts of a living system. Nor could he conceptually link pattern stabilities to organization of form through time. W.B. believed that a science of variation should begin by investigating the harmonies and disharmonies of variation. By redefining questions of growth, variation, and repetition as problems of feedback and information theory, Gregory enlarged his father's 'mystical' ideas of pattern and showed that variety in form, as information, was indeed immanent in patterns of living organisms.[8]

The holistic manner in which Gregory Bateson came to consider evolutionary issues was in distinct contrast to established positions in evolutionary theory. Darwinians emphasized a dualism between physical elements of the environment and life forms. Living forms developed separately, adapting to planetary conditions as they evolved. Evolution was characterized by material processes of natural selection: 'the blind, unconscious, automatic process which Darwin discovered ... is the explanation for the existence and apparently purposeful form of all life, [which] has no purpose in mind' (Dawkins 1986: 5). Darwinians also maintain that evolution is propelled by the blind forces of statistical probabilities. Since natural selection is a statistical expression of environmental forces acting on living species, neither human perceptions nor conscious human action have a part to play in human survival. Natural selection has no mind, and no mind's eye. It has no vision, no foresight, no sight at all. Natural selection is a sort of 'blind watchmaker.'

Gregory Bateson points out that if nature is 'blind,' it does not follow that nature has no intelligence. Later, Bateson puts this question: If humanity is part of nature, as indeed it must be, to what extent is our intelligence also a primary model for understanding the biosphere?

BETWEEN ART AND SCIENCE

Another theme central to his father's intellectual life was that of linking art and science. His father had regarded science as 'easy and within the reach of ordinary people.' Art was something else again, a sort of wizardry.[9] During Bateson's childhood, his father had drummed into him that no ordinary human being could integrate art and science. 'Aesthetic, or heretical or even religious science was a possibility, but to create art straight out, was to William Bateson much like playing God – a sacrilege – however much the Gods were to be envied' (Lipset 1977: 50).

When Gregory Bateson was growing up, he had seen his family founder in attempts to bridge this rather rigid intellectual posture. The unresolved tensions over the issue had contributed to the suicide of his elder brother, Martin (his eldest brother, John, was killed during the First World War). His father had expected Martin to become a scientist, but Martin had been determined to become a poet and dramatist. When Martin switched from science to drama, his 'sin' as his father saw it was to presume that he, a Bateson, might contribute to that higher level (Letters, 321–13d/1966). Martin's attempts ended in failure. 'It was just that sort of paradox that killed Martin,' Lipset notes in recounting the details of Martin's death.

Gregory Bateson had grown to understand that if you label that which you are most concerned to speak about as 'zen' – somehow 'unutterable' – as his father had done, it will never get said. Throughout his own intellectual life, he explored many ways and means of making the connection between art and science – beginning as an adolescent with a study of the English poet William Blake. His study of Blake was prompted by his father, who as an amateur art collector had managed to acquire one of Blake's major paintings. Lipset suggests that Blake became an obsession with Gregory during his undergraduate years because of his belief that he had rediscovered Blake in the same sort of way that his father had rediscovered Mendel (Lipset 1977: 46). Clearly the results of this intense study of the aesthetics of this English painter can be found again and again in Gregory Bateson's writing. In his old age, he felt he was at last able to assume the mantle of Blake's approach to aesthetics, one which Bateson regarded as concrete, rather than 'mystical.' He believed that Blake enabled writers to take up the topics of sacredness and sacrilege in forms quite different from religious thinking. The 'zen' could be approached by a holistic science even though conventional science rejected holistic concepts as non-scientific. For Bateson both sacredness and sacrilege were important metaphors for thinking about holism in ecology and for perceiving ecological unity.[10]

FIELDWORK AND MARGARET MEAD

> During his New Guinea fieldwork, Bateson met the cultural anthropologist, Margaret Mead, whom he later married. In 1936 they did fieldwork together in Bali ... [they had a daughter, Mary Catherine Bateson, but separated in 1948] ... (Kuper and Kuper 1985: 64)

Bateson had matured among that first glittering generation of field-workers who put anthropology on the intellectual stage of Western universities. He was an extraordinary observer, both of nature and of the intricacies of human interaction. Like many gifted individuals, Bateson's abilities were founded upon exceptional sensory attributes. R.D. Laing said of him: '[Gregory Bateson] had the most distinctive perceptual capacities of anyone I've met, and to see someone like him observing other human beings ... to get a feel of just what they're picking up and seeing, and the edge they have on even the quickest of their contemporaries ... was a great consolation about life' (Evans

1976: 75). His abilities as observer should have led to an easy task, that of writing an ethnography of the New Guinea people in the style of his contemporaries. Yet Bateson regarded the fieldwork situation as much more than the collection of data on kinship ties, myths, and village organization, which was the standard fare of ethnography in his day.

During his fieldwork among the Iatmul in New Guinea, he met Margaret Mead, who was working with her anthropologist husband, Reo Fortune, in the same Sepik River area. A love affair developed which led to the eventual separation of Margaret Mead from her husband. After their marriage in 1935, the two anthropologists, Bateson and Mead, combined their talents on another ethnographic research project, a trip to Bali. Here Bateson immersed himself, obsessively it would seem, in taking photographs.

Their project was partly a study of gesture and bodily movement. At the same time, it sought to gather 'psychiatric' data of the Balinese people. The Balinese were noted for going into trances and in their trance-like states seemed, by Western standards, to become out of touch with reality. That is, the Balinese assumed in a trance some of the mental states a Western psychiatrist might define as schizophrenia. The purpose of the project was to learn what childhood conditions might create a propensity for engaging in trance. Bateson took twenty-five thousand still photography pictures on that trip, apparently twenty-three thousand more than he had planned, for he had only arrived in Bali with seventy-five rolls of 35 mm film (Howard 1984: 192). Even this latter amount was – at that time – an ambitious number for ordinary anthropological fieldwork.[11]

Margaret Mead's biographer records Bateson and Mead, weary from long sessions of photography, washing their faces in the same water Bateson had used to process that day's batch of film. Mead rarely lifted a camera but frequently drew Bateson's attention to scenes that he was apparently too busy to notice. She kept meticulous account of what was happening. The two had set out to learn all they could about posture, gesture, painting, childhood relationships, and the symbolism of play, and nothing around them seemed to be irrelevant.

Bateson later said there was a world of difference between how he and Mead approached fieldwork. Mead was a note taker. Without the notebook, it would not be 'Margaret.' She loved the data, even the data which were, by themselves, meaningless. She lived in a world of what William Blake called 'minute particulars.' 'That was how she saw the data. And theory was instrumental to seeing more data ... ' ('Speech for Margaret Mead Memorial,' CAF 167/1979; see also Lipset 1980: 286–7).

His obsession with photography in Bali was quite different from the approach to the first material he had collected among the Iatmul of New Guinea. He said of his first full-length anthropological study that his fieldwork notes were 'scrappy and disconnected.' He continued, 'I did not clearly see any reason why I should enquire into one matter rather than another. If an informant told me a tale of sorcery or murder, I did not know what question to ask next . . .' When it came to the task of fitting observations into a consecutive account, 'I was faced with a mass of the most diverse and disconnected material' (*Naven*, 2d ed., 1958: 257, 259).

Bateson felt that he required a clear perception of the phenomenon that he observed before he undertook an explanation of it. It took several years for him to construct an ethnographic picture of Iatmul culture that was consistent with a sort of 'internal' discussion he had with himself of why he had portrayed the patterns of their culture in the way that he did. He argued that perception of a culture was in some sense limited by the theoretical box of tricks one brought into the fieldwork study of that culture; in a much later edition of *Naven*, he was to spell out the illusions which supposedly objective concepts of anthropology bring to 'the duality between observations of behaviour and generalization' (*Naven*, 2d ed., 1958: 196).

Bateson left Margaret Mead in 1948. Their separation, as Mary Catherine Bateson records in *With a Daughter's Eye*, was not a happy one (M.C. Bateson 1984: 115–27). It coincided with a dispute which Bateson had with the Department of Anthropology at Harvard University, where he was teaching. Bateson left the East Coast of the United States for the Langley Porter Clinic in San Francisco.

NAVEN: THE OBSERVER OBSERVING

His major contribution to anthropology in this period was *Naven*, a book about his New Guinea fieldwork, and several articles about the Balinese. Though Bateson referred to *Naven* as a 'rather unreadable work,' he was always prepared to justify the ideas contained within it. He said, quite correctly, that the book contained the germ of the thinking which he carried into cybernetics and psychotherapy (Letters, 52–15b/1969). One of the many important themes he discovered in writing *Naven* was that the method of induction, characteristic of nearly all scientific explanation, often encouraged scientists to generalize and universalize from particular instances in a false manner.

Adopting the expression of the English philosopher Alfred North Whitehead, Bateson called this misattribution 'the fallacy of misplaced concreteness.' The fallacy of misplaced concreteness derives from hiding 'points of view.' Later, Bateson would use the term 'context.' The hidden point of view arises in the first instance from informants from whom information has been gathered. These always have 'points of view,' but scientists may never label them as such. Often this contextual evidence is removed by the observer, who subsequently substitutes 'hard' data for context. A second level of hidden reference occurs when the observer-scientist calls evidence 'true' and 'objective' – though the knowledge is invariably derived from the scientist's own style of labelling the evidence.

Thus a sequence of behaviour cut out for the convenience of the observer's description becomes a piece of behaviour validating classes of activity, which anthropologists then label 'symbolism,' 'economics,' 'kinship,' 'land tenure,' 'sexual life,' etc. In fact, these are really a by-product of the scientist-observer's interaction with society. Such false labelling results in 'kinship,' 'sexuality,' etc., becoming identified as 'objective' channels of behaviour (*Naven*, 2d ed., 1958: 261ff).[12]

Bateson's lifelong interest in epistemology begins at this point. He notes that results gathered through the method of induction permit scientists to make a statement about the validity of a hypothesis. But there is a second-level implication. Whenever a scientist brandishes evidence, the evidence is 'true' only because the methods of science have guaranteed its truth. It is this second-level argument which often induces fallacious reasoning. In the 'Epilogue' to *Naven*, written in 1958, he takes up another potential fallacy in the relationship between observer and the observed. The theoretical concepts that he had used in 1936, he says, had something to say about the process of knowing, but his descriptions in *Naven* had assumed that the cultural system of the Iatmul was in some form of mechanical equilibrium. Like other anthropologists of his day, Bateson's 1936 analyses were replete with energy metaphors. All cultural and social anthropology is a study of mechanical equilibria, he had originally argued, and structural analysis should contribute to an understanding of the way in which dynamic equilibrium is achieved in the integration of the culture.

Long before the second edition of *Naven* in 1958, he realized that physical metaphors of power and energy had their limitations. Analysis of overall equilibrium in social systems ignored the complications of 'networks of cause and effect' – that is, parts of the system were reticulate and interdependent upon each other. Thus it was 'exceedingly dangerous' for any observer 'to point to certain factors and to say that they constitute the whole cause of the effect which we want to explain' (*Naven*, 2d ed., 1958: 108).[13] Also, networks of cause and effect in social systems appeared to be circular, not linear as in the case of mechanical equilibrium. In the brief space of a page or so, Bateson introduces himself to his subsequent life-concern.[14]

He goes on to argue that when scientists are at a loss to find an appropriate language for the description of change in some system which they are studying, they will do well to imagine a system one degree more complex. Had he himself understood cybernetic concepts correctly, he said, he would have been able to discuss the cybernetic question of persistence of steady states in cultural systems instead of assuming that traditional culture was balanced in a manner analogous to a physical mechanism.

STEPS: BATTLING FOR AN EPISTEMOLOGY

> Bateson's most influential post-war work came in 1956 ... he developed [a communicative] interpretation of schizophrenia in which the concept of a 'double bind' played a central role ... Bateson regarded this theory as an attack upon reductionist learning theory. He was dismayed when his notion and the holistic focus on the family as an integrated unit was taken up for therapeutic purposes by psychiatrists. (Kuper and Kuper 1985: 64)

Though Bateson's 'most influential' postwar work according to this biographical reference was produced in 1956, it did not appear in book form until 1972, a considerable gap of time. In fact, the gaps in time between Bateson's major publications require explanation. The gap between *Naven* and his second book, *Communication: The Social Matrix of Psychiatry*, is one of fifteen years, from 1936 to 1951. This can be attributed to the vagaries of the wartime years together with his move away from the teaching of anthropology. However, the period 1951–72, a gap of more than twenty years, is far more surprising since it covers a period of financed research which produced a steady flow of essays and lectures about double bind. Yet there is no Bateson monograph. The reasons are revealed in his archives, and, considering their nature, it is surprising that Bateson maintained his equanimity.

He wrote his second book in conjunction with the psychiatrist Jurgen

Ruesch. *Communication* broke new ground in both cultural anthropology and psychiatry by showing how information concepts provided a more comprehensive view of values, perception, symbolism, and social behaviour than those current in either of the two disciplines. Bateson and Ruesch argued that there are no social sanctions or arbitrary values (ethics) *external* to the communicative processes from which they arose. Aesthetic, religious, and moral views arose out of integral relations of human beings in communication with each other and are a product of the field of communicative activity which their interactions construct. The two authors concentrated on how such a field is constructed from patterns of interaction. In one swoop, they created a sociology of systems of communication, whose validity was not generally recognized until the late 1970s. Later, Bateson would carry these central points – fields of communication, rather than fields of value – directly into his ecological epistemology.

In addition, the authors attempted to undercut controversies between scientists and clinicians about the curative function of therapy. Usual psychiatric approaches treated the ills of the psyche either by prescribing drugs that acted on brain states, or through *controlled manipulation* of the patient by the therapist. Ruesch and Bateson redefined the therapeutic situation. A 'cure' became possible through *participation* of the therapist in a matrix of communication with the other persons. Therapeutic 'change' was brought about through contrasts between client expectation of communicative interaction and the actual flow of communicative events in the therapeutic encounter.[15]

His third book, *Steps to an Ecology of Mind* (1972), is a set of essays. Bateson states in the 'Foreword' to *Steps* that it contains 'almost everything' worthwhile he had written, apart from longer articles and more extensive analyses that could not be included. The statement is quite untrue. Bateson is by any standard a voluminous writer. The articles in *Steps* represent only a sample of his writing, and this sample could have been chosen with more care relative to his central ideas.

His archives show that as early as 1948 Bateson considered putting together a book of his 'Metalogues,' some of which appear in *Steps*.[16] 'Reflexive Man' was the title of another volume he considered publishing in 1954 (Notebook 22/1954). The key theme would have been an extension of the argument in *Naven* about method in science, that is, the inductive fallacies of misplaced concreteness. 'Reflexive Man' would have provided a link between anthropology, with its emphasis on the nature of culture and 'character formation'; cybernetics, with emphasis on messages and communication circuits; and psychology, with emphasis on perception, learning, logical types, and paradoxes (Notebooks 22, 23/ca. 1954). A series of 'Four Lectures' given in 1955 and still unpublished could have related interpretation of messages to 'a philosophy of human relations' involving perception, learning, logical types, and paradoxes (CAF–126/1955).

In 1961 he planned a book specifically dedicated to the issue of schizophrenia. The general purpose of the book would have been to explore schizophrenia in terms of communicative order and his own theory of double bind. He hoped to show that schizophrenia was 'soluble' to the extent that it was misperceived as a unique disease. Instead it was a kind of communicative disorder to which there were a spectrum of solutions. Schizophrenia fitted a spectrum of problems about order and disorder which ranged from individuals, to families, to cultures. Included in these was a very broad range of human activity from the use of metaphor, to humorous expression of paradox in everyday life, to the exhibition of compulsive delinquency (Notebooks 27, 28/1958).[17]

The manuscript was ready in 1965 but was pre-empted by members and associates of his own research team. They had approached Bateson's publisher with a manuscript of their own. *Pragmatics of Human Communication*, by Paul Watzlawick, Janet Beavin, and Don Jackson, was published in 1967. *Pragmatics* spelled out many of Bateson's ideas and clearly overlapped with the volume that he had proposed. Bateson recognized that *Pragmatics* would be the definitive version of his ideas until he could get another volume together, and he was aggrieved. Norton, his very own 'family publisher,' had delayed negotiations with him while talking with the other authors.

Another member of his research team, Bateson's chief collaborator, Jay Haley, thought *Pragmatics* 'took the basic ideas of the Bateson project and did not give proper credit for them.' Haley reported Bateson as saying that the book 'stole 30 of his ideas.' Haley also believed that *Pragmatics* spread misunderstanding about the double bind hypothesis (Letters, Jay Haley to Carlos Sluzki and D.C. Ransom, 1319–10a/1976).[18] Several years later, Haley published his own history of the research project as an attempt to rectify these distortions (Jay Haley, in Sluzki and Ransom, eds., 1976).[19]

In Bateson's eyes, the title of *Pragmatics* was completely contrary to the theoretical ideas about communication he had developed. He had always been antithetical to the theoretical perspective of communication as some form of pragmatic 'tool.' Nor was his position on the issue obscure, for he had begun wrestling with 'pragmatic functions' of culture in his first (1936) edition of *Naven* (1958: 261–2). Watzlawick's *Pragmatics* discussed forms of communication in isolation from cultural communication and aspects of information in nature. It completely ignored the 'roots and branches [of communication] in anthropology and biological evolution.' He wrote a caustic letter to Watzlawick: 'I used to wonder how Kahunas [Hawaiian Priests] feel when they see carvings of their gods in the shop window of a travel bureau. Now I know. Of course it is something of a compliment to have the white man admire the native arts. And the travel bureau is only being "pragmatic." And the loot is sometimes correctly labelled as to provenance. And the native has no comeback' (Letters, 1463–14a/1966).[20]

By the time *Pragmatics* was published, Bateson felt ground down by the schizophrenia project. He left his research project on schizophrenia at Palo Alto accompanied by 'a growing distaste for all the people concerned including the psychiatrists, the patients, the psychologists, the families and the [Veterans Administration] hospital and boredom with the repetitive nature of the transactional patterns which all these persons exhibit' (Notebook 32/1964). He also felt worn out by a long drawn dispute between him and his research team members over the question of 'power' as an explanation of social interaction. Chapter 2 will go into this question in greater detail, but overcoming metaphors of 'social power' in the study of family organization was crucial in his own epistemology. He was hoping that his newly established communicative approach would challenge prevailing definitions, all of which seemed to rest upon these 'power' metaphors. All metaphors of 'power,' Bateson believed, led back towards a sort of Darwinism, the 'survival of the fittest.'

Even his colleague Jay Haley did not fully understand the epistemological issues, Bateson felt.[21] When Haley began to stress in his papers the 'struggle' of individuals within the hierarchy of family order, Bateson knew Haley's behavioural interpretations of social power would be assimilated all too easily by psychotherapists. They conveniently conformed both to the premises of the profession and the premises of linear causation which Bateson had tried so long to dislodge.[22] Thus Bateson moved from psychotherapy to a study of natural history and the communicative ecology of dolphins. This took him to John Lilly's research centres in Florida and the Virgin Islands and, later on, to the Oceanic Institute, Hawaii.

ECOLOGY: A 'POST-POLITICAL' MOVEMENT?

The point of *Steps*, he wrote to his publishers, was to exemplify a single way of thinking in each of several different fields. One way to label this sort of thinking was 'ecology,' but a more technical name was 'systems theory.' The book would exhibit the ways in which this thinking grew in him over thirty-five years (Letters, 1357-2b/1970). Unlike *Naven*, in which the reader simply focuses upon the records and the observations about the method of recording anthropological data, *Steps* requires readers to adopt several different starting points and progressively draws these perspectives together. It requires active participation of the reader in order for the overlap of its themes to be perceived. The reader's integration of comparative material illustrates both the 'step functions' of the systems model that Bateson presents and – in the reader's understanding – what a 'step' in a pattern of learning might be. The 'steps' in the title is a refinement of Bateson's ideas about circularity, a recursion of the observer observing. This step function is what Watzlawick had mistranslated as 'pragmatics.'

Bateson had begun to grapple with issues of ecology by the mid-1960s. In a talk given in London in 1967, entitled 'The Dialectics of Liberation,' Bateson estimated that within ten to thirty years ecological instability would reach major proportions. He said there was an even chance that something more serious than the extermination of one nation would occur within the next thirty years. The reasons he had in mind were numerous: the risks of nuclear warfare and fallout; the increased concentration of carbon dioxide in the atmosphere; the effects of this concentration of carbon dioxide on the melting of the Antarctic ice-cap; the ever increasing use of pesticides leading to ecological degradation, together with a human population explosion. In effect, Bateson had anticipated many of the major environmental concerns of the 1990s, although we have yet to face extermination of a nation through ecological degradation.[23]

The conference at which the talk was delivered was organized by R.D. Laing and should have provided a friendly forum for Bateson's views. Yet his Cassandra-type comments were couched in language which was very difficult for the political radicals in the audience to swallow. Bateson pointed out to a highly sceptical audience that 'liberation' did not mean an immediate instigation of radical political action but first required an understanding of *what* we are going to think about as 'liberation.' It meant *how* we are going to think about ecological issues (Letters, 1096–27; *Steps* 1972: 426–39).[24]

The following year, Bateson put together a conference which examined how we could liberate ourselves from the structure of thinking that has put our civilization into an ecological mess in the first place. The technological intrusion of human beings into the regenerative organization of the biosphere posed a great threat not only for ourselves through destructive use of nuclear weapons, but for all life. Human beings, in Barry Commoner's memorable phrase, were 'fouling their own nest.'[25] Bateson would combine Commoner's approach to ecology with other issues with which he had been grappling for some time – those of cybernetics, mathematics of stability and time series, and the family as an example of a homeostatic system.[26]

Although Bateson's recognition as an ecologist coincided with the rise of the 'counter-culture,' he shared few of the counter-culture's ideas. He rejected the mysticism he found in 'flower power' and the hippie cult. He refused to support the students' call for radical participatory democracy on American university campuses, for he had deep misgivings about the revolutionary nature of the philosophy supporting participatory democracy. He formulated in his own mind the supposition that student revolt of the late 1960s was in some way 'post-political.' Concepts such as 'conservative,' 'liberal,' and 'radical' were misleading, he believed. Student leaders were not so much interested in 'liberalism' or 'civil rights,' or 'revolution' or 'power,' as they were fascinated by the demise of the old 'political society' grinding towards its own collapse. While young people were not yet ecologists in a fully rounded sense of that term, they had discovered a central ecological premise: when the basic ideas are wrong within, any system which harbours them is doomed. No amount of political tinkering can save the old system, he believed; only a fundamental change in ideas.[27]

He was definitely not a political man: 'my personal politics are simple. I utterly despise the whole business' (Letters, 1497–43/1973). Elsewhere he confided that he rejected a political role partly out of predisposition and partly because he felt he lacked the qualities required for leadership. 'I am not a man of action – not even an organizer. I am unhappy when people try to make me a leader' (GB, 1980c: 70–5). Yet he did once engage in a successful political lobby. He gave testimony on behalf of the University of Hawaii Committee on Ecology and Man in favour of a bill which proposed to set up an Office of Environmental Quality Control in the government of Hawaii. The testimony is published in *Steps to an Ecology of Mind* as 'The Roots of Ecological Crisis.' Ironically, it is one of the most easily accessible documents that Bateson published (*Steps*, 1972: 488–93).

In the mid-1970s he was offered a seat on the Board of Regents of the University of California. The offer of appointment was an indication that he had risen to a position of prominence in American intellectual life. Bateson yielded slowly to Governor Edmund G. (Jerry) Brown's insistence. In his first meetings with the governor, he said that political life seemed to demand action based upon insufficient data and precise language before any conceptual clarity had been achieved. In December 1976, Bateson argued further before finally agreeing to be 'cage rattler' on the board (Lipset 1980: 287–91).

The ecological beliefs for which he stood inevitably interfered with his attempt to rise above politics at the Board of Regents. In 1979 he resigned from the Special Research Projects Committee of the board because the university proposed to link ongoing academic research in physics to production of nuclear weaponry. Bateson described the commitment of the university to continuing research on production of nuclear weapons as 'evil.' He could see only two outcomes of an arms race. One was the use of accumulated weapons by either superpower leading to the probable destruction of humanity and 'the mammalian way of life.' The other involved a deliberate risk, which he called 'trust' (Letters, 1177–9c/1979; GB, 1980g).

He explained what he meant by 'evil' and 'trust' in terms of his own theories of survival.[28] There was no escaping the political implication of his submission of his letter of resignation: he was too 'liberal' in the right-wing climate of the late 1970s and early 1980s. Moreover, his arguments overlapped with the themes of the peace movement. The rhetorical question 'Why can't we trust the Russians?' was constantly put by the peace movement in its years of renewed activism during the early 1980s. The letter spelling out his reasons is vintage Bateson. It was crucial to recognize that 'survival' does not have a subject, not even national subjects, in the twentieth century, he said. Survival is a larger fabric within which the death of the individual person, or even nation, is continually necessary. Death is a necessary part of the ecology within which all life is framed. So long as people or nations are tormented by their individual deaths, and make this torment central to their decisions, they will be unable to think ecologically. Such a highly individualistic mode of viewing things will always lead to the conclusion that to kill the whole biosphere is preferable to risking one's own skin (Letters, 1177-9a/1979; GB, 1980g).

The chair of the Special Research Projects Committee, William A. Wilson, accepted Bateson's resignation 'reluctantly.' Wilson offered the following comments: 'War is hell, Gregory, there is no doubt about it. There are several things that are worse, however, and they all come as a result of defeat. America is not a starter of wars. Totalitarian governments are ... You may find it more acceptable to be red than dead. I don't happen to share that approach neither for myself nor my family ... I happen to have no fear that the world will be destroyed by a nuclear holocaust, but in my opinion one way to avoid that is for America to maintain military parity with the Russians' (Letters, 1177-17a/1980; GB, 1980g).

CONCLUSION

> His final book [published while he was alive] returned to an early interest in the analogy between evolutionary change and the structure of mind ... It is, as yet [in 1985], too early to assess Bateson's unique career and his various contributions ... (Kuper and Kuper 1985: 64)

It is time to move beyond this hesitant assessment. First, Bateson's thinking is a complex defence and enlargement, abandonment and rediscovery, of his father's ideas. His anti-Darwinism, anti-materialism, and imaginative appreciation of the interrelation of science and aesthetics all reflect his father's positions. Throughout his career, W.B. had attempted to explain their relevance in each of the areas of inquiry which he undertook. His father's career was an ongoing search for a forum in which to show that science needed to discuss pattern, form, and the relation between parts and wholes. The son repeated the experience of his father, but it was not until the son began to discuss ecological understanding that he began to convince audiences of the relevance of W.B.'s holistic thinking.

Second, from the perspective of the 1990s, it is clear that the younger Bateson was far ahead of his time, wrestling with some of the major topics of our age. Among them are the relevance of communication to an epistemological framework in the social sciences; and the development of a new science to tackle the issues of ecological breakdown. Third, Bateson stressed the importance of scientists taking a reflexive stance towards their field of inquiry. His initial remarks were addressed to his fellow anthropologists. The discussion of cultural order, he told them, involved not only description of 'other cultures' – as is the hallmark of ethnography – but also taking into account both the multiple viewpoints of informants and the belief system of observers observing the other culture.

By the late 1950s, Bateson was on his way to investigating reflexiveness, the observer observing, in a variety of issues in science and psychiatry. As a scientist, Bateson saw himself investigating the concomitants of cybernetic feedback, 'a large, complex interactive gestalt which has its own sense of artistic merit [but] which can be investigated by complex theoretical models [of "homeostatic feedback"]' (Letters, 240–10b/1957). Such an 'interactive gestalt' meant perception and consideration of communicative relations at many levels, each of which was in a reciprocal feedback with the rest, and each of which imputed multiple perspectives for scientists who observed them.

By the time Bateson had shifted his discussion to ecology, his 'interactive gestalt' had grown from a vision of recursive activity to an epistemology based on clear, definite, fundamental principles. Until the late 1960s, he did not grasp the significance of how far his thinking had carried him towards a coherent epistemology. It was not until the last decade and a half of his life that he believed he had achieved some answers to his own epistemological questions. His field of explanation, which he termed 'ecology of mind,' showed how patterns of relations existing between all living forms and their environment constituted a single field of reciprocal interaction. Like the GAIA hypothesis, Bateson shows how organism *plus* environment modify each other, as all living organisms contribute to the ordering and regenerative organization of the biosphere.[29] And like GAIA, the contribution of the system of living organisms to the environment of which it is a part depends on automatic mutual adjustments, which are fundamental to the overall stability of the planet. Finally, Bateson begins to write about an ecological epistemology, the principles of which permit reflexive examination of its own assumptions. Here Bateson goes far beyond current interpretations of GAIA. As ever, his approach is entirely original: he would look at GAIA-type phenomena by examining the recursions of their 'communication' and comparing them with our own human processes of communication.

Bateson's epistemology clashes with the principles of applied technology, with the rationalist assumptions behind applied technology, and with the principles of social power used in its support. The West has used vast systems of technology, Bateson argues, and justified their presence within the institutional order by an eighteenth-century belief in individualism, combining this deference to individualism with a cultural discourse on rationality. The West framed rationalism and individualism by means of metaphors of social power. In his view, this *combination* of assumptions - unlimited use of technology, individualism, rationalism, and metaphors of social power - which has so completely dominated twentieth-century thought, is pathological.

2

A Theory of Consciousness

Bateson was never shy of dropping his readers into the midst of the great problems of the world. The great problem presented in this chapter is the causal relation between 'self' and 'system.' In ecology and biology, the concomitant problem is the causal relation between 'organism' and 'environment.' Dominant discourse, whether in biology, sociology, or psychology, conceives of causal relations and interactions in terms of energy, power, and control. Bateson frames his arguments in an alternative perspective, that of organized communication. While a communicative perspective is not unusual in either sociology or psychology, Bateson carries his discussion of communicative order into the context of ecology – a very unusual step. The relations of 'self' and 'system' become a means of comparison for relations of organism and environment, and vice versa. As we shall see, the leap from one to the other is made through his 'theory of consciousness.'

Modern biology is completely committed to the perspective of control (Lewontin 1991: 83). Biologists hold that the organism lives in an environment which is independent of it. Thus internal activities of the organism are determined by natural evolution, while external activities, deriving from the environment, impinge on the organism and the organism passively responds to them. This view, an expression of a divide between internal and external characteristics, has important reverberations. If organisms are constituted and molded into biological order as an output of forces over which the organisms have no control, then the whole world of nature is outside any organism's control. The implication has political reverberations that 'the world is outside our control, that we must take it as we find it and do the best we can to make our way through the mine field of life using whatever equipment our genes have provided to get to the other side in one piece' (Lewontin 1991: 83).

The same sort of dualism exists with respect to 'self' and 'system' in sociology and psychology, even though its predominance has declined in recent years. Forty years ago, Bateson and Ruesch presented the assumptions of the dominant discourse – in order to criticize them – rather well. Sociologists and anthropologists at that time attributed order in society to social forces external to individuals; that is, social order derived from norms, values, and symbols which impinge on and constrain individual action. Equally, psychiatrists at that time discussed 'coherence,' the psychological constitution of personality, in relation to the force of symbols external to the individual impinging upon 'mind' or 'personality.'

According to these disciplines, norms, values, and/or symbols constituted an order of objective constraints, external to individuals and therefore independent of activity on their part. In all classic statements of positivist social science, external constraints are the source of control of individual behaviour and of individual response to social order. Constraints become *internalized* through two forms of application of social power. One is to be found in processes of domination, in which political and legal sanctions push external values onto the internal beliefs of individuals. In the second case, external values become internalized through childhood socialization, as an outcome of 'habitualization,' the nurturing process undertaken by mothers, fathers, siblings, and other family members.[1]

Bateson and Ruesch would have none of this. They proposed that individuals in communication with each other *construct* 'values,' 'symbols,' and constraints. There are no values 'external' to the relations of communicators in any system. Therefore the conditions of codependency which arise between 'self' and the system are conditions which 'selves' construct. This did not mean that all constraints and stabilities in a communicative order arise directly out of conversations which individuals had with each other. Some constraints arose from the communicative order itself and were common to all systemic patterns of communication. But communicative constraints, they argued, are entirely different from constraints supposedly derived from the external 'power' of the social system. They invited their readers to imagine a system in which constraints, boundaries, and stabilities are nested within the networks of interactions of system members and in which system constraints are mutually coordinated.

Their joint book, *Communication: The Social Matrix of Psychiatry*, also addressed another issue. The dominant view of dualism led to the construction of two separate and distinct social sciences, the one observing social forces which arise in society, the other recording perceptions arising within the individual. This split was not merely academic; it matched the fact that Western society really does talk and act as if external social constraints and individual perceptions are separate from one another. Bateson and Ruesch proposed that humanity lives by those propositions whose validity is a function of belief in them. Therefore, a belief in social values must in some way lie in a circular, causal relation to their perception, and vice versa (*Communication* 1951: 212).[2]

MUTUAL CAUSAL CONNECTEDNESS

Bateson and Ruesch's view of mutual causal relations has its own political reverberations. If there is no environment independent of the organism, or 'self' separate from communication of propositions of that 'self's' beliefs, then mutual connectedness gives rise to causal sequences in which 'selves' (or organisms) both create the systems they are in and transform them.[3] Bateson's depiction of circular and reticulate causality as an alternative to 'energetic causation,' as he termed it – positivistic causality – is presented in many essays. Here, I will examine one of his best known. Entitled 'The Cybernetics of Self: A Theory of Alcoholism,' it first appeared in 1971. It was republished the following year in *Steps to an Ecology of Mind*. Although it deals with the phenomenon of alcoholic addiction, Bateson wrote it as an essay on the nature of control and power.

Bateson proposes that human order is not mechanistic; that is, behaviour is not organized around fixed paths which passively react to external stimuli. Instead any movement occurs through some form of mutual causal coordination. Communication and some form of learning are important aspects of mutual coordination. In particular, learning about change is an important component of the relationship established between 'self' and the system of which it is a part. Coordinate adjustments occur through grasping implications of change and then adapting – or failing to adjust – to conditions of change.

'The Cybernetics of Self' is one of Bateson's great essays. As with all of his great essays, it not only speaks of the question at hand but also demonstrates the nature of the question in the presentation of it. Bateson presents order as a unity of many levels. By contrast, the dominant discourse of control and of social power reduces the multi-level phenomena of order to that of an association of system components at a single level of interaction. As is typical with Bateson, not only is his essay about a multi-level phenomenon, but also it can be read at several levels of interpretation. First, there is the inductive problem, the 'fact' of alcoholism and a pattern of addiction to alcohol. One might call this a fieldwork problem. Second, there are the theoretical questions about the nature of causal mechanisms which systems of communication exhibit. The pattern of addiction occurs within a system of continual oscillation at many interacting levels. The behaviour of 'self' is dynamic and is linked to the continual oscillations that such a system displays. Third, there is explication of an epistemological problem. How does any setting yield in such a system an understanding of stability and/or change in the system as a whole, which in turn yields an understanding of 'self' and its transformations?

The epistemology of 'Cybernetics of Self' is valid for other contexts also. An extension of its arguments about control and compulsive behaviour evokes the premises of our own interaction with the biosphere. Can human beings 'control' the environment? Or is the whole world of nature unresponsive to human control? Are we correct in seeing our relations to the environment as becoming stabilized by reductions in human energy consumption? We shall see why Bateson maintained that our ecological dilemmas are reinforced by the presumption that ecological order is driven by energy consumption or can be managed by attempts at energy control. Mutual causal systems are unlikely to respond directly to changes in energy throughput. These ideas are spelt out more fully in the contrast between ecological models, the one derived from energy consumption the other from mutual causal organization, presented in Appendix 1.

THE 'LOGIC' OF ADDICTION

Alcoholism is an illness whose symptoms are well known to many people. Underlying the illness is an equally well known, but less well understood, pattern of addiction. The addiction of the alcoholic drives him or her to drink, even though the alcoholic may be aware of the dangers in uncontrollable drinking. Addiction, therefore, is associated with some form of recurrent compulsion. This recurrent compulsive behaviour will be repeated no matter what the dangers to the alcoholic.

Bateson considers why an organization called Alcoholics Anonymous is able to counter this pattern of addiction when other therapies fail. According to Bateson's interpretation of AA procedures, the first step in transforming the pattern of addiction is for alcoholics to recognize that they are alcoholics. Subsequent steps of the famous 'Twelve Steps' make alcoholics aware that the 'self' alone cannot treat the disease. Alcoholics come to realize that they are not 'captains of their own souls,' individuals who are capable of being in charge of their own destinies, but are, instead, 'powerless' over alcohol (*Steps* 1972: 312). From these steps emerges an important insight into patterns of alcoholic behaviour and their 'logic.' Typically, alcoholics dismiss suggestions that their relationship to alcohol is disruptive, either to their own or other people's lives. And typically alcoholics act as if they are self-contained, autonomous units. AA does not treat alcoholism as a disease in the normal sense of that term, although it recognizes that psychological denial of the disorder in alcoholic behaviour may be said to be 'sick.' Drinking is said to be a symptom of error in the order of the addict's relations to his or her social world.

The restorative 'logic' of Alcoholics Anonymous lies in the way in which AA treats addiction as a problem of disorder in relations among human beings. The 'cure' that AA offers lies in learning how to change patterns of experience. Unlike drug therapy or aversive therapy, the 'cure' of AA rests within transformations of ways that human beings order repetitive and recursive rhythms of their existence.

AA recognizes that any human system of order has various levels nested within it, Bateson says. Rather than considering addiction to be the result of a single-level interaction between the alcoholic and 'the bottle' - a clash of wills between the drinker and consumption of alcohol - AA recognizes that a reorganization of 'self' has to occur before an addict is cured; this reorganization of 'self' invokes many levels of change. Alcoholics themselves often do not recognize this multi-level phenomenon of self. Instead, they display an obsessive need for absolute control over those few objects which satisfy their addiction, especially 'the bottle.' In short, AA therapy recognizes that addiction to alcohol is a consequence of an unhealthy, or error-prone, relationship between individuals, their 'self,' and the system of which they are a part.

ALCOHOLISM AND CONTROL

Bateson began to consider the question of alcoholism in 1949, just after he had been relieved of his teaching post in anthropology at

Harvard University. Initially he did not propose to write about alcohol, but rather to write an essay on the nature of 'social change.' Like any other anthropologist, he wanted to compare stabilities and change in various cultures. He began with Irish culture, and he planned to contrast instabilities apparent in the family organization of Irish people with instability and social transformation which he had documented in his fieldwork among the Iatmul, the New Guinea people he had studied before the war (Notebook 12/Dec. 1949).

At this point he was specifically interested in two issues. The first was the way that recurrent cycles of behaviour within family or cultural groups led to instability; the second was how attempts to grapple with these recurrent cycles led to patterns of social conflict. By 1950 his work on the Irish had begun to focus on alcoholism as a cultural form. It was then he began to think about AA, noting that the AA program of rehabilitation did not appear anywhere in the psychiatry textbooks. It seemed to him that Bill Wilson, one of the founders of AA, was 'a master psychologist.' Bateson began to explore procedures at AA meetings. He made a note to himself of the title of the pamphlet regularly distributed at AA meetings. It was called 'The Power of Prayer,' and he noted: 'must get to the bottom of [the significance of] this' (Notebook 13/1950).

Bateson followed on by interviewing alcoholic patients. One interview provided information about a cycle in the pattern of alcoholic drinking – the recurrent cycle between taking the first drink and alcoholic amnesia. Another interview concentrated on hidden relations between the drinker and the drink. The informant, Bateson notes, was daring himself to drink, and in doing so 'dares self to catastrophe.' Another informant spoke of 'tightrope walking in dreams – Breugel demons connected with anti-Semitic feelings' (Notebook 13/1950).

The following year, Bateson felt he had sufficient material to begin an essay that he would call 'A Science of Peaceful Adjustment.' The focus of the essay would be a comparison between the 'war' in which habitual drunkards find themselves as they strive to win the war against their addiction, and the wider patterns of warfare which occur anywhere. Habitual drunkards beat themselves down again and again with alcohol and still 'in pride' return to the bottle determined to achieve control of their drinking, Bateson observes. The process may end in death, or in other ways, in the bitterness of self-repudiation. So, too, with the combatants in war.

He wrote in his notebook: 'Warfare – like alcoholism is an addiction in pain and despair, pride and good intentions [and in which] we search for a panacea – a science of peaceful adjustment.' Nevertheless, the first step in achieving such a science is the bitter acknowledgment that no such science is possible. The pattern of addiction cannot be managed in this manner. Bateson notes that AA holds that 'there is a power greater than myself,' or 'I believe in God,' and strangely with this acknowledgment – with this change in the alcoholic's view of himself – comes a dawning of new possibilities. 'We scream for control. And we scream for hope ... But faith?' What does this act of faith accomplish? Apparently, 'that condition that we be willing to let it [happen],' a condition which is not so easy to meet either for alcoholics or in confrontations in war.[4]

THE 'POWER' OF PRAYER

The AA notion of the 'power' of prayer is very different from other scientific models of dynamic interaction based on concepts of social power, notes Bateson. The dominant discourse conceives of social order as the aggregate of interactions of separate units clashing with each other. The 'power' of interaction in such systems, as social scientists conceive it, is much like the impact of billiard balls. This view goes no further than repeating versions of causality common since the sixteenth and seventeenth centuries and can be found in the mechanics of Newton and Descartes.[5]

By contrast, AA notions of therapy are a good example of circular causal sequences – relations of mutual feedback. In other essays, Bateson points out that the phenomenon of mutual causal, non-linear, and recursive sequences had only become apparent to science during the mid-years of the twentieth century. Mutual causal systems are always in continual oscillation. Oscillations in such systems do not occur at one level only, for the characteristic order of such systems is that they have several levels and several 'circuits' between levels. Oscillating systems with several levels commonly undergo reversals in the pattern of oscillation which affect their circuits at various levels.

Bateson implies that a reversal of oscillation in various levels of an oscillating system could be considered as shifts in polarity. If so, the reversals in polarity are not the same as the sort of reversals or oppositions which social science talks about. When social scientists frame social actions as 'causes' or as consequences of the application of social power, a reversal or a conflict is reported as being 'logically opposed' to the coherence of the system. In other words, 'contrariness' or conflict is defined in terms of mutually exclusive activity between a system and the units of a system: one type of action is logically opposed to another type of action and negates it.[6] The logic of mutual exclusion can permit one or the other, but not the existence of both. Yet polarities, or contrary patterns, frequently co-exist in oscillating mutual causal systems.

All multi-level oscillating systems can undergo escalating cycles. This indicates that the pattern of their operation is non-linear, and that their dynamics are responsive to thresholds. Escalating cycles occur when the many levels of the system become entrained. Under these conditions, they may speed up until there is 'runaway.' Thus the 'false pride' which alcoholics commonly have, and which they attribute to their own ability to control their addiction, leads to an escalation of their own drinking pattern. At some point in the escalating oscillation, a threshold may be reached. Once over this threshold of mutually coordinated constraints, the system may 'runaway,' and its total disintegration may occur. Bateson depicts this situation as happening when the alcoholic who is on the daily treadmill of hitting the bottle suddenly reaches a threshold 'on the other side of death.'

At this point built-in limits or thresholds of an oscillating system may cause an escalation to plateau or even to undergo 'inverse progressive change.' Thus the alcoholic has a particular disaster, or a series of disasters, in which he or she 'hits bottom':

> The panic of the alcoholic who has hit bottom is the panic of the man who thought he had control over a vehicle but suddenly finds that the vehicle can runaway with him. Suddenly, pressure on what he knows is the brake seems to make the vehicle go faster. It is the panic of discovering that *it* (the system, self *plus* vehicle) is bigger than he is. (*Steps* 1972: 329–30)

In human organization, one might call this moment of dramatic transformation a change of pattern or habit. In technical language, the reaching of a threshold is associated with a 'step function,' a movement in the pattern of oscillation from one state to another. One outcome is death. There is another outcome for the alcoholic trying to reform. Hitting bottom results in the formation of a 'healthy relation between each person [within the AA group] and this Power [of the larger system].'

LEARNING AS CAUSALITY

Bateson's essay shows that a change from addiction to sobriety is somewhat precarious. Change in the sober state appears to be accompanied by a new set of relations between 'self' and 'other' and by new understanding of the context of these assumptions. In other essays, Bateson carries out an extensive investigation of the nature of 'learning,' and he imports some of the results of these investigations into 'The Cybernetics of Self.' He states that all individuals and social groups learn about the world of human affairs through learning about the contexts in which those affairs occur. Learning at this level is largely unconscious and is self-reinforcing. More generally, learning involves change in habituated behaviours, and learning about how to change habituated behaviour.

The existence of levels of learning – from habit all the way to higher order learning – is a fundamental aspect of individuals and of communicative systems in general. The AA 'cure' is an example of higher order learning, a type of learning that occurs rarely in life because it requires individuals to take account of their moving from one system of relations to another. The higher order pattern of learning requires change in a set of premises, and such learning is 'epistemological':

> If a man achieves or suffers change in premises which are deeply embedded in his mind, he will surely find that the results of that change will ramify throughout the whole of his universe. Such changes we may well call 'epistemological.' (*Steps* 1972: 336)

Bateson argues that the false pride which is characteristic of alcoholics is epistemological, and that the premises of false pride – expressing control over the bottle – enter into the whole pattern of alcoholism. This is why addiction cannot simply be perceived as a disease which affects individual victims who become alcoholics. 'Pride' exemplifies an epistemology of 'self' in which the self is presumed to be cut off from that of which it is part. Alcoholic 'pride' is also an attempt to maximize self-control through conscious control of external circumstances. This perception of control and of mind controlling its own environment is the hallmark of an epistemology of dualism in occidental civilization.

The refusal of the alcoholic to recognize a broader system of which the self is part, and the continual attempt of the self to maintain control through direct purposive action, lead to that type of inevitability which the Greeks called *hubris*. A healthy self requires several levels of understanding in order to achieve stability, and not all of these are derived from an autonomous self. Nor can they be totally derived from direct, conscious action of an autonomous self upon the environment. In short, a stable self requires much more than the single level of awareness that purposive conscious control provides. It requires a multi-level setting, that which the West calls 'unconscious' or 'preconscious' aspects of mind.

EPISTEMOLOGY AND SOCIAL POWER

In the rest of this chapter, I intend to enlarge on the links Bateson draws between communicative order and his own theory of consciousness. His theory is developed, in turn, through a contrast and an analogy. The *contrast* is that between the characteristics of non-linear, multi-level oscillating systems and the causal characteristics of mechanisms of the Newton and Descartes type. The former give rise to patterns of causality in communicative systems, while the latter give rise to metaphors of social power. The *analogy* is that which he drew between causality and setting in these two contrasting systems. The analogy, together with the contrast, lead to a discussion of notions of social power and its alternatives; they also lead to an examination of the occidental theory of consciousness and its alternatives.

To quote Bateson, metaphors of social power are a corrupting influence on modern thought (Letters, 1385-5d/1974; GB, 1974l: 26–7). The notion of politics depending on 'power,' as if that power were the same as horsepower or watts of energy, is totally unacceptable for any explanation of biological and social behaviour. 'Power' in this sense must be looked at as a metaphor promoting self-validating error. In Bateson's view, sociological theories of political action have always used power as if there was a real world of impact, forces, and energy. The study of politics is riddled with models of social power, complete with inputs and outputs of 'power' expressed as zero-sum games. The constant use of the word 'power' gives rise to the notion of unrestrained power, and this makes it possible to say – quite inaccurately – that 'A has more power than B,' or that those with 'more power' will always be more powerful. Behind such statements is the supposition that all social activity is, in the end, atomistic, and that causes and effects in social interaction are of the push-and-pull type – linear and transitive.

Bateson believed that metaphors of power are an indication of a deep attachment to physicalist and mechanistic explanation in Western sciences, both physical and social. Yet social systems, like ecological systems, are primarily systems of information and communication. When communication and information are substituted for mechanism and atomism, the errors of mechanistic interpretation become more obvious. If physical force were transformed into 'information flow,' then scientists' attachment to the metaphor of power would recede, and the *idea* of power as a type of physical energy would be discarded.

Bateson admits that 'powerful interaction,' in the established sense of that term, occurs in communication systems, for some individuals derive their power from control over information flows.[7] Yet such control is always subject to system constraints, and an individual can only control the system up to a certain level. As he put it: the tiger is only part of the forest, the actor only part of the play (GB, 1974l: 26–7).

SOME DIFFICULTIES OF INTERPRETATION

Bateson is committed to an epistemology of pattern and form. This epistemology assumes that people operate within fields of habitual or repetitive activity, expressing customary rules of relationship. Within this field of interrelationships, an observer must concentrate first on finding out what propositions are prevalent and then observe how particular people have learned, or modified, relations in an on-going system of events. In an event-centred approach, no forces are postulated. The 'field' or 'setting' is made up of patterns or configurations of behaviour adjusting to each other at many levels of the setting.[8]

An obstacle in Bateson's approach is that his communicative epistemology makes an uneasy shift from empirical examples of the use of power to an epistemology of pattern and form. It involves a shift from inductive empiricism of first-order observation to a discussion of the belief or myth of power, which is largely a second-order discussion. A second-order discussion probes ways in which concepts of power are formulated and maintained. Since many of his readers trained in the social sciences cannot think of the processes of politics except in the first-order terms of empirical power relations, Bateson's refusal to acknowledge their validity introduces an immediate difficulty.

For example, Bateson discounts the empirical circumstances of power (i.e., the sort of power derived from a barrel of a gun) as a valid source for a notion of power. When he discusses Josef Goebbels, the former Nazi minister for propaganda, he avoids any mention of the military force which any Nazi party functionary had at his disposal. Bateson argues that Goebbels believed he was powerful and in control of the Nazi propaganda machine when he was, in fact, guided at every stage by informers, that is, by circuits of information in the system as a whole. Bateson argues that Goebbels was fundamentally wrong in his assumptions of control, and since he was wrong, it was inevitable that his mistaken beliefs of control would in the end destroy the very elaborate propaganda system he had constructed. In effect, political leaders who believe they are 'in control' of their own political situation are mistaken ('Human Nature,' CAF 142-A8/1969).

In the same article, Bateson argues that his example of the fallacies of control exhibited among members of the Nazi propaganda ministry could be extended to other contexts. He cites the outburst in Watts, a largely black suburb of Los Angeles which rioted in 1965. In Watts, black people had become enraged by their overwhelming feeling of frustration and deprivation. 'The scream is necessary,' but if the scream is not listened to, then Bateson advises, destruction of persons and property in the name of Black Power is no solution. The likely result of property destruction would be to compel those against whom the scream was directed to hold on tighter. As a result, black-white conflict would escalate into a situation which would make all solutions to the conflict less possible.

Conventional social scientists would have little trouble in categorizing the above examples as either state-induced terror or racism, with both cases demonstrating the fact that control and power exist. In the conventional view, power is a means through which domination of others occurs, and for many social scientists all conflict in society is an interactive field of power.[9] Bateson insists that whenever social analysts discuss social power, they engage the issues at the wrong level of analysis. 'Power' is a myth and thus requires a reflexive discussion about the metaphor of the myth. We should not discuss power on the basis of an empirical analysis of the 'reality' of force. The '*myth* of [empirical] power always corrupts because it proposes always a false (though conventional) epistemology' (Bateson, in Sluzki and Ransom 1976: 106).[10]

Furthermore, arguments about power always conjure up metaphors derived from physical energy. If these metaphors are applied to living systems, all subsequent explanation is fallacious:

> In principle all metaphors derived from a physical world of impacts, forces, energy etc., are unacceptable in explanations of events and processes in the biological world of information, purpose, context, organization and meaning. The power metaphor must be pulled to pieces for whatever meaning it has - and must be looked at, as a functioning falsehood or error, causing what pathologies? Self-validating up to what point? (GB, 1974l: 27)

It may seem odd *not* to see power in the realm of human relationships, but Bateson stressed that the attribution of power and control always became a stumbling block to solutions to conflict because it is always self-verifying (Bateson quoted in Keeney 1983: 131).[11] In his discussion of the situation in Watts, he suggests that the only resolution is to accept that one's own position is part of a larger situation. He speaks of the necessity for social interaction involving the two opposed sides in which both sides have pride and humility rather than arrogance. 'Any move that will increase trust, responsibility and love will be a valuable contribution.'

Considered as the short-term solution to an empirical problem, this seems far-fetched. But he would have us pay attention to the distinctions between (a) fundamental principles of a propositional order and (b) empirical observation of the situation. Bateson insists that fundamental propositions, which derive from the setting of the whole system, are not reducible to empirical data at a single level of description. The problem with most conventional social science was that it proceeded with single-level descriptions, he said, and so confused fundamental propositions with heuristics, rules of thumb. Fundamentals, rigorous propositions in his view, are always distinct from empirically induced truths. Bateson believed that the behavioural sciences have all too often assumed that fundamental principles can be constructed directly from empirical evidence. There must always be two beginnings to any explanation, observation *and* fundamental principles. The two are non-substitutable; each is authoritative in its own right (Bochner, in Wilder and Weakland 1981: 73). Each requires its own description, and we must proceed, he said, by developing a double description which includes both. Behind this argument lies his belief in the fundamental prospositions of communicative order, namely those of 'circularity,' mutual causation, and multi-level interaction.

There is one final issue. Discussion of the application of political force is nearly always considered in social science literature as a matter of degree. As a result, social power is subjected to quantitative analysis. The truth or falsity of expressions of degrees of power is conceived of along a single dimension. Yet this quantitative analysis of power, an analysis of the 'logic of degrees,' cannot reflect the many levels of value that are characteristic of human organization. In particular, the single-level analysis of 'degrees of force' cannot permit distinctions between qualitatively distinct levels of power which inevitably enter into any relationship of conflict.[12]

Because it relies on quantitative analysis, conventional social science proceeds by mapping data onto heuristics, and, when the heuristics are deemed to be satisfactory, goes out to collect more data and maps that onto the prior data – a process which supposedly provides a better 'explanation' of the phenomena.[13] Social science is full of such heuristic devices, which are offered as explanations – among them anxiety, ego, competence and motivation, and, of course, power. Power, however, is an especially notable case since not only is 'power' a heuristic, but it is a false heuristic. This is why Bateson referred to the *myths of power* rather than to the concept of power itself. Any statement that political success depends on power is itself corrupting. Those who relate power to expertise are people who themselves are the myth-makers who validate myths of power.

A THEORY OF CONSCIOUSNESS

Before Bateson began to label his work an epistemology of mind, he called his approach a 'theory of consciousness.' His critique of the relation developed between consciousness and purposeful action by Western science during the last century is consistent with, and overlaps, his critique of social power. Western science and philosophy since the sixteenth century have taken consciousness to be self-evident, Bateson said. Consciousness was the primary data of knowledge – '*cogito ergo sum*' – a premise from which Western society could go on to study the remainder of the universe. Consciousness had become a 'tool' in the syntax of our explanations, not itself a phenomenon to be investigated ('The Problem of Consciousness,' CAF 335/1950). Western science and philosophy gave little consideration to the proposition that consciousness was a relative phenomenon, or that the forms of consciousness could be approached in cultural terms.

Bateson argued that Freud's battle for the proposition that a large part of psychic life was inaccessible to consciousness had certainly changed Western belief. No longer was mind simply a tool with which to construct rational explanations of the universe. Freud's writing on the unconscious evoked another pattern of mind against which the processes of conscious thinking could be compared. Yet, Bateson noted, neither Freud nor his contemporaries of the nineteenth century considered consciousness a problem worthy of being investigated.

Indeed, Freud raised further dilemmas. He seemed to believe that unconscious processes of the mind could be explained in the same manner as the conscious mind. Freud almost believed that the unconscious mind had 'its own private organizing consciousness inaccessible to the more familiar consciousness of the upper levels' (CAF 335–A2/1950). Yet the structure of consciousness *was* an open question, Bateson argued. What was required was a theory of consciousness that fitted what we now know about the unconscious. This would pave the way for a greater understanding of the relations of consciousness and unconsciousness as levels of mind.

The way to resolve the Freudian dilemmas was to adopt the reverse of the Freudian approach. That is to say, instead of describing the unconscious in the image of the conscious, it was necessary to describe the conscious mind in order to fit consciousness to what we now know about the unconscious, and to fit both 'with what we know of all communication networks.' The remedy for the ills of conscious purpose lie with what Freud called 'the royal road to the unconscious.' Though Freud was referring to dreams, a wider definition would include 'the creativity of art, the perception of art, and poetry ... the best of religion ... all activities in which the whole individual is involved' (*Steps* 1972: 438).

Bateson's previous years as an anthropologist had made him well aware that the relation between the conscious and the unconscious varied from culture to culture. For example, a society of shamans and a society of physical scientists hold very different evaluations of the importance of the relationship between consciousness and unconsciousness.[14] Shamans among the Iatmul of New Guinea claimed that they were able to 'see' *ngglambi* – a black cloud or aura surrounding a person. Iatmul believed that a person with a black *ngglambi* would encounter tragedy. Here unconscious processes enter in so determinate a way that unconscious processes of thinking – myth, dream, ritual – inevitably affect the way in which a society constructs its epistemology. In our civilization, however, the importance of consciousness becomes progressively exaggerated vis-à-vis unconsciousness. With the aid of cybernetics, Bateson felt a reversal of Freudian approaches to consciousness was entirely possible (CAF 335–A4/1950). The premise of the reversal was to draw a distinction between the purposive-conscious mind, and the single-level analysis of conscious agency which flows from it, and an alternative theory of consciousness in which 'mind' is perceived as a combination of levels which includes both the purposive-conscious mind and non-purposive components.

Aesthetic expressions, for example, are non-purposive. Perceptual and aesthetic activities do not assume well-formulated purposes, nor do they assume definite motivations or the presence of clear intention. Notions of the good and the beautiful, the activity of play and ritual, derive from purposes that have no other motivation than engagement in creative acts.[15] Bateson insists that all conscious-purposive action should be balanced by other forms of understanding which are *not* purposeful and *not* linked to clearly defined intentions or prescriptions.

He notes that too often Western social science transforms that which belongs to the patterning of the perceptual into the activity of moral-practical judgment. This, in turn, reflects the importance that the Western world attaches to conscious decision taking. A self-evident fixity of conscious action pervades all Western theories of social change.[16] Western epistemology defines consciousness as 'action by a doer,' while unconsciousness is defined as its antonym. Bateson maintains that these definitions render unconsciousness as too passive and too fixed a phenomenon, while consciousness itself is regarded as an entirely independent factor in social change. That is why social change in Western social science is examined as a type of moral change. Bateson's analysis of social change considers the overall communicative patterns in which conscious-purposive activity lies. It takes into account not only the possibility that consciousness itself undergoes qualitative change in social change, but also the possibility that there are changing rates of consciousness in the process of social change.

The emphasis on moral change is also a by-product of the division between consciousness and the remainder of mind, he says. Occidental people expect to be articulate about moral judgments because moral judgments presume a predominance of conscious activity in our society. Most social theorists who discuss social change assume that human consciousness is relatively static and that society undergoes change by continuous adjustment to circumstances external to individual perception and external to the qualitative features of consciousness.

Yet purposive-conscious activities lack systemic wisdom; they often require remedy, for they are partly blind to the systemic nature of mind as a whole. Thus the whole weaving of the 'inner' individual process of perception and aesthetic sensibility with the 'outer process' of action is subtle and complex. Purposive action becomes arrid when such principles are ignored. In a memorable phrase: 'Are there *necessities* of poetry without which prose is pathogenic?' ('Size and Shape in Mental Health,' CAF 299/1979).

PATTERN AND GESTALT

Bateson's theories of consciousness support his wider arguments about patterns of 'mind.' He argues that the supposed mystery of mind turns out to be a means of foisting materialist assumptions about reality upon us. The Western world since Pythagoras and Plato has known that pattern is fundamental to all ideas and mental processes, yet 'this wisdom was thrust away and lost in the mists of the supposedly indescribable mystery called "mind."' Underlying this false attribution of mysticism to mind is an inability to pursue pattern in natural order. To grasp pattern is to presume a fundamental 'emptiness,' and emptiness is profoundly disturbing to any materialist:

> Mind is empty: it is no-thing. It exists only in its ideas, and these again are no-things. Only the ideas are immanent, embodied in their examples. And the examples are again no-things. The claw [of a crab when compared with the gross anatomy of other creatures] ... is not the *Ding an sich*: it is precisely *not* the 'thing in itself.' Rather, it is what mind makes of it, namely an *example* (of resemblance) of something or other. (*Mind* 1979: 11)

Materialist science juxtaposes 'reality' with identifiable location. Much of modern scientific technology is used as an extension of human sense organs so that things can be located in an identifiable space. For example, the modern microscope aids the eye to measure and to identify visual ranges which the natural organ is unable to see. Pattern, by contrast, is not locatable. It has no location in the object observed; instead its existence results from a relationship of comparison or contrast *between* two objects.[17]

Another illustration of the non-location of pattern is the one Bateson gives of the difference between a blind and sighted person:

> A seeing man on entering a room will use his eyes to obtain spot-for-spot images of what is in the room. The blind man, using wind currents and echoes, will get much of the 'same' information but in very different form. If a sofa has been moved to a new position under the window since the last time he visited the room, the *difference* between the room then and the room now will be perceptible to him, wherever he is in the room. (GB, 1975g: 135)

This illustration concentrates on the systemic properties of non-locatability within a system of differences and the means through which it is possible to detect change and learn about the system. A blind person is by no means prohibited from 'reading' changes in a refurbished room, but there is a difference between the ways in which the sighted and the blind undertake their 'reading.' Unlike sighted people, blind people must perceive complex interrelations of difference through some form of 'scanning' process. Bateson describes the system of differences which they 'read' as 'hologramic,' by which he means that part of the whole is contained in each part.

The distinction he is trying to draw is between conventional science, 'the sighted person,' who reads change through precise identification of bits of information, and a reading of the hologramic pattern. Blind people cannot locate a single piece of information but can rely upon the fact that all parts of a system carry information about change:

> A component of the change will be everywhere in the room and will be especially evident as the blind man moves around ... all parts of the system will be changed when any part is changed. So that to sense organs which can register the change, all parts of the system carry information about the change ... [but] a scanning process usually will be necessary. (GB, 1975g: 135)

Inductive explanations in conventional science are arrived at through experimentation, the storing of knowledge of bits and pieces, which have been located, measured, and minutely described. This permits generalization of their characteristics from induction, the generalizations being based on manipulation of data and verification of the measurements undertaken. Knowledge gained through sensing change in resonating systems (the blind person, the stick and wind currents and echoes) relies upon scanning mutual interaction of many packets of information. Here knowledge is neither gained through local packets of information, nor is it stored in this manner. Unlike inductive knowledge, knowledge here is 'spread around' knowledge.

Sensing patterns of redundancies (see chapter 6 for further discussion of this term) in resonating systems requires prior experience or knowledge. As Bateson states in his example, some special skill and knowledge is required for the blind person to undertake a scan which will give an adequate 'reading' of the system, patterns of difference, contrast, and shape. But given this skill, the redundancies which exist between all parts of such a system enable a blind person to make an educated guess from part of the system to the whole. And unlike our understanding of change derived from inductive knowledge, the changes which a blind person interprets rely on the fact that all parts of the system are changed when any part is changed. Hologramic characteristics can be found in all resonating systems, Bateson said, and resonating systems are clearly evident in the network of the mammalian brain and play an important part in information retrieval. They are 'probably' relevant in ecology and evolution.

Finally, Bateson held that the differing levels of consciousness and unconsciousness – as with the differing levels of action and perception – form steps in which there is a reflexive shift *from the more concrete to the more abstract* ('Four Lectures,' CAF 126–B10/1955). Reflexive shifts are a crucial part of any process of learning and are crucial to high-level reframing of propositions, the transformation of epistemology. The visual concomitant of this reflexive shift is reconfiguration of percepts or gestalt. However, the 'step' between one percept and a new percept, between one gestalt and a reconfigured gestalt, is a peculiar one.

A gestalt, because it relates to a whole, is not a unit of information in the same way as an empirically derived concept; for it is an aggregate of information. Any attempt to place gestalten alongside propositions or values, as if they were both positive structures, will lead to trouble, he said. It confuses a process of patterning, the grasping of a whole, with processes of grasping parts of a whole:

A gestalt is an aggregate of information, but is not a unit of information. To add gestalt [*sic*] or to count them leads to trouble ... [A gestalt consists of positive and non-existent information] ... non-existent cues are a universal ingredient of gestalten ... gestalten may be spatially or temporally delimited. Essentially there is no difference between them ... A reward, however, seems always to be related to temporal rather than spatial delimitations. The cues of delimitation being in both cases non-existent ... [segmentation of information into gestalten is related to the fact (perhaps) that learning only occurs with sequences of reinforcement]. (Manuscripts, 1948–9, CAF 166-K8–9)

The patterning of a gestalt may include an ordering in time so that one can speak of 'a wider gestalt' as an aggregation of relevant information, but its relevance cannot be drawn from conscious segmentation of information. Thus analogies between learning as purposive human activity and learning as a change of gestalt perception tend to break down. Processes which activate gestalt perception deal with aggregates of information which appear to be grasped in a shift from static to temporal sequences. Thus, in moving from one percept to a new percept, not only is there a reflexive shift from a unit of information to aggregate information, from the concrete to the more abstract, but also from the static to sequences in time. In the AA case, for example, a shift in percept occurs as the alcoholic begins to be cured. The alcoholic discovers a self in a dynamic system very much broader than the alcoholic originally supposed.

SUMMARY: ALTERNATIVE CAUSALITY

Alcoholics Anonymous is an organization which through its own practices developed a notion of mind and a notion of power very different to that prevailing in Western metaphysics. Western science assumes that a large part of mind is concerned with consciousness and intentional action; and that individuals are able to direct and control events. It sees 'mind' as separate from the body and conceives mental disorder in the manner of an objective disorder. At a practical level AA's approach to the problem of addiction is oriented towards learning and is reflexive, not dualistic.

Bateson argues that the success of AA's approach to alcoholism lies in understanding how inappropriate learning stems from fallacious beliefs of individual control, beliefs which are themselves epistemological. AA procedures provide a means for transforming the epistemological fallacy, or error, into a set of healthy premises about the relation between 'self' and 'the world.' The essay on AA is a demonstration of the way in which trust can alter the false beliefs or false premises of causality, with 'trust' and 'belief' being the outer dimensions on which a recursive order of interpersonal relations (self with others) is constructed.[18]

It is also an exemplification of the notion of a setting, and in this sense is a fundamental contribution to social science. Bateson is always presenting an insight into change and adaptation within a discussion of 'setting.' He argues that learning is a natural process in the setting of living systems. So, too, reflexiveness is associated with learning. At the same time there are no ready-made categories inside the skin-bound head to prevent errors in reflexive mapping; nor are there any error-preventing categories 'outside' which can be grasped and internalized.[19] The errors we make are not easy to correct because they are buttressed by self-reinforcing feedback mechanisms ('Moral and Aesthetic Structure,' CAF 198-A2/1968; *Sacred* 1991: 254), as is the case, for example, of the fallacies of power and control. Thus mistakes are often not open to inspection.

Bateson explains that the AA example is not only valid for the small-world setting, but is itself a suitable metaphor for the logic of error in a much larger domain. Bateson's testimony on behalf of the University of Hawaii Committee on Ecology and Man in March 1970 extended his notion of addiction to what he termed 'the roots of ecological crisis.' He cited the use of DDT as an example of addiction. When DDT was first invented in 1939, it was an insecticide that was merely put to use in an *ad hoc* way. By 1950 it was known to scientists that DDT was seriously toxic to many other animals, but by that time there was a vast industrial commitment to DDT manufacture. At the same time, the insects at which DDT was directed were becoming immune; and the animals which normally ate those insects were being exterminated. Meanwhile, the use of DDT had permitted the human population of the world to increase. 'In other words, the world became *addicted* to what was once an *ad hoc* measure and is now known to be a major danger' (*Steps* 1972: 489). The wish to control nature, once expanded by vast uses of this industrial poison, had been bolstered by the conviction that 'another drop from the bottle won't kill you.'

Senator Al Gore seized on Bateson's model of addiction as an exemplar of Western civilization's dysfunctional thinking in its approach to ecology. Gore points out that Bateson's analysis of addiction is a casual explanation for an otherwise inexplicable situation. Our civilization is holding ever more tightly to its habit of consuming larger and larger quantities every year of coal, oil, fresh air, water, and topsoil, and we continue to indulge in the consumption of the earth itself no matter what the mortal danger to our civilization might be (Gore 1992: 220–1). Logically speaking, continued indulgence is absurd and will, if continued, result in runaway ecological degradation.

By implication, people fail to realize that they are addicted to patterns of consumption which disrupt a healthy relationship between themselves and the environment of which they are a part. A 'cure' to this addiction is required through reorganization of Western society's relations with its environment. No reordering of ecological context is possible until people realize that the source of environmental stress is their false sense of control and the patterns of fixation they have formed in their relationship with the environmental system of which they are a part. Thus Bateson's analysis of addiction and of dysfunctional thinking is easily extended to current environmental issues.

In his later writing, Bateson explores how our own theories of consciousness have ramifying effects on our inability to engender appropriate reflexiveness.[20] The prevailing combination of conscious purposeful action, management of the environment, and a belief in the use of high technology for solving ecological degradation is lethal, he argues. Herein lies the need for an alternative understanding of causality in ecology, an understanding of 'logic' in communicative and recursive systems. Even those committed to the more empirical analysis in sociology, biology, and ecology would have to agree that Bateson's discussion seems to fit an empirical situation in which the combined social and ecological effects of using force are totally catastrophic. Clearly, there are no 'matters of degree' in ecological survival. Conflict between industrial nations has now become so catastrophic that matters of degree in nuclear warfare, for example, have become transformed into all-or-nothing survival issues. It appears the same will be the case if national conflicts arise over massive ecological degradation.

3

The Map Is Not the Territory: Time, Change, and Survival

Bateson believed that he was living at a turning point of the history of science, indeed of the history of humanity itself, though this experience would require lengthy interpretation before the nature of the transformation was understood. Twentieth-century natural science was still committed to a materialist perspective, and in Bateson's view, materialist science claimed too much for its own theories. Nevertheless, physicists had begun to challenge, even 'dematerialize,' existing concepts of matter in the early years of the twentieth century, and Bateson paid the most careful attention to the history of this process.

We have dealt so far with Bateson the nonconformist, setting his views against established interpretations, indeed the traditions of whole disciplines - psychology, sociology, anthropology. This chapter explores a somewhat different perspective. Bateson was far more attuned to developments in natural science than most of his colleagues. As we shall see, he began to work with key premises of twentieth-century science and took these into account when examining social and biological issues. Among these twentieth-century ideas that find so prominent a part in Bateson's thinking are principles of indeterminacy; a reformulation of the concept of time; formulation of concepts of self-organization in biology; and the emergence of a concept of information. This chapter will consider each of these in turn.

It was Bateson's belief that both biological and social science dealt with indeterminacy and complexity in an unsatisfactory manner. In the years immediately following the Second World War, he wrote a number of short pieces spelling out the task of the social scientist as being to 'state, clearly and rigorously, just what types of complexity are special to the [biological and social] phenomenon with which we deal' (Letters, 852-3b/1946). Looking around him, Bateson found some who were prepared to share this perspective and follow it to evident conclusions. For example, those in biology who were opposed to the attempt to reduce biological phenomena to a subfield of physics took up the theoretical issues of indeterminacy apparent in the new quantum physics (discussed below) with some vigour. These 'general systems' biologists recognized that since physics itself had begun to wrestle with indeterminacy, then perhaps a greater number of scientists should begin to recognize that the axioms of classical physics were unsuitable for the types of complexity - or indeterminacy - associated with observation of biological phenomena.

Social scientists, unlike biologists, seemed to miss this point entirely. It was evident to Bateson that if natural science was undergoing profound transformation as a result of its wrestling with indeterminacy, then it was utterly inconsistent for social science to cling to outmoded concepts of determinacy that the hard sciences themselves were slowly abandoning. Yet social scientists continued to be happy with notions that human behaviour was determined by underlying physical or energetic processes. Some did reach back to the biological world to explain human behaviour in terms of its biological inheritance, but when they did so, it was usually by attaching importance to fixed patterns of behaviour - biological 'instincts.' Most disregarded biology and tried instead to create laws of human behaviour analogous to the mechanical interactions of physical particles. A good example was Bateson's first mentor in social anthropology, A.R. Radcliffe-Brown. Radcliffe-Brown proposed to appropriate the methods of the natural sciences in order to examine the network of institutionalized activity in human societies. His aim was to conduct a comparison of social institutions and, by cross-comparing social norms as if they were physical objects, create a set of universal rules about social behaviour. By so doing, Radcliffe-Brown hoped to remake social anthropology into a natural science of society (Radcliffe-Brown 1957).[1]

As discussed in the last chapter, Bateson's position was that the study of living forms commonly involves pattern, context, and meaning, and that none of these can be easily explained by the concepts of physical determinism - energy, force, power, external impact. The assumption of most physical sciences is that only quantitative description will produce knowledge and explanations of phenomena. This, too, was in error insofar as biological and cultural systems were concerned; physical science used methods suitable only for the description of a universe of material particles. When the physical sciences measured physical forces and impacts, through mapping dimensions of mass, time, and length, they provided a description of material 'thingishness.' Yet quantitative methods could not contribute much to an explanation of processes in living systems. In subsequent work, Bateson would even argue that materialist methods are only suitable for the description of a universe whose very 'thingishness' must, in the end, remain inaccessible to us (*Angels* 1987: 62).

Nevertheless, he recognized the importance of the conceptual revolution in physics. He became attached to the phrase, which originated out of the logic of the new physics, 'the map is not the territory.' Bateson interpreted the phrase as meaning that the ability of living forms to take their environment into account is not of the same order as physical interactions of the environment itself. The idea that the mapping process is *not* the territory gives rise to an understanding that there is a field of relations we construct between ourselves and the 'territory' – the 'objective world' – so that what we map is that relationship in which we participate, and not a direct representation of the things 'out there.'[2]

He held to this view when he moved on to discuss ecology in his later years. While other ecologists began to argue that modern physics can provide the scientific background to the changes in attitudes and values that our society so urgently needs (Capra 1983: 48), Bateson never accepted that holistic and ecological views are supported by the findings of modern physics. Even when this New Age approach became popular, blending ecology, physics, and spiritualism, Bateson held that ecology must employ different methods from those of natural science. In the field of relations we construct between ourselves and the 'territory,' the one (our physical ties to 'the territory') must not be confused with the other (the relations we discern in that territory).

His reasons were congruent with his notions of reflexiveness discussed in the previous chapter. Explanations, he said, are not only about the forms observed, but also about the science through which they are observed. The very explanations of science have circular or reflexive effects on the organization of the living forms being explained. It is this recursiveness which gives them the appearance of being 'objective' in a physical sort of way, though they are, in fact, patterns of information. We must search again for the powers to bind and to loose that are the building principles of life, he claimed. Old solutions were clear enough. The power to bind was physical and lay in the principles of energy transformation, which, in turn, derived from movement of atoms and molecules. The new answers were quite different. They lie in the coupling of propositions about ourselves in relation to the biosphere (*Angels* 1987: 175ff). We shall consider this below with reference to Bateson's discussion of survival.

INDETERMINACY

The Einsteinian principles of relativity, together with the development of quantum physics, fundamentally altered the highly deterministic expressions of the relations between mass, energy, and interaction of physical particles characteristic of natural science in previous centuries. Physics of the early twentieth century effected two major breakthroughs. The first was on a cosmic scale - the new theories of motion, mass, and the rate of time that appeared in Einstein's papers. The second lay in the microcosmic world of quantum physics. As a result of Einstein's special theory of relativity, the idea of absolute time, which had been fundamental to Western thinking since the age of the Greeks, could no longer be reasonably maintained. Einstein's theory stated that time was relative to the position of the observer. If a ray of light takes time to reach our eyes, it will take longer to reach us the further we are away from the observed object. Thus two observers at different cosmic distances from an event will see that event at different times. His special theory of relativity proposed that in relation to the observer, the velocity of light is always constant but that time is relative. Eleven years later, Einstein's general theory of relativity showed that mass also affected the rate of time; so that if the earth had been larger, the rate of time would be slower on it.

The overall effect of Einstein's theories was to take physics from a descriptive three-dimensional world existing in absolute time to a four-dimensional world of relative rates of motion in time. Normally, we perceive only three dimensions, two dimensions of space and one dimension of time. The fourth dimension was one which was not apparent and which Einstein had to construct in order to formulate the effect of relative motion on measurement of space and time. The fourth dimension was, therefore, a construct, *a space-time continuum* in which space and time are not abstract, separated, and fixed coordinates but rather are integrated into a field whose patterns form 'hills' and 'valleys' of space-time.

Subsequently, in the microcosmic world of particles, quantum physicists also discovered, to their own surprise, that the rules of observation which had for so long been incorporated into the methodology of Newtonian mechanics did not apply to subatomic physics. Newtonian concepts of matter stressed its absolute solidity, its exactly determinable state, and its reducibility to points. The development of quantum physics showed that properties of fundamental particles in the subatomic world of electrons do not, and cannot have, these Newtonian characteristics. In the microcosmic world of quantum physics, all those characteristics which had exemplified 'matter' in Newtonian science had to be reformulated.

With the emergence of quantum physics, modern science came to grips with the possibility of fundamental indeterminacy in the material universe. Observation in the classical world of matter and particles had always allowed the observer to chart the state of a particle of matter by recording both the position and velocity of the particle simultaneously. Observers of subatomic particles in quantum physics could speak precisely *either* of a particle's position *or* of its momentum, but they could not precisely chart both at once. This excluded the possibility of forming a consistent concept of the electron's state (Coveney and Highfield 1991). As several of the most prominent of the quantum physicists wrote, Werner Heisenberg among them, determination of cause and effect could no longer be pursued in the fixed 'objective' manner of classical physics. The observation of quanta always implicated the relative position of the observer; observers could determine either speed or position – but never both at once. In short, experimenters could not help but interfere with the experiment in some dimension in the very act of observation.

Physical science was placed in a quandary as to how it should treat its classical concepts of determinacy and objectivity. Clearly determinacy could not be fundamentally relativistic; yet notions of causality in quantum physics seemed to include measures of indeterminacy.

For many years, the implications of a mathematics of curved fields of space-time were understood by only a handful of scientists. Although the theory of relativity took many years to be absorbed by the public, philosophers of mathematics quickly recognized the profound transformation of principles of time, motion, and matter which it had produced. Science in the nineteenth century had considered pattern to be a static unchanging form, or, alternatively, a slow unfolding of continuous movement in space. Western idealist philosophy had been based on these classical conceptions.

Now these classical metaphysical conceptions of form had to be cast adrift. The profound reconceptualization of form, confirmed both by Einstein's theories and quantum mechanics, indicated that formal processes have shapes of their own – shapes which occur in relation to other formal events.[3] The English mathematician and philosopher Alfred North Whitehead was among the first metaphysicians to respond. He attempted a reconstruction of idealist thinking by translating the concept of form into the four dimensions of space-time which Einstein had deduced. Then he considered how our own three-dimensional perceptual constructs grasp pattern and form in such a relativistic field of 'events' and 'processes.'

FIELD THEORY: WHITEHEAD AND LEWIN

Whitehead's attempts to produce linguistic descriptions of space-time fields proved elusive and difficult to follow, although his most accessible work, a series of lectures he called *Science and the Modern World,* proposed an influential alternative philosophy of science in which concepts of *process, events,* and *organism* replaced the concept of *matter* (Whitehead 1967: 194).[4]

In the realm of social science, a German mathematician and psychologist, Kurt Lewin, carried Einstein's and Whitehead's field theory to a more narrowly circumscribed dynamic of psychological and social events. He had some success, as Lewin's work was used in some branches of social psychology until the 1960s. The subtle analogies of 'space-time' fields portrayed in Lewin's psychological account of field theory continues to be an important reference for those who challenge synchronic theories of psychological and social events (Bourdieu and Wacquant 1992: 196–7).[5]

In his 'field theory,' Lewin enlarged upon psychological constructs of the experience of time. The experience of time is, of course, reflexive and presents very different problems from the metaphysics of time. Lewin merged both temporal process and events and their reflexive social and psychological events into an overall field of relations, from which he derived topological 'maps' of their occurrence (Lewin 1951). Bateson followed Lewin's work with some interest, recommending Lewin's writings to his students. He expressed a much greater interest in Lewin than Whitehead, because Lewin's analysis, Bateson said, was the first to attempt a formal epistemology of pattern which related the internal events of mind (which were inevitably temporal) to external regularities. Lewin's psychological field projected a relation between inner and outer events onto a 'psychological space' located neither inside nor outside an organism, but which linked 'organism' to a field of which it was a part. This was a fundamental orientation for Bateson, one which he was to pursue for the rest of his career (Notebook 47/Nov. 1971–Feb. 1972).

Although Bateson expressed a lesser interest in Whitehead's work, he scarcely could have avoided him. The Whitehead's were friends of his father, and W. Bateson's emphasis on rhythmic order in nature was a result of a long and intimate friendship with Whitehead. It was through the matchmaking of Mrs Whitehead that his mother and father eventually became married (Lipset 1980: 22, 30). Gregory Bateson's great friend of his younger days, the noted biologist Conrad Waddington, was also much influenced by Whitehead, with consequences which will be mentioned in chapter 7.[6]

TIME AND CHANGE

Time is one of those fundamental principles which social sciences need to account for, but accounting for time is more difficult than recognizing its fundamental importance. One of the aspects of temporality that both Gregory Bateson and Whitehead concerned themselves with was relations between subject and object in time. Subject-object relations within a field of time assume quite different patterns than if the same relations are examined only as dimensions of spatial order – as in classical Cartesian methods. In the latter, subject and object appear to be quite separate. Within a temporal field, boundaries of subject and object are by no means so distinct, being defined by events which recursively draw on each other.

Bateson was not particularly concerned with the metaphysics of temporal fields, but the perception of subject-object relations within such space-time fields was a crucial concern. One of the peculiarities of observation of time is that while time is, in an existential sense, a necessity, the observation of time cannot be reduced to mere flux. If all is flux, and everything is changing and nothing remains the same, then it is difficult for the observers, who are also changing, to construct any point of reference. Without such a point of reference, there is no standard of comparison; and without any standard of comparison, knowledge of flux will only be very limited. The most common evidence for this is the experience of free fall sensed by parachutists and astronauts. The motion of falling out of an airplane and the experience of air resistance in the flux of the fall, by themselves, give no impression of distance covered or of velocity. Only through other points of reference can parachutists tell how far or how fast they have fallen. To engage these senses requires some form of sense or instrument which will indicate patterns of *both* change *and* not-change. There is a similar requirement for recognizing change in any temporal sequence; recognition of change requires a sense of not-change in stable patterns. The problem is that agreement as to 'what' is changing is also elusive. For patterns of change are not usually single-dimensional, nor do they usually occur at constant speed. Indeed, sensing difference in speed is intricately bound to recognizing and understanding a pattern of change.[7]

Relations of subject and object are associated with differently perceived patterns of stability and change; and issues surrounding recognition of what is changing and what is not changing, or sensing correctly differences between changes that are fast and changes that are slow, are ubiquitous in biological and evolutionary science. We need to know much more precisely how change is related to time in biological systems, Bateson wrote:

> The essence of the problem is that biological systems are commonly (?always) capable of both immediate adaptive change and [longer term] acclimation. But how much immediate adaptive change can be accomplished is limited ... If the demands for change do not come too fast, the system can therefore meet them. But what circumstances determine what is 'too fast'? (Letters, 1019–63a/1969)

The answer, he suggested, depends upon the levels at which we examine biological or ecological systems. In nature, we find the various levels working along together, necessarily so, but we badly need models of adaptation at all biological levels which will represent 'flexibilities' whereby the organism modifies the environment to suit itself.

In a formal sense, Bateson argues, there is a requirement for second-order feedback in which experience of change at different levels of order promotes an 'awareness of awareness' of patterns of change in living systems. He argues that second-order thinking should become a necessary and integral part of any thinking about 'creatura,' living systems. If this awareness of ecological awareness is understated or missing, its absence threatens our own survival.

ATOMIC SUCCESSION: WHITEHEAD'S PATTERN OF EVENTS

Among the prominent issues Whitehead addressed in *Science and the Modern World* and *Process and Reality* (the two texts to which Bateson commonly referred) were change and endurance; the eternality of objects in space-time; value and interfusion of elements in organisms; and the pattern of the whole which influences the characteristics of the subordinate organisms that enter into it (Whitehead 1967: 86–94, 123). These notions often found their way into the list of questions which Bateson posed to himself when examining new issues. Whitehead stressed the importance of the temporal, the integration of perception with action, and the necessity for all processes to 'take account of' bodily feeling in dealing with cognition.

Whitehead had been among the first to understand that the Western scientific theory of a fixed environment, which had always been analysed through a controlled series of measurements made by a precisely located observer, was no longer a tenable concept. Observers were themselves *in* an environment, and this needed to be taken into account in the study of specific types of 'enduring' organisms. In short, observers were part of patterns of events. In *Science and the Modern World*, Whitehead began to stress the way in which external patterns are an 'occasion' for the unity of the percipient and perceived.

Whitehead's 'pattern of events' intrigued Bateson, yet he felt that Whitehead's explanations were too metaphysical, examining change and endurance in an abstract field of space-time that had little relevance to processes of perception in living organization. Whitehead seemed to be concerned with events and processes as if they were discrete pulsations of an atomic order. He emphasized the atomic succession of temporalized events in which every spatio-temporal region implied the unfolding of another region which included itself as a part. This produced a concept of nature as a continuum, in which every imaginable 'hole' or gap is occupied.

The concept of microcosm as macrocosm was all very well, Bateson said, but he objected to the notion of a continuum of temporalities which stretched from the realm of living organization to the realm of inert matter. This was not consistent with qualities of reflexiveness which characterized mind in living systems. The crux of the dispute between Bateson and Whitehead was this: if the nineteenth century had reduced nature to a continuum of mere matter, the recovery of order could not proceed, Bateson argued, simply by producing another continuum, this one in space-time. From Bateson's point of view, Whitehead's processes of perception and creativity lacked a concept of levels and, without levels, could not adequately account for the full range of formative patterns which link mind to the processes of nature. The relations of perception and creativity were nested in steps, rather than forming the continuum which Whitehead described. The 'time binding' of percipient events – which was implicit in Whitehead's analysis – would require more extensive study in the light of levels and their nesting. As Bateson came to express the problem, the structure of knowing was inevitably full of holes and gaps, and was not well represented by a continuum. Bateson was able to draw from both Korzybski (see below) and cybernetics; and the latter provided him a means for explaining the phenomenon of 'gappiness.'

It is evident that Bateson, while disagreeing with Whitehead, made several of Whitehead's questions his own. Evolution always concerned organism *plus* environment, Whitehead said. In a situation in which the advances of technology were invasive, the key mechanisms of evolution needed to include an understanding of the evolution of a favorable environment. According to Whitehead, 'the key to the mechanism of evolution is the necessity for the evolution of a favourable environment, conjointly with the evolution of any specific type of enduring organisms of great permanence. Any physical object which by its influence deteriorates its environment, commits suicide' (Whitehead 1967: 109). This, of course, was one of Bateson's great themes.

The ordering of time in relation to pattern was also a common concern. In Bateson's view, Whitehead's depiction was clearly outdated by the advent of cybernetics.[8] Whitehead relied too much upon the physical analogy of 'atomic succession of events' in what he termed 'temporal processes of realisation.' And his methods proposed that atomic succession could be analysed 'into a group of linear serial processes,' each linear series of which was a space-time system (Whitehead 1967: 123). For linear and serial processes in temporality, Bateson would later substitute the non-linear patterns typical of cybernetic loops and information feedback. He would also carry this notion of non-linearity over to his discussion of perceptual process. The seriality of process which Whitehead made so prominent a part of his discussion of percipient events would be replaced in Bateson's writing by perceptual patterns responding either to repetitive self-adjustment or to systemic reorganization, both of which are typical of cybernetic systems.[9]

THE MAP IS NOT THE TERRITORY

Alfred Korzybski was a mathematical philosopher following in the footsteps of Whitehead. Bateson thought of Korzybski as a 'popularizer' of Whitehead and Bertrand Russell, and regarded Korzybski's ideas as a second-hand rendering of *Principia Mathematica* (Letters, 1519–8e/1970). Nevertheless, Korzybski was to have a profound influence on Bateson's conceptualization of the structure of knowing, of its reflexiveness and recursiveness. Bateson contributed to Korzybski's journal, *ETC* ... , during the 1950s, and his correspondence files from that time reflect the contacts generated by these publications.

He recognized that Korzybski's concepts of 'time binding' derived from Whitehead and that its concomitant – mapping repetitions contextualized to the moment of their occurrence – was an extraordinary contribution to the understanding of the relation between mind and 'the objective world.' 'Time binding' refers to recurrence, a predominant process in human and biological events, but also a pattern in physical events. According to Korzybski, the basic proposition of 'time binding' is that as a result of repetitions occurring in time, all repetitions are contextualized to the moment of their occurrence.

Prior to Einstein's theories of relativity, science and logic held to indefinite conditions of 'certainty,' for each had assumed that there was a substantive identity between the categories within which the world was described and the world itself. As a result of Einstein's juxtaposition of time in relation to motion and matter, all statements had to become contextualized in relation to the time of observation, Korzybski said. Thus the relativism of the Einstein-Minkowski equations was now fundamental to the way in which *all relations* of similarity and difference become intelligible to us (Korzybski 1949: 206–20).

Korzybski maintained that as a result of Einstein's theory of relativity, all the old Aristotelian arguments about pattern, form, and analysis of causality no longer held. Science and logic had to overthrow their two-thousand-year indebtedness to Greek thought and devise a new system of thought based explicitly on non-Aristotelian premises. The overthrow of Greek thought must include all concepts of truth and falsehood insofar as they were based on suppositions of 'real' certainties. 'Real' objects in the external world had to give way to probabilistic certainties.

In addition, the truth of any statement could no longer rest on indefinite premises of similarity. Instead of a logic of positive premises expressing identity, the negative premise ('Whatever is, is not – e.g., 'a word *is not* the object spoken about') is a more secure beginning for logic and linguistic rules, concluded Korzybski. The main effect of holding the negative premise – the non-Aristotelian premise – is to create a disjunction between ourselves and the natural world, and to substitute a logic of temporal disjunction for a-temporal identity.

As Korzybski stated, we must take account of the relations of disjunction between us and the world. The links between the verbal world and the objective world about which the verbal world constantly talks must be reformulated as *relations we observe* between verb and object. 'To be' in the ontology of the non-Aristotelian universe means 'to be related,' and 'to be related' means that we construct these relations. We constitute some form of mapping process, and this mapping process, our own construction of 'being related,' is in distinction to the 'objective world,' that is, the 'territory' which it maps.

Korzybski's summarized his principles of general semantics by the memorable expression: 'the map is not the territory.' He meant that words are neither outside objects nor are they inner feelings; instead all language can be considered as names for the relations we construct between the objective and verbal world. All order, therefore, is constructed through some form of mapping process (Korzybski 1949: 61, 63).

'TIME BINDING': MAPPING AND INDEXING

According to Korzybski, the central characteristic of mapping is that the mind of the mapper is always one degree more abstract than the phenomena it attends to. Almost any object felt by the senses represents an abstraction of some sort. In complex living forms, the capacity to produce higher and higher abstractions eventually results in an awareness of the abstracting process and, eventually, engenders a science which considers the mental operation of 'abstracting.' The whole process is a repetitious spiral of abstraction upon abstraction, map upon map, much as, for instance, any attempt to inquire about the 'meaning' of a word in everyday life leads to a definition depending on the meaning of other words ... and those depending on other words ... and so on ... in a cascade of meanings of meanings of meanings until we reach the meanings of undefined terms which we somehow think we know, but cannot tell.

Nevertheless, the high degree of relativism which the construction of maps of maps of maps displays is not a random process. Between the 'territory,' the objective world, and our verbal world lie structured relations of meanings and feelings. The map is not the territory, but a *correct map* must have a similar structure to the territory. This accounts for its usefulness. If the structures are similar, then the empirical world becomes 'rational' to a potentially rational being.[10]

The importance of Korzybski's scheme of time binding was the way it pursued alternative notions for constructing logical argument. Every movement from n to $n + 1$ always takes place at a particular time and in a particular context and in so doing transforms the Aristotelian definition of the infinite. In the Aristotelian sense, 'infinite' means 'indefinite process of generating numbers.' In a *non-Aristotelian universe*, every movement becomes indexed in relation to particularity in time. Indexing creates a variable finite out of an indefinite numerical procedure and ensures that order no longer relates primarily to the characteristics of number, but to relations in time. All order has context, and the temporal context in which ordering takes place is expressed as 'antecedent' or 'consequent.'[11]

Korzybski believed that his procedure of indexing, or, in non-mathematical terms, the creation of contexts, enables all problems of circularity and paradox in a relativistic order to become reformulated. Indexing orders the moment between each circularity or repetition, and this moment, no matter how small a time, is always finite. The ordering moment always reveals a difference from the order revealed in the previous circularity, and the difference in the ordering can be expressed verbally or by other means. Thus indexing secures a 'semantic arrest' of an indefinite infinite, converting 'vicious circularities' (those circularities which confuse part and whole) into circularities of difference. Thus repetition of part and whole, and the relation of the repetition, can be expressed.

Through temporal indexing, consideration of recurrent or cyclical order need no longer *necessarily* fall into vicious circles of explanation. Every turn of the wheel exhibits difference in the ordering of antecedents and subsequents. The Aristotelian ideal of indefiniteness – 'same cause, same effects' – is transmuted into circularities of difference among causes, a situation which 'even adds to the interest and beauty of life and makes science more interesting' (Korzybski 1949: 206–20).

Generalizing the notion of an index means that the totality of living forms – 'actual life' – is composed, not of an indefinite, infinite array, but of a definite number of unique individuals, each of whom is different from all other individuals. One logical benefit of this distinction is that the definiteness of individuality need no longer be confused with the indefiniteness of the class or rank to which the individual belongs – a clear gain in humanity's conception of itself. Also, Korzybski stated, previous ordering procedures had presupposed *similarities* to be fundamental to the classification of order. This conceptual rule must now be reversed. *Differences* are fundamental. When Korzybski founded a magazine of general semantics, he pursued the notion that difference is fundamental to all indices of order, all causality, and all notions of the beautiful.[12]

HOW MIND IS PART OF THE SYSTEM IT SEEKS TO EXPLAIN

Another group of people with whom Bateson began to share his approach were biologists attracted to general systems theory. Before the Second World War, an Austrian biologist, Ludwig von Bertalanffy, wrote several papers suggesting that modern biology required a naturalistic epistemology, one which rejected materialist mechanisms in favour of an understanding of organization and dynamics of wholeness. After the war, von Bertalanffy joined with a noted economist, Kenneth Boulding, to found in 1954 the Society for General Systems Research. One of the purposes of this society was to enlarge the scope of 'systems explanation' to an interdisciplinary mode of inquiry embracing the study of all living forms.

General systems theorists also argued that the work of quantum physicists Werner Heisenberg and David Bohm had shown that there were no ultimate entities to which the universe was reducible. Matter and energy in the universe existed in conjunction with an observer of them; the universe could not be reduced to objectively defined units – neither corpuscles nor waves. Thus scientific knowledge resulted from an interaction between the knower and the known. As a corollary of this interaction between observer and observed, general systems theorists held that the data about physical or organic systems are not simply sense impressions received from external sources but a construct of those experiences through which 'data' is identified, namely, through sensual experience or through its capture by instrumentation.

They contrasted their perspective with that commonplace in both science and logic from the 1920s to the early 1960s: namely, that 'reality' be subjected to methods of sceptical inquiry, and that the validity of the axioms derived therefrom be demonstrated by sceptics' interpretations of the 'objective' world according to well-defined correspondence rules. This was commonly referred to as the 'received view on scientific theories.'[13] Only during the 1960s was the received view challenged from a number of different directions, with the cumulative effect of ensuring the diminution of the axiomatic approach to scientific knowledge.

Under von Bertalanffy's influence, general systems theorists rejected the notion that 'reality' was nothing but a heap of physical particles, genes, reflexes, or drives. They built on the view that there is an irreducible wholeness of events and processes in nature which reductionist science discarded. And, if the 'data' of physical, organic, or social systems are not sense data received from *external* sources, but a *construct* of those experiences, then any system or structure in science should be conceived as a model of mind events of the observer, relating mind to systems of physical events.

In effect, general systems theorists argued, there must be a formal relation between natural systems and cognitive events. As they put it,

> constructs [are] based on innate or learned categories, the concordance of different senses, previous experience, learning processes, naming, i.e. symbolic processes, etc., all of which largely determine what we actually 'see' or perceive. Thus the distinction between 'real' objects and systems as given in observation and 'conceptual' constructs and systems cannot be drawn in any commonsense way. (Lazlo 1972: 152)

Von Bertalanffy called this aspect of general systems theory *biperspectivism*. It soon became a springboard for a thoroughgoing explanation of how cognition – mind – was itself part of the system it seeks to explain.

The general systems theorists began to undertake a reformulation of categories of scientific causality. They argued that our conventional interpretation of causality was based on the observation of cause and effect in physico-chemical systems. In their view, causality in living systems was characteristically different from physico-chemical systems. Matter and energy in physico-chemical systems follow a fixed pathway, in which input triggers responses and produces output ('work') in a linear manner. By contrast, organic systems are intrinsically active and 'autonomous,' that is, self-organizing.

Autonomous or self-organizing systems actively transform both themselves and their surroundings when adjusting to conditions for ongoing survival. None of this is taken into account in conventional discussions of causality in science. In physical systems, all causality is deemed to be reversible; that is to say, an effect can be traced to its initial cause and vice versa. From a general systems perspective, the attributions of causality in physical systems are inappropriate for organic systems. Causal relations between an external input and system output are reciprocal, or mutual causal, and are not strictly reversible.

Physical science assumes that direct stimuli, or inputs of energy, determine subsequent events, namely, how the system will behave. But a self-organizing system is able to organize what happens to input *within* the system; there is, therefore, no fixed, unaltered channel of events between receipt of external input and system output, the general systems theorists claimed. The same final state or goal in a self-organizing system may be reached from different initial conditions and by different pathways. In short, the dynamics of self-organizing or autonomous systems give rise to the premise of mutuality or reciprocity, which radically alters the standard assumptions of causal relations. Clearly, wherever mutual causal processes can be identified, the behaviour of organisms cannot be described as if *single causal* pathways, driven, for example, by input of energetic flux, determine subsequent effects. This, in turn, modifies scientific understanding of relations between input and output, or between external conditions and internal conditions, or between organism and its environment. Another way of expressing this premise is to say that organic systems are able to generate their own fields of influence.

PROBLEMS OF BIPERSPECTIVISM

The distinction between mutual causality and single causal determinism remains an important one in the field of ecology. As will be discussed below, ecologists who support the first view present a very different version of ecosystems than ecologists who still support the physicalist approach to ecosystem survival.

Bateson accepted mutual causality as a characteristic of process in biological systems from early in his career. As we have seen in chapter 2, this became a fundamental premise on which to build his own ecological perspective. But to judge by Bateson's correspondence, there was some reserve in his contact with general systems theorists. While

Bateson engaged in active dialogue with leading figures in general semantics, he did not take up active exploration of von Bertalanffy's ideas. Bateson readily agreed with von Bertalanffy that modern science faked a split between the observer and the observed, between the mind of the scientist and nature, but he could not agree with von Bertalanffy or other general systems theorists in their discussion of spontaneity in evolution.[14]

According to von Bertalanffy, both natural and cognitive systems included a principle of spontaneity; spontaneity was a characteristic of all autonomous systems and underlay their creative responsiveness. Bateson rejected this version of spontaneity-as-creativeness as being far too mystical a proposition. He also disavowed von Bertalanffy's claim that the spontaneous aspect of human cultural activity derives from a generalization of the 'aha' experience. His own theories of perception and cognition were built on the fundamentals of information and communication - habit and learning modified by experience. Bateson did not deny the 'spark' of the 'aha' experience but noted that the process did not stop there: 'It is like trying to track an afterimage [after the "spark"]. You stare at the light and you look away and you see an afterimage and you follow it and it keeps running away from you and you try to catch it.' The 'it' refers, perhaps, to the covering and uncovering of relations between relationships in biology or culture (*Sacred* 1991: 303).

Nor could he agree with the conclusions which prominent general systems theorists drew about the nature of human consciousness. One such theorist, Eric Jantsch, claimed that consciousness merges into evolution through forms of 'self-realization' and 'self-transcendence.'[15] Bateson regarded evolution, and growth of 'mind' in general, as a fundamentally stochastic process which at no stage could be subject to design, least of all design attained through human self-transcendence of the faculty of consciousness.

In many ways, he also disagreed with general systems theorists' conception of *biperspectivism*. A welter of problems seemed to lie in the isomorphism they proposed between the spontaneity of mental events and sponteneity in natural events. Bateson was insistent that the study of symbols, to which these general systems theorists were attached, could not lead back to the source of human creativity, for the analysis of symbols was something like analysis of individual words in a dictionary. A focus on human symbols cut up the tapestry of culture into a dictionary of false meanings. It left unexamined the most significant aspect of interpretation, the *relations between* cultural phenomena. Symbols only pointed to the existence of these relations.[16]

The lasting benefit of general systems research has been to raise fundamental objections against reductionism in conventional science, and to make the case that what science takes to be 'real' is, in fact, merely a construction of that which observers take to be 'reality.' General systems science argued that which Cartesian science maintained was divorced from the observer cannot in principle be so divorced. As Bateson said, reductionism and the fixed perspective from which the observations of most of modern science were made also conspired to confirm 'super-naturalism.' Conventional science assumed that its methodology was so secure that scientists need not consider the conditions under which they observed nature. Or, if some part of their explanation accorded with mechanistic principles but the rest did not, they were happy to push the rest of it 'out into the supernatural,' thus, in a way, confirming the existence of the supernatural. The only way out of the mess was 'by thinking in much wider terms than Descartes was willing to think' (Letters, 740–4/1980; transcript of the lecture 'Eternal Verities'; GB, 1981e).

MIND AND INFORMATION

The use of the term 'mind' immediately evokes ideal forms of order. Though Bateson used the writings of idealist philosophers, such as R.G. Collingwood and Alfred North Whitehead, to aid him in his discussion of pattern and meaning, he had as many objections to the speculative metaphysics of idealism as he had to the reductionism inherent in materialist explanation. Bateson's writings ground discussion of mind in information and communication, which he regards as immanent in all living organization and without which no order in nature could occur.[17]

To place Bateson within the traditional dichotomies of idealism and materialism in Western philosophy is misleading. Bateson conceived of 'mind' as a synonym for a systemic combination of pattern, information, communication, and ideas. One crucial distinction between Bateson and the stream of thought associated with Western idealist philosophy is that Bateson always argues that 'mind' is systematic *not* 'inside' the head. This accounts for differences between Bateson and Korzybski. It was evident that all Korzybski's notions were ultimately embodied and localized in some physical system. Korzybski stressed what was going on inside people's heads as they abstracted from the outside world. He did not sufficiently address the question of how individual abstractions were themselves linked to the social contexts of communication or epistemology in which they were implicated, thus limiting the concept and use of general semantics for Bateson's purposes.[18]

It also accounts for differences between his own approach and that of Jantsch and von Bertalanffy. As mentioned above, Bateson objected to their attaching 'spontaneity' to forms of consciousness. In fact, he rejected any explanation involving coincidence, spontaneity, or extrasensory perception of information.[19] Arguments about spontaneity or coincidence as the root form of 'creativity' were typical of idealist metaphysics. Natural order is a communicative order, said Bateson, and communicative order had *both* material *and* ideal elements. For abstract notions of creativity, Bateson substituted a science of communication; and no science of communication can avoid the ways in which information exhibits a combination of these two levels, material and ideal. In one sense, all information is material in that 'news' is carried by a sense-perceivable event. The whole process of abstracting form and pattern – the ideal element in communication – cannot occur without pattern being carried piggy-back on material signals in information channels (GB, 1980f; *Sacred* 1991: 235–42).

Information and communication have many different meanings, but in the ordinary sense, their meaning is always bound up with 'news' of some kind in some concrete situation. Sense perception of news or a message requires an origin, a channel through which the news is carried, and a means of interpretation through which the difference between the message as 'news' and the message as repetition can be identified. There is a 'both-and' requirement in interpreting information. On the one hand, the significance of news must not be reduced to the material elements in sense-perception. To do so would leave out all the figurative attributes of news. Bateson regarded many of the materialist analogies of 'news' used in the early days of cybernetics as fundamentally unsound. These early information theorists reduced the meaning of the message to its degree of clarity in the transmission of signals, that is, relative to the signal-noise for a particular design of the communication system.[20] He was adamant: to define the meaning of news as the topological form of a signal would jeopardize all future understanding of communication (Letters, 931–4/1946).

While a clear signal may be a physical event having dimensions, the meaning of the physical event lay in a pattern which had no dimensions at all.[21] It is true that a signal remained a 'bit,' a 'yes-or-no impulse,' an event having dimensions. However, the patterns which enter into meaning are of an entirely different form from the impulse of the signal. These figurative aspects of information - an image, a representation, an idea - give form or shape to the significance of 'news.' The two are not separable, and their conjointness is fundamental to an understanding of communication. Furthermore, whatever the material content of a message, the impulse of the sensory event, is inextricably bound to the form of a communicative situation. After all, Bateson said, silence may have as much meaning in communication as clear instruction; and messages identified as 'noise' in one situation could be regarded as a revelation in another - as is frequently the case in new forms of art.

Bateson saw mind as deriving from the systemic organization of life. Mind is closely associated with the construction of pattern in all living systems, and Bateson's 'naturalism,' if that be the word, always led him towards an understanding of mind as part of natural history. Mind is immanent pattern, available to observation, in the same way that a natural historian observes any pattern of nature.

Observation of immanent pattern requires more than a visual investigation. It must also include another mode of inquiry alongside it, an examination of propositions about what we know of pattern in biological organization. In this respect, Bateson agrees with general systems theorists: the pattern of mind has also to include itself. Without an account of the observer's relation to the observed, no explanation of pattern in nature could be valid.

ADAPTATION AND SURVIVAL

Let us recall a key phrase from Whitehead. The activity of an organism in any living system must favour *both* the environment *and* the organism itself, he said. Without activity having this double result, the organism is doomed. Following Whitehead, Bateson considers adaptation to involve interpretative propositions, or ideas, about the relation between organism plus environment. According to Bateson, issues of survival include our own habituated ideas about how we survive. The minimal unit of survival in all biological systems expresses both a relation - organism plus its environment - and proposes their interrelationship.

It includes propositions about the forms of the relation of organisms to their environment:

Survival depends on two contrasting phenomena or processes, two ways of achieving adaptive action. Evolution must always, Janus like, face in two directions – inward toward developmental regularities and physiology of the living creature and outward toward the vagaries and demands of the environment. (Letters, 1177–5f/1978)

As with any process of information, survival is carried by 'units of a news of a difference carried in circuits' (Letters, 206–7d/1973). And, as with any network of adaptation, this must include all relevant pathways of information – all circuits of information at all levels, from gene-in-chromosome up to the epistemological-premise-in-society. All are relevant to an understanding of survival. This view of survival, as an idea about the relation between organism and environment, is a far cry from ecological survival as presented in university textbooks. Generally speaking, ecologists describe characteristic structures of ecosystemic organization as grounded in physical phenomena. In the usual ecological sense, 'adaptation' is considered to be an energetic link of biological units with their resource base.

We may now go back to some of the issues of time, repetition, and the experience of temporality with which this chapter began. Bateson proposes that survival, like any mental process, owes its existence to a 'binding' in time. Survival is akin to the notion of 'that which stays true longer than that which stays true not so long.' However, survival is not simply a question of length of time or mere continuance. It may appear to be a tautology to say so, but living things have to be survival-worthy in order to survive:

If mere survival, mere continuance, is of interest, then the harder sorts of rock, such as granite, have to be put near the top of the list as most successful among macroscopic entities. They have retained their characteristics unchanged since quite early in the formation of the earth's crust ... But the rock's way of staying in the game is different from the way of living things. The rock, we may say, *resists* change; it stays put, unchanging. The living thing escapes change either by correcting change or changing itself to meet the change or by incorporating continual change into its own being. (*Mind* 1979: 103)

Stability among living things may be achieved by continual repetition of some cycle of smaller changes, which cycle will return to the *status quo ante* after every disturbance. Survival-worthiness – 'staying in the game' – requires active alteration in the organization of a living thing, either by 'changing itself to meet the change' or by 'incorporating continual change into its own being.' Bateson is suggesting that survival-worthiness requires the flexibility to reintegrate an organism with its environment under continually changing conditions: 'Finally, if Death should have his victory over species, Nature will say "Just what I needed for my ecosystem"' (*Mind* 1979: 103).

From Bateson's point of view, the physiology of the creature is not *the sole or even the central unit* of any pattern of life, but one level adapted to the environment of which it is a part. Ecological science's presentation of ecosystems primarily as energy systems, not information systems, resulted in ecology disregarding the importance of temporality. Ecological science also ignored all the dilemmas which a mistaken understanding of patterns of change can bring. Oscillations, time lags, and other forms of change in ecosystems always posed dilemmas of survival-worthiness for the minimal unit, organism plus environment.

Bateson often used the fable of Lewis Carroll's 'bread-and-butterfly' to substantiate this point. The fanciful dilemma of Carroll's bread-and-butterfly in the story of *Alice in Wonderland* was that it had wings made of thin slices of bread and butter and a head made of a lump of sugar. When Alice asks what the creature lives on, the reply comes back: 'weak tea with cream in it.' Obviously if the creature ate its food, it would die; so an optimistic Alice asks what would happen if it cannot find any food. She receives the same answer: 'it dies.'

The point of Lewis Carroll's fable, Bateson repeated, was that bread-and-butterflies became extinct, not for any material reason – because their heads were made of sugar, or because they could not find food – but because of the impossibility of contradictory adaptation. 'The answer is that they became extinct because they were caught in a dilemma, and the world is made up that way, and it is not made the linear single-purpose way [of materialist causality]. And so on *ad infinitum*' (GB, 1978c: 54; *Sacred* 1991: 211).

Bateson's approach sounds fanciful, but we ourselves are caught in massive ecological dilemmas. Consider the issues of 'sustainable development,' a metaphor around which the Earth Summit was organized in Rio de Janeiro in June 1992. Policies deriving from sustainable development would supposedly tame the level of industrial ouput and decrease global energy use, particularly forms of energy degrading the biosphere. But the Earth Summit at Rio carefully avoided raising the issue of 'sustainable human population' in its agenda of policies for sustainable development.

The one is the lump of sugar, the other the tea. There can be no agenda for sustainable development unless the vexing questions of human population levels are considered. What is sustainable at one level over a period of time is clearly not sustainable at another population level over a longer period of time. Human population levels are, in turn, related to human poverty, and human poverty amplifies degradation of the environment. The Earth Summit at Rio revealed that sustainable development, as a program for environmental action, is inherently paradoxical. In fact, the phrase could be said to be the most modern and most worrying version of the fable of Lewis Carroll's bread-and-butterfly.

In Appendix 1, I present a comparison between the model of an energy-driven ecosystem represented in the writing of Eugene Odum and Bateson's own model. In the conventional ecological model, Odum states that energy is the single common denominator of life on earth, 'something that is absolutely essential and involved in every action large or small ... Energy represents the ability or the capacity to do work ... or perform something.' Without energy there can be no life; therefore 'all humans should understand the basic principles of energy transformation ... We should start teaching energetics in the first grade' (Odum 1989: 67).

As energy is defined in relation to the capacity of the ecosystem to undertake work, and 'since money and energy are related, using energy as a basis for evaluating and allocating goods and services of all kinds is a logical approach [to the conversion between natural ecological systems and human systems].' The conversion factor provides monetary 'value' for natural ecological benefits. Thus the total 'worth' of an estuary of a river produces a total energy flow in terms of embodied energy, to which money is the counter-flow (Odum 1989: 103). Policy decisions which derive from this approach assume ecological survival is primarily a question of monetary costs against human benefit.[22]

By contrast, Bateson's model is one of 'embodied information' rather than 'embodied energy.' At first, it seems to resemble a common house thermostat; but on closer inspection, his 'thermostat' follows rules of mapping that distinguish its map from the territory of its own circuitry.

It is reflexive, is more abstract than the territory it maps, and has levels of temporal indexing. In short, his reflexive thermostat is a model of elements of recursiveness in survival: 'We live in a universe in which causal trains endure, survive through time, only if they are recursive. They "survive" i.e. literally *live upon themselves* – and some survive longer than others' (Letters, 955-36/1976; *Sacred* 1991: 220). We must come to an understanding of recursive causal processes, he says, the literal processes of 'living upon themselves,' in which a system returns to the point from which it started and which for a greater or less length of time will necessarily survive. 'If our explanation or our understanding of the universe is in some sense to match that universe, or model it, and if the universe is recursive, then our explanations and our logics must also be fundamentally recursive' (*Sacred* 1991: 220).

4

Metaphors for Living Forms

Bateson emerges as a remarkable innovator, not only in his imaginative expression of an 'ecology of ideas,' but in the thematic presentation of these ideas. He experiments in his texts with non-linear forms of argument and in this manner matches the form of communication with the knowledge he is trying to convey. Living form spirals, and so Bateson's text spirals – in its own metaphor for living form. One commentator, close to Bateson in the last years of his life, writes: 'Bateson is sometimes regarded as difficult to read. The obstacle is one of form rather than content. The misconception that his works are flights into abstraction or ungrounded speculation arises from his use of alternative forms of description' (Keeney 1983: 6).

Successful experimentation does not necessarily avoid density in argument, and this can lead, as in Bateson's case, to difficulties of comprehension. Misunderstanding as to what Bateson was about occurred during every period of his work. Anthropologists were perplexed by his discussion of 'national character' as configuration in culture. Psychiatrists were perplexed when his articles on schizophrenia proposed a communicative rather than a medical approach to the disease. Prominent cyberneticians commented that they really did not understand what Bateson meant by cybernetics. Even his daughter confessed difficulties in her role as co-author in presenting his ecological epistemology. Her father's views always required her to 'shift gears' in her own thinking. Like other readers, she searched for consistency and demonstration, read what he had written, and threw up her hands: 'Daddy, it's just *not* here' (*Angels* 1987: 145).[1]

The subject matter Bateson wrote about *is* indeed difficult. Bateson himself pointed out that his precursors who wrote about 'ideas' and 'mind' were also very difficult to read – authors such as R.G. Collingwood, Alfred North Whitehead, and Ludwig Wittgenstein.[2] To the public's complaints that his work required a painfully long time to read, Bateson replied that in a world consumed by its belief in materialism and behaviourism it is no wonder that his whole notion of 'immanent mind' is puzzling. He claimed it was worse to be read with imprecision, than simply to have his readers puzzled by what was written on the page. Non-understanding could be corrected by going over the argument again; but not false understanding. The far greater worry, he confessed, was the repetition or copying of ideas in a shoddy and corrupt form:

About me and my ideas. I personally am very surprised at the rate of their spreading. I notice, however, that they are spreading in a very shoddy and corrupt form. I write as precisely as I can but find that in general I am not read with equal precision. Of course, the ideas are actually very difficult, even for a person with epistemological or cybernetic background. And I am even surprised that you say the average reader can get the sense of the article of mine in as few as three or four readings. I usually find it takes more readings than this to get what say [R.G.] Collingwood is saying. And he writes with more elegance and precision than I. (Letters, 610–2/1974)[3]

Bateson believed that his audiences' materialist epistemology was a major source of confusion. This often led to his introducing a talk about his ideas with a little prologue as to how he came upon them. He adopted this same approach in his Foreword to *Steps* and other major publications.[4]

Bateson's style is crucial to the communication of his ideas. In a thoughtful summary, the psychotherapist Lyman Wynne suggests that a second reading of Bateson is always necessary because, as author, Bateson is writing in a particular style in order to change the context of his readers' thinking:

Almost every paragraph and certainly every anecdote that Gregory Bateson tells or writes jars one awake, first in wonderment – 'What does he mean now?' I then find myself re-focussing both from a greater distance and then at closer proximity. My reaction on these occasions when I expected myself to formulate and summarize what he has said in discursive non-analogic terms has been frustration with what seems to be obscure or opaque complexity. At other times I have been amused to discover, when I come back to exactly the same essay in a more open, meditative frame of mind, this altered context that I give to his writing has transformed the puzzling passage into one that is charmingly lucid and illuminating. ('About G.B.,' Misc. Mss., box 10)

In effect, Bateson's own style of writing agrees with his theoretical approach to recursion – that any change of context provides the opportunity for the reader to contrast the second moment with the first and then, reflexively, look back at both for a broader, more holistic comparison.

As already stated, he believed that the direction of epistemology must be shifted. Like Wittgenstein, he asserted that epistemology should no longer simply talk about metaphysical propositions, or evoke data in support of logic based on metaphysical propositions, but aim at improving thinking in everyday life (Monk 1990). Both Bateson and Wittgenstein address issues in which formal thinking is necessary, but both consistently try to demonstrate thinking as an 'operation' of everyday living. The formal problems lay in attaining an appropriate perspective. Bateson's editor, John Brockman, understood the epistemological problem exactly: 'Bateson is most clearly understood because his work is not an explanation, but a commission. As Wittgenstein noted, "commission tells us what we must do"' (Brockman 1977: 5–6).

IDEAS – 'MY FORTIFICATION'

Despite an evident sense of commission in his writing, other issues seem to get in the way of Bateson's exposition. Bateson is perpetually fretting about the status of his ideas. The fretting can be seen most evidently in his collaboration with Jurgen Ruesch over the publication of *Communication*. Their collaboration faced both intellectual and personal problems. Bateson's exact status as contributor was a source of friction between them, this being a particular worry for him during the most anxious period of his personal life. He had ended his marriage with Margaret Mead and his academic connection with anthropology; and he was facing an uncertain future, having launched himself into a new area, the study of psychotherapy from a cybernetic perspective.

Bateson's letters to Ruesch at this time reflect his worries that his own methods had driven him into a 'mulish negativism.' At the same time, he accuses Ruesch of being afraid to move on the issues of cybernetics on a grand scale. On 26 August 1947 he wrote to Ruesch:

I think that deeply we agree in the horror of 'reality,' but for you, to deal with reality gives reassurance. I get analogous reassurance from immersion in ideas ... If ideas are for me a network of fortifications, but for you first a threat, and then something to be assimilated, it would follow that I would naturally want a *network* intact - compulsively testing every link ... from one point of the net to another to make sure it is all O.K., deriving my reassurance and joy from keeping the whole net up ... But if your problem is one of assimilation - then you want to deal with the ideas one by one. The image that comes to my mind is of a turtle trying to cut a network of rather worried worms - it cannot swallow unless he can somehow chew-off piece by separable piece. But to me when you succeed in chewing-off piece after piece, that piece *ipso facto* becomes completely tasteless and uninteresting ... in talk I cannot keep the whole network spinning in the air and I'm bound therefore to give pieces which you can swallow. But when I write I make the extra effort - try to include the whole network in every sentence - and you gag on it. My jumping from one part of the net to another makes it impossible for you to assimilate any of it ... this business of ideas is for me a matter of balances, reflexes, tightrope walking-anality-defecation as a whole body function ... (Notebook 2c/1947)

As the letter intimates, Bateson was worrying about remaining friends when they were both quite clearly set on a course so radically opposed to the mainstream. This required getting straight the balance between intellectual integrity and the possibilities of their own mental pathology. The outside world was in any event calling them both 'crazy.' Could they trust one another? Were they merely trying to persuade one another that the world is a conspiracy and therefore were engulfed in their own paranoia? It seemed that the whole project became a fortress that would test Bateson's own mental stability.[5]

Years later, with his cybernetic and interpersonal communication arguments well established, Bateson still worried about his 'fortification' of ideas. He worried that he did not have an overall, holistic grasp of what he was trying to say until he was well into his sixties:

It was only in late 1969 that I became fully conscious of what I had been doing ... I found that in my work with primitive peoples, schizophrenia, biological symmetry, and in my discontent with the conventional theories of evolution and learning, I had identified a widely scattered set of bench marks or points of reference from which a new scientific territory could be defined. (*Steps* 1972: xvi)

In this Foreword to *Steps*, Bateson suggests that much of his anthropology was a failure, that his research into dolphins achieved little, that his psychiatric research was saved on several occasions only at the last moment and by his colleagues' faith in him. Bateson at sixty expresses constant need for reassurance in his ideas, and surprise that others had faith in him and his work when he himself was uncertain of its promise and direction.

Most theoretical writers in the field of social science would consider it normal to achieve a generalist's understanding of their subject only towards the end of their careers. Bateson began with a settled notion of the fallacies of generalization in the social sciences and sought to replace the methods of empiricism by a reflexive understanding which would express the interaction of ideas. The question arises whether the epistemologist who was most acutely aware of the need for a science of reflexiveness was in some way unable to deal with false expectations in his own case.

Bateson wanted to pursue a science of reflexiveness, but he seems to have been a harsh judge of himself and unable to shake the abstract canons which pervade natural science. These canons glorify achievement, purpose, and control over data, the very characteristics against which Bateson was formulating his epistemology. Yet Bateson panicked at his own lack of publication.[6] His personal reaction to the belief that he had not got 'it' done is indeed ironic, and there appears to be some early personal history behind such a reaction and his allusions to his failure.

HOPSCOTCH - A MATRIX OF IDEAS

By moving from one discipline to another throughout his life, Bateson often left behind audiences which he had made warm to his ideas. Leaving behind an established discipline is usually difficult for most academics, but Bateson appeared to circumvent the issue by concentrating on his own matrix of ideas, none of which belonged to a particular discipline.[7]

Nevertheless, he tended to assume, for purposes of presentation, that his matrix was well understood by his audience. The effect was to leave his readers constantly searching for starting points that did not seem to be there. Bateson used the 'network of ideas,' or 'matrix of relations,' as he termed it, as method: By 'matrix' Bateson meant 'a mould' or 'a form,' close to the Latinate sense of 'womb' or 'mothering of ideas':

A matrix, to judge from its etymology, is supposed to give birth, not receive it. And yet ... [in the course of my life] ... the network of ideas or matrix has been fertile, not in the sense that it has given birth to ideas separate from itself but in the sense that it has given birth to more parts of itself, that ... matrix has been a growing thing, getting more and more complex, wider and wider in its scope, and I believe more fertile as time has gone on ... The matrix, after all, is an epistemology, and, specifically it is a recursive epistemology; at the same time, it is an epistemology of recursiveness, an epistemology of how things look, how we are to understand them if they are recursive, returning all the time to bite their own tails and control their own beginnings. (GB, 1978g[i]: 41; *Sacred* 1991: 191)

Bateson usually employs a comparison of terms within a matrix. He developed this approach first as a graduate student and later in the writing of his first book, *Naven*. Often the matrix took the form of a three-column diagram in which the first column had 'data'; a second column had 'explanatory notions,' indicating explanatory principles generally in use in the social sciences; and a third column had 'fundamental truisms' or 'great scientific laws' or, more simply, 'verities.'

If the ultimate goal of science is the increase of fundamental knowledge, then the relation between data and explanation should concern fundamental truisms and should relate the first of his columns to the third, 'eternal verities.' The fact that these eternal verities were also cultural assumptions, myths which Western culture refused to recognize as such, was crucial to his case. Often Bateson's argument plays with the failure of supposed explanations and with why the derivation of explanations from data in column one results only in the rationalizations of column two. What they might have been, if they had contributed to explanatory notions in column three, is represented as a tantalizing goal. Therein lies a whole new tautology.[8] 'Column two' explanations were always heuristic ideas, rules of thumb which did little more than reify ordinary concepts. The terms of such explanations could be arbitrarily changed and made to mean exactly what the author intends. Far from being 'the fundamental reference' from which thinking must proceed, such heuristic explanations usually fell victim to Whitehead's fallacy of misplaced concreteness, taking parts for wholes and presenting a heuristic as a fundamental rule of order.[9]

Prior to the publication of *Steps*, in which the matrix of his ideas first appears, readers were puzzled by his leaps over conventional divisions of academic inquiry into other disciplines, and by his propensity to follow a line of argument developed in one discipline as the basis for argument within the other. The problem occurred not only with readers but with editors. Argument *appears* so obscure, so unrelated to conventional wisdom, that editors requested rewrites. In one notable case, the editors took it upon themselves to excise theoretical passages. 'Toward a Theory of Schizophrenia,' the very first joint publication by Bateson, Jay Haley, Don Jackson, and John Weakland, seems to propose a theory based on empirical observation and generalization (GB, 1956d). Yet its propositions were deductively derived and there was precious little casework to support them. The editors had omitted the deductive basis of the argument, leaving readers with the impression that the authors were generalizing from case studies. 'More than anything else [the omission] led to all the silliness of [researchers at a later stage] trying to count the double binds ... they are not things of that sort. You cannot similarly, count the number of jokes in a conversation' (Letters, 52-31a/1971).[10]

The image of hopscotch was, like his matrix of ideas, a formulation of his younger days.[11] It was reinforced by the comparison he made as a professional anthropologist between the social system of the Iatmul of New Guinea and the culture of the island of Bali. Another of its origins lay in the relations of counterpoint he discerned in the poetry of T.S. Eliot and William Blake, especially Blake's *Songs of Innocence and Experience*. Blake's counterpoint is never worked out as a coherent form, Bateson says, but creates an imagined contrast between a world of rules and a world totally lacking in rules, 'between the hypnotic concentration on an arbitrary goal that you might find in [the playing of] games ... [and] the strong barriers which prevent one from saying in a conversation something that would break that fabric of a conversation ... the whole gamut of definable and undefinable controls on behaviour' (Letters, 398-3c-3/1946). Each term of the comparison is the topological inverse of the other: the one form or culture sees its hopscotch lines as permitting freedom of movement between the lines, while the other sees the same lines forbidding movement across the lines. The latter has controls which are not felt as commands but *are felt* as part of the structure of the universe.[12] The artist - and by implication Bateson himself - tries to take 'steps' that 'combine two worlds, each with different sorts of hopscotch lines,' in a way sufficiently related that they are 'coordinated into a single artistic structure.'

The lack of proper cross-referencing of Bateson's ideas with respect to his matrix is rectified in the catalogue of the Bateson archives at the University of Santa Cruz. Most of this task had to be carried out after Bateson's death; partly by his family circle and partly by Rodney Donaldson, an archivist acutely aware of the major issues. Donaldson's archival compilation is sheer good fortune, for the cataloguing is itself a counter-design to the absent matrix and to a large extent overcomes this limitation to understanding Bateson (Donaldson 1987).[13]

RADICAL SOFTWARE

An author who uses hopscotch as a metaphor for his method should not complain to his audience nor hector them for their failure to understand. The philosopher Stephen Toulmin picked up on this point in his review of *Mind and Nature*. He complained that Bateson spent too much time exhorting his audience to change their ideas, and not enough in a detailed examination of the methodology required to sustain a 'post-modern' science (Toulmin, in Wilder and Weakland 1981: 357-68).[14] Other critics have maintained that as Bateson lost touch with the early experimental style prevalent in his writing during the 1930s and 1940s, he also lost touch with his audience. Bateson became, instead, an 'oracular essayist.' The 'text' to which he became devoted was his own life-history as a conference-goer (Marcus 1985: 66-81).[15] Bateson's essays may contain evocations of a rich, behind-the-scenes dialogue of conferences, but in the end, Marcus says, they give only 'partial glimpses of thought on a grand scale by a thinker who no longer feels impelled to write.' Hence, 'the inability of his final ecological vision ... to take hold widely' and his piecemeal impact on a number of fields.

The 'Cassandra'-like quality of Bateson's writing, and the label of 'oracular essayist,' can be judged from two points of view. Bateson could easily have assumed the role of an ecological Cassandra. His audiences in the 1960s wanted him to adopt the stance of a political radical, and, in the 1970s, of a 'guru,' but Bateson regarded himself as a man of science – albeit of a science transformed. Only rarely did he rely on prophetic statements to carry his message. The opposite was more characteristic of him. He was adamant that he was not going to come off his particular 'donkey' in order to secure cheap publicity.

At the same time, the seminar and conference format at which he became so adept, taken together with his public image of 'guru,' provided him with income. Little money was available to him as a salaried academic during the 1970s. Even though he became a member of the Board of Regents of the University of California, he had only a part-time post in the anthropology department at the University of Santa Cruz, with a part-timer's salary. He permitted his image as 'guru' to be fostered in popular intellectual journals such as *Psychology Today* and *CoEvolution Quarterly*. The interviews probably helped sales of *Steps*.

His seminars were not meant to be an occasion for disabused materialists to indulge themselves, but he was paid to speak at the more spiritual centres of the counter-culture movement – the Esalen Center in Big Sur, the Zen Center in San Francisco, the Naropa Institute, a Buddhist retreat in Colorado. Even Werner Erhard, the founder of *est*, 'a training program in the expansion and transformation of consciousness' according to an *est* brochure, provided him with an opportunity to conduct paid seminars. Yet the New Age philosophy on which *est* and other similar cults fed was one which Bateson completely rejected. His thesis of immanent mind derives from contrasts between culture and nature at differing levels of interpretation. It is 'experimental' epistemology, he said, not a leap from materialism into the mystical.

In his seminars, he spoke from strength, for he felt that science was at last moving in his direction. He commented to Lipset in 1973:

> . . . I have had the luck to have the cat [i.e., the climate of advanced scientific or philosophic opinion] mostly jump in the direction which I had taken. Finally it begins to catch up with me, and I begin to feel embarrassed when I stand up in a big auditorium where a third of the audience have a sort of primary assumption that they will agree with me. It is, if you consider the matter, rather strange and improbable that ideas which my father was groping for should have become almost fashionable. And it feels very strange for me, accustomed to being a voice crying in the wilderness, to find myself more famous than infamous. (Letters, 861–5a/1973)

When he spoke, Bateson was content with a much looser style than in his writing. Bateson said of himself: 'I know that behavioural science writing is usually loose and redundant while natural science writing tends to be tight and economical. I talk like a social scientist and write like a natural scientist' (Letters, 1463–21/1966). Bateson began to develop speaking 'routines' – items which he used all the time as themes of his talks. He called them 'his armamentation.'[16] His routines were often memorable, so that academics, usually fine-tuned for forgetting what some other academic said, recall a Bateson talk with complete precision years later.

Certainly, his ideas seem to emerge most clearly in situations in which he is given time to go over his arguments, as in dialogues and seminars. In these settings, his audience was able to consider Bateson's use of metaphor, stories, and parables in relation to specific contexts, and in more formal terms: 'what is this meta- for?' That is, how does this idea improve the operations of thinking in everyday life? (*Angels* 1987: 183–200). Another benefit of the properly conducted seminar experience was its capacity for handling complex issues which engage the feelings of the participants. Bateson was overjoyed at the success of the conference later published as *Our Own Metaphor*: 'What I finally managed was by use of group therapy to build a working group which could work with both its brains and its feelings. A new thing: where conferences work only with intellectuals (and the feelings are submerged) – while the group therapy people are all anti-intellectual' (Notebook 40/1968).

In small seminars and conferences, he was able to inspire his audience by weaving together their ideas through dialogue, so that the audience became collectively involved in the activity of thinking. A central feature of this style was Bateson's homily that 'it takes two to know one' (Nachmanovitch 1982: 35, 36). Yet his performances were not even. When Bateson was delivering a formal lecture, he could 'lose it' and become totally incomprehensible to any but those who already knew, from prior exposure to his ideas, precisely what he was talking about. There were times when audiences, at first eager to hear him, would turn on him and protest his incomprehensibility; and some walked out.[17] Interviewers, too, sent to talk to a celebrity, would sometimes become confused at the obfuscation into which they seem to have been drawn. In one such interview, Bateson even connived at miscomprehension. The interviewer was anxious to record for posterity what Bateson 'really' had to say. Instead, Bateson tried to pull the interviewer away from his initial perspective of the 'word' and the 'record' to a situation in which problems and solutions would emerge from the activity of communicating. The interviewer did not understand the tactic, and the interview ended in failure.

THE FAMILY – A CIRCLE AND ITS PRESENCE

It is hard to think of other major intellectual figures of the twentieth century who involved their family in their work quite so readily as Bateson did. His father, his first wife, Margaret Mead, and his daughter all became co-researchers and co-authors with Bateson in at least one project. His third wife, Lois, was also involved in his dolphin project.

The involvement of the father in the son's intellectual projects has already been noted. The 'presence' of Bateson's father was rarely absent from his matrix of ideas. At the Veterans Administration Hospital in Palo Alto, Bateson was taken up with confronting sceptical scientists wedded to genetic causes and clinical solutions for schizophrenia. The presence of his father seemed pushed into the background, but once released from the institutional and administrative grind, he immediately returned to writing papers about his father's notions of biology and evolution. Some of these were to form the basis of the comparison or 'abduction' between evolution and culture central to his 1979 publication, *Mind and Nature*.

When Bateson reached out for approval of his ideas, it was often an approval shaped by the intellectual interests of his family and of a small number of other friends. These included the biologist and evolutionist C.H. Waddington, the cybernetician Warren McCulloch, the mathematician Anatol Holt, and the Jungian analyst Joseph Wheelwright of San Francisco. This circle, an enlarged family almost, also received special treatment from Bateson in his talks and writing. Correspondents deemed 'enemies' of the family circle tended to receive very different treatment. For example, the Huxley's were well known for their family's prominent support of Darwin in the nineteenth century. When Julian Huxley wrote to Bateson asking relatively straightforward questions about Bateson's views on the double-bind aspects of schizophrenia, he received stiff and very formal replies (Letters, 692–1 and 3/1965).

Warren McCulloch provides a typical example of Bateson's response to members of the 'family circle.' McCulloch, a noted cybernetician, received nothing but praise from Bateson, accolades which overlooked vast differences between the two. Although the major themes of McCulloch's *Embodiments of Mind* are the ways in which the neurophysiology of the brain indicates principles of circularity, redundancy, and feedback in its design, McCulloch's 'mind' is clearly the physical substratum of the brain (McCulloch 1965). His highly deterministic physicalism of mind and ideas is totally inimical to Bateson's notions. McCulloch is a progenitor of artificial intelligence and modern cognitive science, while Bateson rejects the key assumptions of the latter. Yet, while living in New York State, Bateson was close to McCulloch on a personal level. He lavishly praised McCulloch as having pulled epistemology down out of the abstract realm of philosophy into natural history (Letters, 955–36b/1976). Retrospectively he dreamt about McCulloch's 'mandala' – 'a silver one with many cells, two circumferences, every cell containing a question mark' (Notebook 56/1974).

The 'family circle' were among the members of Bateson's most successful conference. *Our Own Metaphor,* the published report of the conference, can be read as a straightforward record of the event, or as a justification of Bateson's 'experimental epistemology.' Bateson believed the self, conceived as subjective experience, also had to be pursued as a function of the complexity of *systemic relations* and in a language appropriate to those relations. The *Metaphor* conference demonstrated how to overcome communicative situations in which self became transformed into an *object* of action and separated from a continuing process of self-construction. Bateson's resolution, restoring balance to an idea of self, was to give feeling the status of an 'idea.' *Metaphor* captures Bateson in his most Blakean mode: emotions set a context for reason and knowing, and should never be separated from a process of 'self-knowing.'

METALOGUES

The engagement of the family circle in formal aspects of Bateson's work is no more evident than in his 'Metalogues.' These are written texts constructed as a conversation between 'Father' and 'Daughter.' Metalogues are literary forms through which a 'message' or content of a proposition is presented in the manner of an imaginary dialogue. More than this, metalogues reveal that any message is meaningless until it is related to a classifier or context which limits what the message can be about.

Like poetry, a metalogue does not necessarily lead anywhere. It is its own circle. The presence of feedback in interchange between speakers allows the dialogue to address several levels of meaning all at once, and readers may jump from one propositional level to another in complete violation of the formal rules of logic. But the metalogues reveal that dialogue, communication, and discourse are not predicated on the strict application of logical rules of cause and effect. The contexts of ordinary conversation are more complex than any logical rules. Rules of rhetoric require that formal elements of discourse and dialogue conform to a uniform sequence of argument to which both speakers adhere. By contrast, neither speaker nor hearer in the metalogues requires such controlled sequences of argument in order to make a coherent point; nor is either required to continue the discourse on a single level of argument. Coherent patterns of inference emerge, despite jumps in levels of meaning, for coherence derives from implicit ideas – inferences drawn about the social relations of speakers in communication with each other.

The perplexities of the metalogue are in many respects a demonstration of the perplexities of all communication. The elliptical quality of metalogues demonstrates the importance of feedback for any resolution. The metalogue is at once cognitive *and* perceptual. This is true of all communication. An initial presentation of ambiguity is necessary for any possibility for reflexive thought to emerge. Circular repetition in the metalogue carries with it an image of round-and-round, but we, once we are interlocutors, become aware of another conversational interaction. For observers of conversational interactions, further patterns emerge, those of the punctuation of repetitions in the conversation, a sort of step-by-step progression in its otherwise circular and repetitious form. In turn, steps of this sort spiral to some form of 'ladder' of ideas.[18]

WORKING THE METAPHOR

Bateson uses metaphor and analogy, stories and parables, as ways of demonstrating 'operations' of thinking. Like metalogues, these operations are also congruent with the ideas he is trying to convey. One operation on which all successful communication depends is a shared understanding of the rules of the language game occurring at a given moment, and shared understanding of the relation between the rules of *this* 'game' and other language games into which 'this game' may evolve (Notebook 22/1954).

As will become more evident in chapter 6, the rules of shared understanding are not equivalent to semantic rules. Bateson's rejection of Korzybski's general semantics turns on the latter's insistence that there is a field of logical relations between grammatical syntax and communicative meaning which should not be breached. Bateson argues that 'understanding' arises out of the relations that communicators develop in the course of their communication and that this, more than the application of logical rules, gives coherence to communicative activity. Other authors agree with Bateson, though they use different terms in putting their case forward. Habermas, for example, refers to the 'situational contexts' of communicative action and the 'illocutionary force of an utterance' (Habermas 1981: 278–9; 288–95); that is, to the relations of speaker and hearer in a speech act.

Both Bateson and Habermas point out that shared understanding only arises when communicators have a common understanding of their premises at several levels of significance, but Habermas then goes on to point out that not all acts of communication are situated around 'understanding.' Some acts of communication mean to annoy, mislead, offend, infuriate, humiliate, and so forth – they are 'perlocutionary acts' with definite ends other than 'understanding' through speech acts. Bateson does not draw this distinction. There are, he feels, many different acts of communication – 'language games,' to use Wittgenstein's term. These are separated not so much by the *intentions* of speakers and hearers in communicative acts on which Habermas places such strong reliance, as by the contexts of communication, the circumstances under which people engage together in communication. Bateson was a radical relativist when it came to analysing communicative activity. For Bateson, all '[communicative] uses are relevant to different contexts,' so that all 'language games' require rules of mapping ('mapping' being Bateson's own translation of what Wittgenstein termed a 'language game') (Letters, 732–2/1969).

He treats mapping as an art form. The psychiatrist Rollo May observes that Bateson becomes unconsciously poetic when he talks about the mapping of form, order, pattern, and relationship in communicative acts – for they are the touchstones of his life. May's rewritten transcript of Bateson reads:

[Ideas and Pattern]
. . . which is in the book I am trying to write
I call my old Friends
Being those patterns which I have met with before
And shall meet with again
And which tell one that things are alive
These patterns exist in the morphogenesis of marigolds,
They exist in the morphogenesis of forests,

They exist in the book I am trying to write,
And in debates among clusters of people.
They are the necessary outward and visible sign
Of the system being organized. (May 1976: 40)

Nevertheless, Bateson abstracts from sense experience in a manner different from that of a poet. Like a poet, his observation of pattern requires comparison and contrast between multi-level abstractions of sense experience; but from these comparisons, Bateson attempts to derive a natural history of their patterning. He turns to the use of metaphor, 'works the metaphor,' in order to express order in the qualitative comparisons and contrasts in pattern.

The agreements of metaphor derive through the consideration of parallel cases. The parallel cases in Bateson's version of metaphor are not parallel in spatial terms, that is, perspectives drawn on a geometric ground. Rather the parallels evoke *differing levels of sensuousness* which, in their combination, evoke the whole in human experience. The whole implicates primary process, vision, imagination, and the more abstract notions of aesthetics, the patterns of 'goodness,' symmetry, and beauty. Metaphor is analogical: it both asserts and denies the relation A *is* B. Bateson notes that taken by themselves, the images juxtaposed in metaphor would be incongruous, even untrue: 'every metaphor contains a multitude of details which are untrue. In the game of "cat's cradle" there is no cradle ... and no cat. Only a *relation* between an imagined CAT and an imagined piece of string' (Notebook 65/29 Dec. 1976).

Only when put into relation with each other do the objects juxtaposed in metaphor evoke meaning. They also evoke cumulative images of pattern. Unlike the rules of logic, which order a chain of reasoning in order to assert an identity, it is through metaphor and parables that we try to communicate truth. 'There is no other way. No "literal" communication ... ' (Notebook 65/29 Dec. 1976). So, too, the use of metaphor provides the opportunity for the reader to contrast a pattern perceived at the second moment with the memory of the pattern in the first instance and then, reflexively, look back. In doing so, readers are able to attain a more abstract level of understanding, closer to the unconscious or uninspected premises that they hold. Metaphor puts into motion a sort of reflexive shift along a spiral of steps.

One of the best examples of Bateson 'working the metaphor' lies in his discussion of 'creatural theory.' Bateson borrowed the term *creatura* from Carl Jung. The particular Jungian text to which Bateson was drawn was 'Septem Sermones ad Mortuos,' one of Jung's shortest pieces, a fragmentary impression that Jung himself wrote of the psychic self-exploration ('metanoia') he underwent in the years 1913–17. Bateson was requested to undertake a review of Jung's 'Seven Sermons,' which he later published (GB, 1974e). The 'Seven Sermons' reveal the paradoxical nature of psychic activity, of life in general, and of all psychological statements. They present Jung's discussion of the double face of the psyche – one face turning inward towards the personal experiences of the unconscious, the other turning outward towards the transpersonal and collective aspects of the psyche which Jung was to elaborate upon in later works, exploring how an individual psyche was integrated with the world. They also mark Jung's turning away from the conventions of Freudian argument towards the adoption of his own synthetic method, based on the contrasts of personal consciousness and collective archetype (Wheelwright 1982: 54, 55).[19]

Two of the main psychic dimensions which Jung discusses in his 'sermons' are *pleroma* and *creatura*. *Pleroma* is the 'nothingness' or 'fullness' of the eternal and infinite, within which all contrasting qualities are balanced out – good and evil, beauty and ugliness – and therefore cannot be distinguished. *Creatura*, by contrast, is confined to space and time. *Creatura* creates the qualities of good and evil, of beauty and ugliness, 'in the name and sign of distinctiveness.' According to Jung, the 'very ground' of *creatura* is distinctiveness:

> Distinctiveness is creatura. It is distinct. Distinctiveness is its essence, and therefore it distinguisheth. Therefore man discriminateth because his nature is distinctiveness. Whereof also he distinguisheth qualities of the pleroma which are not. He distinguisheth them out of his own nature ... speaking from the ground of our own distinctiveness and concerning our own distinctiveness. (Jung 1965: 380)

Bateson, in his review of 'Seven Sermons,' sees *pleroma* and *creatura* as conjunctive contrasts. Jung's metaphor *pleroma* becomes 'the unliving world described by physics which in itself contains and makes no distinctions.' It follows from this that if *pleroma* is 'void' or 'fullness,' a totally unstructured realm about which nothing can be said or thought, we can only know the non-living material universe through communicative contexts which we ourselves establish. Since we cannot directly capture order in *pleroma*, the distinctions we make in our communication about it are central to an understanding of order in nature.

The description of *pleroma* undertaken by physicists, for example, explains 'appearances' of pleroma through the dimensions of mass, time, and length. Yet this way of describing 'thingishness' must itself derive from an initial distinction - that quantitative measurement is the most appropriate means of describing the 'void and fullness' of *pleroma*. As *creatura*, we may assume that *pleroma* has its own regularities - inertia and change, cause and effect, connection and disconnection - but the regularities of *pleroma* remain, in the last resort, inaccessible directly. Thus the information we have about non-living matter is 'speculative.' A material order exists, and we can make careful distinctions in our description of that material order as physics and chemistry continue to do, but since non-living systems lack the ability to communicate information we can only 'know' them in a quite limited manner:

> I can describe a stone, but it can describe nothing. I can use the stone as a signal - perhaps as a landmark. But *it* is not the landmark ... What happens to the stone and what it does when nobody is around is not part of the mental process of any living thing. For that it must somehow make and receive *news*. (*Angels* 1987: 17)

Creatura, on the other hand, is 'that world of explanation in which the very phenomena to be described are among themselves governed and determined by difference, distinction and information.' To say anything is at once to create distinctions and is therefore the ground out of which *creatura* looms. If *pleroma* and *creatura* are thought of as polarities in a gestalt, then *creatura* is a figure in the ground of *pleroma*, but it is also a figure that 'speaks of itself.' In distinguishing, *creatura* distinguishes through the distinctions it draws, and so recursively points to the criteria for distinguishing. Thus 'creatural theory' becomes an epistemology contributing recursively to 'the epistemology of how we know and think' ('Creatural Theory,' CAF 69/4-5 April 1975).

Both Bateson and Jung recognize that wherever a distinction is drawn which separates a unity, as with the figure of *creatura* on the ground of *pleroma*, the distinction will always require a 'third position' from which the separation of figure from ground can be contemplated - if the distinction drawn is not to become another dualism. Thus Jung's 'Seven Sermons' also includes the mystic presence of Abraxas, a Gnostic figure of God which Jung employed for this purpose (Jung

1965: 378). In the Jungian text, *creatura* and *pleroma* are both contrasted with Abraxas. As 'God above God,' Abraxas is a level higher than the opposed qualities of homogeneity and distinctiveness. Abraxas, Jung writes, is 'effect in general' and embodies force, duration, and change; *both 'God' and 'the devil' are themselves marked by duration and change, for Abraxas always stands above any act of creatural distinction.*

Evoking a triad was a much healthier step towards an appropriate epistemology of living forms, Bateson states in his review, than the dualisms of mind and body which Descartes had insisted upon. In other writing, Bateson 'works the metaphor' of Abraxas, naturalizing Jung's image of the 'third ground' to make Abraxas more a figure of myth about biological unity than the type of Gnostic substitute for Jehovah which Jung had drawn. In one reference, Bateson considers Abraxas to approximate the mythological goddess Shiva.[20] In another, Abraxas is 'the most terrible and the most beautiful of all gods that man contains within his microcosmic self and that in turn is contained in the macrocosm' (Letters, 201–9c/1974). In another, 'Abraxas is an accurate representation of the largest conceivable *gestalt* (or oganized view of the cosmos – especially the biological world). There are no positive values which are not precisely balanced by destruction ... this Creator-Destroyer is God' (Letters, 1488–32a/no date [Jan. 1974?]). And in yet another, Bateson cites Abraxas as the embodiment of duration and change: 'the combination of life and death,' whose oscillations determine the time grains, rhythms, and size grains of biological systems and which must enter into the description of any attempt to explain order in life.

Abraxas brings a new understanding of death. In our way of thinking, life and death are opposed to one another, but in the figure of Abraxas as 'Shiva' they are combined, an integral aspect of the systemness of biological systems, Bateson says. 'Modern ecological theory indicates that death should be regarded as part of life rather than its opposite' ('The Nature and Culture of Man,' CAF 201/1971). Through understanding the metaphor of Abraxas, death is transformed from the opposer of life to a punctuator of life. The terrible beauty of Abraxas lies in understanding that Abraxas is also incorruptible: his 'effectiveness' – death – is necessary in the aesthetics of living organization.

Obviously, in using Abraxas in this manner, he was changing Jung's original meaning. He acknowledged that in the Jungian presentation, the 'Seven Sermons' are mystical fragments, 'responses to questions

– bitter questions – posed by the DEAD who had failed to find answers in Jerusalem' (Letters, 1488–32a/no date [Jan. 1974?]). Yet Bateson felt there was no requirement to continue with the exact meanings of *creatura*, *pleroma*, and Abraxas that Jung had used. He could borrow the metaphors. After all, *creatura* and *pleroma* were 'explanatory principles,' and, as mentioned above, all explanatory terms can be used to mean whatever definitions are given to them, according to Bateson. In addition, Abraxas was a mythical figure, and understanding of myth 'depends on being able to wobble ideas around.'[21]

Finally, both Jung and Bateson agree that the ordering relations of *creatura* have an outer limit. In Bateson's terms there is a boundary or 'interface' between living systems, where ordering relations apply, and non-living systems. *Angels Fear*, his posthumous publication, begins with a discussion of the 'interface' or boundary between *creatura* and *pleroma*. A boundary can be considered as a 'gap' in a continuum which is otherwise perceptually undifferentiated. The 'gap' then becomes a locus for contrast, that is for perceiving a difference and creating a distinction between figure and ground. Once the boundary is perceived, the distinctions in its levels and the characteristics of the 'gap' can be spoken about.

PARABLES: STORIES FOR EVOKING GESTALT

Former students are fond of recalling that Bateson often made his point through 'telling a story' either as narrative or parable:

> He taught a lot of bits of information, data from experiments, from experience, from art, from poems and savory quotations he loved to recite, which were in and of themselves not 'it.' They were, rather, 'illustrative' of 'it.' They were, a sort of carrier wave ... He had a repertoire of stories, three or four dozen multipurpose parables. His explanations were built from these stories, combined, inverted, end linked in various ways, as much as giant protein molecules are built from a fixed repertoire of 20 amino acids. (Nachmanovitch 1982: 36)

Bateson's stories often merge into parables, and though parables are usually confined to religious contexts, Bateson retains their form as 'illustrative of "it"' – the 'it' in Bateson's texts concerning either appropriate, or false, paradigms or ways of thinking. According to Northrop Frye, a parable in the Christian tradition is a visual analogy to accompany the act of reading or speaking about God as *logos*, the Word. It is a means for evoking the 'imaginative' in order to produce a kind of second response to the presentation of God as *logos*. In literate societies, the imaginative response is to 'the word.' In oral societies, the imaginative response is to oral phrase memory. In oral forms of address, the second response combines with the first and evokes a kind of 'vision,' a metaphorical 'seeing' through which listeners are able to take in the entire significance of what they have heard (Frye 1990: 63–96). A biblical example is 'Let your speech be alway with grace, seasoned by salt.'

Bateson uses parables for approximately the same reason, in order to discuss *logos* within the dominant paradigm of materialism, and those of splits between mind and body, and science and supernaturalism, to which it gives rise. A parable was just like a tautology. The statements themselves in the parable may not be true, but the links between the statements, the steps from one statement to the next, must be indubitable: if P, then P (*Angels* UE no. 7). One parable can carry many ideas and principles beside that which the speaker intended. Parables should be uttered in pairs or clusters to avoid ambiguity; 'Jesus often did this' (Notebook 65/29 Dec. 1976).

In his posthumous publication, *Angels*, Bateson uses parables in order to compare Christian thinking about the unity of the biosphere as the work of a transcendent God with 'ECO,' his version of the 'Gods' of ecosystems. He invokes a number of parables to show how the Christian *logos* and the *logos* of ecological Gods do not accord with each other. One parable Bateson uses in *Angels* is Coleridge's 'Rhyme of the Ancient Mariner.' Bateson explains that the Ancient Mariner succeeds in getting the albatross off his neck by becoming 'blessedly unaware' of his own predicament. At one level it is a parable of the relation between consciousness and unconsciousness and how all solutions to the problems of life cannot be found through conscious, intentional activity. At another level, Bateson uses 'The Rhyme of the Ancient Mariner' to show that in very large systems the split between the individual and the ecosystem is very different from that proposed in the religious view. The point about the parable is to evoke two very different images of how change can occur, and mistakes can be rectified.

In the Christian view, the sanctity of the individual in the image of God guarantees *direct* communication between the individual and the transcendental principle. Prayer, in the Christian conception, permits direct invocation of a Unifier, and through prayer individuals in the West seek the guidance of the unifying principle to aid them in changing their errant ways. Some Christian practices go further and favour the idea that prayer is *for* something, but Bateson believes this expression of prayer as 'tool' is a symptom of pathology (*Angels* 1987: 83ff). Instead, prayer invokes the principle of 'the power of mind over matter.' To make a picture of mind and matter interacting in this way, either mind must take on the character of matter, or matter must take on mental characteristics, but 'neither of these hypotheses will do – one leads to Teilhard de Chardin and the other to "behaviourism" – Darwinian evolution' (Notebook 65/1976). By contrast, ecosystems exhibit principles of self-organization. Instead of direct communication between individuals and the ecosystem *per se*, boundaries of communication are closed off. There is an uneven distribution of information among the interacting parts of an ecosystem; for (as we have seen in the previous chapter) survival in biological organization rests on the multiple interaction of information-in-circuits, the circuits themselves being distributed throughout the whole. Coherence in ecosystems occurs precisely because of this uneven distribution of information; instead of *direct* contact between organism and a unifying principle, the lags and flows of information-in-circuit occur in time. This is why an ecosystem gives the appearance of coherence, while also seeming to have clear boundaries within its overall system.

Peculiarly, direct communication may be damaging or lethal to an ecosystem (*Angels* UE no. 7). Gaps, or 'interface' between the boundaries of the whole, permit change to occur without disruption of the whole system, or, alternatively, without the whole system being required to adapt constantly to minor variations. In short, if we are to capture an understanding of change in ecosystems, we will have to examine gaps, boundaries, and interface, and only through their recognition will we discover wider patterns of coherence in the system or, by implication, recognize dilemmas of our own survival (*Angels* 1987: 83ff).

To advance his notion of ECO, the gods of ecosystems, Bateson quotes Blake (Notebook 65/29 Dec. 1976):

Your Christ is the friend of all/Mankind
Mine speaks in parables/to the BLIND.

Bateson argues that parables in the Christian tradition are often about forgiveness. In the Christian faith, it is permitted to plead forgiveness because 'we did not know anything about it.' Human mistakes are excused on the ground that though we know God, and we want to be religious, we continually drift away from the principles of religious existence. All religions, like all gods, engender false rituals for dealing with errors and mistakes, he says. And religious ritual becomes part of a replication of our own refusal to see self within a system.

In an ecosystem there is no forgiveness of sins. Since ECO expresses a unity where there is no separation of premises from action, the principles of ECO cannot be in accordance with human intentions. Bateson's ecological gods are not so permissive as the Christian Creator: 'The horrible thing about the god Eco – the gods of eco-systems, is that they have no free will, no sentimentality, they can be insane (which most gods are supposed to be incapable of). In St. Paul's phrase, they "are not mocked." So if you stand against the eco-system, it's no good saying you didn't mean it or you are sorry' (GB, 1975b: 29). In the published version of *Angels*, he repeats the same message:

> There is a parable which says that when the ecological god looks down and sees the human species sinning against its ecology – by greed or by taking shortcuts or taking steps in the wrong order – he sighs and *involuntarily* sends the pollution and the radioactive fallout. It is of no avail to tell him that the offense was only a small one, that you are sorry and that you will not do it again. It is no use to make sacrifices and offer bribes. The ecological God is incorruptible and therefore is not mocked. (*Angels* 1987: 142)

5

Cybernetics – Janus of Modernity

A reader merely dipping into Bateson's writing could scarcely avoid Bateson's attachment to cybernetic principles and might quickly conclude that Bateson is a mechanist who supports a technical, computer-oriented approach to ecological order.[1] The opposite is the case. Bateson's relationship with cybernetics was full of ambivalence. As this chapter will show, he could at once claim to be a founder of cybernetics, since he was an important figure at the Macy conferences of the 1940s which officially began the discipline, and its most trenchant critic. Certainly Bateson became full of despair over the technical pretensions of some of the leading figures of cybernetics.

The science of cybernetics, because of its origins and applications in electro-mechanical and electronic engineering, seems a strange starting point for a new science of ecology. Even at best, the systems-engineering version of cybernetics is Janus-faced in its relation to ecology. On the one side, cybernetics has been an integral part of the intrusive technology of weapons systems which threatens ecological stability on our planet in a massive way. On the other side, many people interested in current issues of ecology and environmentalism are aware that cybernetic feedback underlies current understanding of ecological systems.

Cybernetic homeostasis underpins one of the best-known scientific approaches to an understanding of the system of life in the biosphere, the GAIA hypothesis. The GAIA hypothesis proposes that life itself regulates the atmosphere and other geochemical systems of the planet. The basic GAIA argument is that neither geological nor biological evolution happens independently. Taken as a whole, the planet behaves not so much as an inanimate sphere of rock and soil sustained by the accidental processes of geology, but more like a macrocosmic biological organism that adjusts and regulates itself.[2] According to its proponents, James Lovelock and Lynn Margulis, there is an active but stabilized interrelation between the material or inorganic components of the biosphere and its multitude of organic forms. This stabilized interrelation derives from the cybernetic character (homeostasis) of ecosystems. Thus cybernetic notions are inherent to all self-regulating and self-reproducing aspects of planetary ecology.

Yet social critics across the political spectrum, from the left-leaning Jurgen Habermas (1970, 1981) to the right-leaning Jacques Ellul (1964, 1980), have identified cybernetics and the systems concepts derived from it as the foremost ideology of the military-industrial technocracy that threatens our planet. They were, of course, looking at how cybernetics radically transformed knowledge of control in electronic engineering, and the subsequent applications of this knowledge in operational command systems in both military and industrial organization. The Janus-faced aspect of cybernetics began with Norbert Wiener, one of the founders of the discipline. He had a major hand in designing cybernetic devices for tanks and anti-aircraft guns. The decade following the Second World War saw a massive extension of cybernetics to automated technology for defence against nuclear attack. Soon cybernetic devices became integral parts of electronic systems and, most particularly, of on-board computers in the exploration of space. The third decade, 1965–75, brought about a sizeable leap in the use of electronics and computerization in the organization of work and leisure. In the fourth decade, miniaturization of computers and electronics carried cybernetic devices from the workplace into the home.

Once the logic of cybernetics was embedded in computers and other automated devices, Ellul and Habermas point out, cybernetic systems spread to the whole landscape of industrial capitalism. The software applications of cybernetic logic enabled an integration of design, planning, production, and distribution of commercial products throughout industrial economies. By the 1980s, banking and service industries had transformed mechanical sequence-by-sequence ordering of capital flows, and production became more and more interlinked with the organization of data; and so the logic of feedback devices became crucial to 'optimal' production and circulation of goods.

Far from being a mechanist, Bateson became the single most important reformer of cybernetics. He was the intellectual leader who most thoroughly and continually opposed its dominant face – that of determinism and control. The transformation of cybernetics from a science predominantly concerned with applications of feedback as control towards a science concerned with problems of how society constructs its own models of change and stability, and then proceeds to hide those constructions in its rationalizations about social and ecological order, stands as one of Bateson's intellectual achievements. Bateson would never have been captivated by cybernetics in the first place if he believed that the epistemology of the discipline was deterministic. From the very beginning, he understood that Norbert Wiener's mathematical approaches to feedback as a time series went against all established principles of determinism.[3] Hence the indeterminism of cybernetics had a potential for reformulating an understanding of behaviour in a wide variety of systems, both artificial and natural – radical software as he termed it.

Bateson saw in cybernetics that which others did not see. Natural science in the post-Second World War era was dominated by nineteenth-century theories of physical flux and determinism, and until this dominant set of assumptions could be transformed there was little hope for a new science of ecological order. Mainstream physics in the mid-twentieth century was best represented by the automata theories of John von Neumann. Von Neumann believed that rational mechanisms and formal logic underlay all scientific and natural phenomena. His world was a world of deterministic dynamics, in which there was no place for randomness, except as undefined elements in a system. Automata theory was a derivative of this point of view, a 'game' driven in its dynamics by highly rational, formal, logical criteria. The challenges of science, according to von Neumann, lay in undertaking research which would examine the appearance of randomness and transform it into an definite process, appropriately recorded, and supported by a logical scheme of explanation (Heims 1980: 158ff).

As Bateson pointed out, nineteenth-century science gave a central value to the conditions under which all forms of energy could be extracted from nature and utilized. Subsequently it found objective value in the relation between 'order' and probable energy states. The domination of nineteenth-century assumptions lay very deep within science, so that when scientists in the twentieth century came to consider the problems of order, the assumptions of their forebearers lay unexamined. Order was assumed to be attached to energy transformation as this fit within scientists' dualist and materialist thinking about 'objective' conditions in the 'real' world (Notebook 10c/1949). Nineteenth-century scientists had defined order in terms of links between positive entropy and physical flux, because the physics of the time was most interested in applications to industry. Twentieth-century social science had carried over these hidden assumptions into its own explanations of order, describing human activity as if social and individual behaviour were made up of particles in energy gradients. Both physicists and social scientists ignored the possibility, Bateson claimed, that another generation of scientists in another century might find that one century's conception of 'order' was another century's conception of misplaced determinism.

Cybernetics was predicated on a whole new science of information. It carried along with it a set of intellectual ideas about order, purpose, and determinism that ran contrary to the narrowly defined determinism of nineteenth-century scientific laws. Wiener's approach identified processes of 'feedback.' Unlike the deterministic approach to order characteristic of the nineteenth century, the discovery of feedback revealed fundamental principles of self-organization. Feedback implied that any organized system must necessarily undertake 'hunting,' 'scanning,' or 'monitoring' events in the environment in which it lay, in order to maintain its own organization. Self-organization through feedback was characteristic of any cybernetic system, whether that of electro-mechanical robotics, or that of the cybernetic neurocircuitry of the human brain, or that of an 'environment,' that is, an aggregate of biological organisms in their own natural setting.

NEGENTROPY AND THE ARROW OF TIME

The science of cybernetics rested strongly upon the links drawn, independently, by both Claude E. Shannon and Norbert Wiener between information and the fundamental laws of energy or thermodynamics. The characteristics of information seemed to be qualitatively different from the nature of physical flux, and because of these qualitative differences, they seemed to suggest a new framework for investigating the fundamental properties of order. The notions of purpose, causality, and the laws concerning the irreversibility of physical processes would also be transformed in this new framework.

Claude Shannon's equations defined information as the negative condition of the statistical properties of uncertainty in thermodynamic gases. In terms of his equations the quantity of information refers to the number of 'decisions' which must be made, and their rate in a stationary channel, in order to reduce uncertainty to certainty. Thus the information carried by a set of messages is defined as the negative of the set's entropy formulated as a logarithm of its probability. Norbert Wiener gave a slightly different definition: information could be said to be the equivalent of a rate equal to the negative logarithm of entropy, or 'negentropy' as he called it.

In Norbert Wiener's analysis, negentropy is a negative quantity which arises out of statistical implications of the Second Law of Thermodynamics. As with Shannon's definition, the 'negative' in negentropy does not have the logical implication of a 'negation' or absolute reversal of the Second Law. The Second Law of Thermodynamics, the law concerning irreversibility in nature, proposes that in a closed system all thermodynamic processes move towards statistical states of increased homogeneity or disorder. This means that in a system of increasing thermodynamic homogeneity, the time path or rate of our statistical knowledge of the positions and energy capacities of the particles decreases.

Negentropy can be defined as a condition of *temporal reversal of disorder, when order is considered as a statistical rate of events in some closed system or channel.* In other words, our knowledge of probable events moves in a direction opposite to the time path of entropic systems. Negentropic conditions occur under a set of circumstances in which, under specific limiting conditions of a closed system of channel, there is a statistical probability of increasing knowledge about order, and hence of decreasing the rate of dissipation (run-down) of order.

As Wiener defined the relationship between thermodynamics and ordering processes, information can bring about order in situations in which information is in a feedback circuit with its source. Information in this sense is a type of 'conservation of time.' Its conservation is temporary in a relative sense, and saves the principle of overall asymmetry, or 'arrow of time,' which is so fundamental to the formulation of the Second Law. The arrow of time in a thermodynamic process indicates an irreversible movement towards 'heat death,' or increasing homogenization of thermodynamic states. 'Negentropy' does not contradict this principle, for in the long term the irreversible arrow of time proceeds from formation of a new planet, such as our own earth, towards its energetic decay. But negentropy could account for the fact of biological order on earth as a localized reversal of the arrow of time.

In Wiener's best-known phrase, information brings order from increasing chaos, even though the islands of order may ultimately have to yield to the overall cosmic movement towards the degradation of energy (Wiener 1973: 23, 25–7). The famous passages in Wiener's book which sum up his discussion are as follows:

The *metaphor [of negentropy]* ... is one in which the organism is seen as message. Organism is opposed to chaos, to disintegration, to death, as message is to noise. To describe an organism, we do not try to specify each molecule in it, and catalogue it bit by bit, but rather to answer certain questions about it which reveal a pattern; a pattern which is more significant and less probable as the organism becomes, so to speak, more fully an organism. We have seen that certain organisms, such as man, tend for a time to maintain and often even to increase the level of their organization, as a local enclave in the general stream of increasing entropy, or of increasing chaos and de-differentiation. Life is an island here and now in a dying world. The process by which living beings resist the general stream of corruption and decay is known as homeostasis ... We are but whirlpools in a river of ever-flowing water. We are not the stuff that abides, but patterns that perpetuate themselves. (Wiener 1973: 23, 25–7; emphasis added)

Wiener's definition of order from chaos had considerable implications for the whole notion of an organism's relation to its environment, because it proposed a resolution of a fundamental evolutionary conundrum. In the nineteenth century, the appearance of biological order seemed to run against many of the principles of physical order. How could the organisms in biological order, which apparently seemed to be so well formed, and so purposeful in their activity, emerge from a physical order that was subject only to the statistical rules of chance. By comparison to the random order of physical flux, biological order appeared to be aberrant – subject to external design. Negentropy, temporal reversal of chaos, and the associated principles of feedback could therefore account for a realignment of the principles of biological order with those of physical flux. The appearance of external design in nature could now be rigorously explained as an outcome of self-organization, of nature's own transformation of evolutionary setting.

ROSS ASHBY'S HOMEOSTAT: ADAPTIVE FEEDBACK

One of the people picking up on Wiener's definition of negentropy was Ross Ashby, an English cybernetician. In his perspective, short-cycle information circuits decreased perturbations brought about by environmental flux by holding steady critical variables of existing organization. Ashby developed a very simple model to illustrate his own cybernetic explanation of 'critical variables.' A cat by the fire finds the heat of the fire too hot, gets up, and moves to a position where it feels more comfortable. The cat changes position only as its own 'critical variables' move outside tolerable ranges. It will move around in a sequence - 'hunt' - until it feels a reduced temperature on its skin, somewhere close to the fire, but not too close, and then settle down once more. The exact position will correspond to prior experience of optimal comfort with respect to critical variables (Steinbrunner 1974: 53).[4]

Ashby transformed prevailing notions of feedback in cybernetic mechanisms into a general model of adaptation and change for any behavioural system. His very simple example of the cat by the fire drew a decisive relation between stability of systems and adaptation. In turn, change in response patterns brought about by adaptive feedback could also be considered equivalent to a pattern of 'learning.' This was true of both biological organisms and artificially constructed feedback mechanisms produced by engineers, such as robots. Both coped with environmental change by altering response patterns in order to restore critical variables to a desired range. In all cases, energy played almost no part and was simply taken for granted (Ashby 1961: 3).

From these observations, Ashby derived his 'Law of Requisite Variety,' to the effect that only variety can destroy variety. In more technical terms, the more information that a system can process by increasing variety, the more the system can cope with information at the boundary between two loosely coupled systems, and the greater overall control it has. By implication, learning increases variety.

Ashby's insights also showed how processes of learning were correlated with biological adaptation. Correlative matching of an organism with its environment generates processes that change the behaviour of an organism from a less to a more survival-promoting form (Ashby 1960: 3-4). Ashby indicated that concepts of feedback, learning, and correlative matching did not pertain merely to single organisms or mechanisms, cats-by-fires, but that the same principles demonstrated in a narrow field of interaction of organism and environment were applicable in the broad field of evolutionary development. The simple observation of hunting - as in the 'cat hunting for warmth near a fire' - showed why. The cat hunting for warmth contributed to a region of stability, cat plus fire plus fireplace. Hunting is a sort of trial and error behaviour which, when it settles down, settles down in a region which maintains all essential variables of organism and environment within certain well-defined limits. It is a useful model for explaining why a system can continue to maintain stability among its functional relations for long periods of time.

Ashby noted that biological systems must be not only stable, but ultra-stable, systems. Ultra-stable systems are 'loosely joined' to their environment. Their joining consists of loose links both to local environments and to the larger environment of system as a whole. Without these loose linkages there would be no possibility for coherence of organism and environment, nor of defence against perturbation of the total system. Here, then, is the origin of Bateson's discussion of communication in large systems referred to in the previous chapter.

If organisms were 'fully joined' to their environment, with rich cross-connections, the set of overall constraints would be so great that relatively minor changes in the environment would kill the organism. A condition of non-communication inherent in 'loosely joined' coupling between organism and environment is necessary for appropriate adaptation (Ashby 1960: 155). As Ashby went on to show, a further requirement for appropriate adaptation and ultra-stability is that any organism must have not only a primary feedback between itself and the environment of which it is a part but also a secondary feedback system in which feedback is linked to feedback among its various subsystems. If it lacked secondary feedback, the organism would be able to deal only with local disruptions and would be unable to resist systemic disruptive effects.[5]

Ashby illustrated all these principles of adaptation by means of an electro-mechanical model he built. He called it a homeostat. The homeostat demonstrated how change in stable systems was accommodated through step mechanisms. One step mechanism had its primary feedback coupled to differences within its fast-acting or immediate states; the other step mechanism had its feedback working intermittently and at a much slower rate of speed. It changed values (took a 'step') only when the oscillation of the system plus environment passed definite thresholds restraining the system's critical states. The first sort of step mechanism plays a part *within* each variation and deviation of on-going activity; the second step mechanism moves the whole region or phase-space towards a new set of values, all of which lay beyond the thresholds of its prior critical states. Slower order feedback determines the bias or parameters of 'error control' in the system plus its environment (Ashby 1960: 98).

In effect, Ashby's homeostat proposed a multi-level model of change, and this model so excited Bateson that he made it the focus of a correction of his former ideas in his second Epilogue to *Naven* (2d ed. 1958: 298–302), a sort of auto-critique of his prior belief in mechanistic versions of social change. Ashby's integration of the concept of learning through feedback also brought Bateson back to some of his own themes about learning he had considered before the Second World War and enabled him to expand them in new directions. Before the war, while behaviourism was in its heyday, Bateson had suggested that an important part of learning was that it seemed to be patterned in different levels. At the time, nearly all social science models of behaviour were based on notions which had been borrowed from physical systems: stimulus-response behaviour was the most usual. Descriptions of learning were built around correspondences to stimulus-response and did not consider patterns of learning in and for themselves.

Bateson's notion of learning to learn – 'deutero-learning' as he called it – broke with the behaviourist tradition. The latter presumed that all learning was a matter of rote memorizing of individual items under controlled conditions of stimulus and response (*Steps* 1972: 279–308). In his concept of deutero-learning, Bateson considered the circumstances under which behaviour became 'reinforced' and argued that an important level of constraint, which behaviourism seemed to ignore, entered into the whole situation of learning. He would later label this constraint a repeatable 'context.'

What Bateson was groping for was a common set of principles about learning that would be abstract enough for his matrix of ideas, that is, principles which would be suitable to describe adaptation in the biological sense of the term, which would account for cultural habits or customary behaviour, and which would also hold true for the psychological phenomenon of 'habituation.' Around him the social scientists of the day seemed to assume that human beings were 'molecules' whose learning processes follow a straight line when plotted against time. But human beings did not learn like this, even if they were assumed to be 'educable particles.' The behaviourists had seemed to hit upon a single context, that of instrumental reward and 'Pavlovian conditioning.' But even some animal psychologists had begun to point out that a pig or a dog 'would not give a damn' for the food pellets or the pains from experimental electric shocks if it were living its normal life. Yet, within the experimental setting, the animal can be made to care so much about these trifles, that it has a nervous breakdown if unable to guess correctly which response is called for by a given signal. Hence it was necessary to build a systematic classification of learning contexts – 'not what is learned but the contexts in which learning occurs' (Letters, 1390–1b/1945).

From his own point of view, Bateson did not have a clear understanding before the Macy conferences of the 'what' that contextual learning was about. At first he thought it seemed to have something to do with 'economy' in the narrow sense of the term, but he was at a loss to explain how such economy fitted in with the laws of entropy and thermodynamics. Contextual learning, unlike rote learning, was surely a change in a selected direction, an 'up-hill business' against entropy which seemed to involve some expenditure of energy, 'some loss of differentiation in some other area,' but 'I just don't know the next question to ask' (Letters, 1390–1c/1945).

Later he was able to explain the 'economy' of habit in a very different manner. To learn about context was a much more abstract sort of learning than the instrumental learning which behaviourists employ, but it is the more abstract ideas of context that tend to sink in, become less conscious, and 'habituated' the most. As contexts sink into habits, they become more difficult to disrupt, more difficult to change, because new information has been organized around the habituated contexts. To change habituated contexts involves changing a whole field of superficial ideas which a person does not usually want to disturb, because people do not want continually to think through problems that they have thought through before. Thus it becomes economical to sink these problems of context into habituated responses (Letters, 1096–27/1967).

Ashby's definition of feedback as learning came very close to the images that Bateson had put forward in his own papers on learning. After the conferences on cybernetics Bateson was able to proceed with the notion that processes of adaptation are related to 'context,' describing the latter as transforms of different levels of difference. In this sense, learning has a definite analogy to levels of behaviour promoting survival in evolution. The 'what' in both human learning and in evolution had nothing to do with energy or particles, but was some form of mapping of variety and difference, incorporating a difference in contexts and levels of context.

Learning was not so much an energy-dependent 'up-hill push' against degeneration of living order.[6] Rather, negative entropy arose through a set of circumstances which permitted comparison of conditions of stability with those of change in some form of temporal setting. He borrowed Korzybski's and Wiener's phrase in order to discuss this capacity – 'time binding' (Notebook 12B/1950). Time binding is important because information derived from the environment is not, in Bateson's view, equivalent to a signal bearing direct adaptive information for the organism. Instead the signal is 'about' conditions outside the organism. While there is always some direct stimulus from the environment to the organism, stimulus-response does not describe the relation between the organism and its environment. What an organism senses in its immediate environment is a signal which its sensory receptors recode, converting direct signals into a transform of difference. The transform of difference permits the context of learning to be taken into account.[7]

REDEFINING NOISE AND ERROR

Although the ideas of Wiener, Ashby, and McCulloch (see following chapter) were crucial to Bateson's subsequent writing, he needed to modify some of their central propositions. Bateson held, with some justification, that there is a watershed within the history of cybernetics between the development of Wiener's and Ashby's initial concepts and his own reformulations.

For example, Wiener's concept of cybernetics as 'steersmanship' indicated that stability, constancy, and meaning in a communication system depended on the elimination of 'noise.' A general principle of his cybernetics was that transmission of information through a channel never increases as it moves from source to receiver. Another principle of classical cybernetics held that the efficiencies of cybernetic circuits increased in proportion to the increased rate by which the design was able to eliminate noise in a channel of information. A third, employed in Wiener's concept of feedback, was that the relation of feedback to the wider system was defined in negative terms – as an oscillation reducer. The organism, or the machine, adjusted to the environment by dampening down changes and diversity.

Bateson's own 'ecology of mind,' by contrast, assumed that noise generation was creative. In Bateson's reinterpretation, noise was 'playful' and creative; it became looped back into the overall system as part of the creation of new patterns. Bateson regarded noise as equivalent to novelty, and novelty, an analogue of playfulness. In animal behaviour, playfulness is a device 'whereby adaptive acts become chosen – that is playfulness creates the noise out of the responses to which the new adaptation is chosen' (Letters, 207–19n/1971). Noise generation, as well as noise sensitivity and 'noise eating,' could all initiate system change.

Bateson found the same problems in Ashby's homeostat as he had found in Wiener. Bateson frequently referred to Ashby's homeostat because it tied together a whole series of perennial questions surrounding biological or social adaptation.[8] Yet he came to see that Ashby's discussion of adaptation contained hidden assumptions of control. Ashby's homeostat presented adaptation as a 'switching process' through which a system altered its distribution of constancies. It was true that Ashby had noted that organisms and complex systems are loosely coupled to their environment and to each other. Learning then was a central component of loose coupling, or adaptation, for only by such means could any mechanism cope with the variety of disturbances that the external environment presents.[9] Yet the design of Ashby's homeostat was based on the notion that any restriction of an organism's capacity to receive and to process variety (information) will result in restrictions to the range of circumstances to which it can respond, and will therefore threaten its viability. On closer analysis, his model defined stability as a dampening down of environmental perturbations in conjoined regions or phase-space. In an energy-driven system, Ashby's assumptions were entirely appropriate, but in a system where functional interrelations between organism and environment were dependent upon sensing differences in relations between each other, these assumptions were more open to question.[10]

Ashby's assumptions of control became clearer to Bateson when he tried to develop his own homeostat, which, he hoped, would model conditions of learning more explicitly.[11] He found that homeostat-type models could not represent an interactive communicative exchange. Homeostats could not model a situation in which the changing state of 'pupil' had any function in the overall 'teacher-pupil' system of relations (Letters, 672–3a/1957). While Bateson could live with the absence of 'affect' in the homeostat's model of teacher-pupil relations, he began to see that the homeostat resembled a clockwork machine, rather than a living organism. Despite Ashby's claims to the contrary, the homeostat reduced system stabilities to a singly determined oscillation, the reduction of noise. Ashby, like other engineers, had assumed that the presence of noise in a communication channel was an error to be overcome.

As with his objections to Wiener, Bateson found these assumptions far too limiting. In a homeostat, error is apparently reduced by oscillations throughout *the whole* of the circuit; error finally dies away while travelling through the whole circuit. This corresponds to negative feedback (Letters, 207–191/1971).[12] In biological systems, however, noise can be transformed into pattern and order under appropriate conditions. If biological adaptation did not include possibilities for a system or subsystems to recycle errors and in the process create new patterns from noisy sources, then a vast potential for change in biological systems was lost. Noise was an enormous flexibility, and a vital source for future adaptation. Thus the presence of noise was by no means an error to be overcome; rather, it was a source for future adaptation (Letters, 207–198/1971).

Another problem also emerged. Ashby had not adequately discussed conditions of reciprocal transformation of communication between organism and environment. Organism and environment were supposed to be interactive and interrelated as part to whole. In the homeostat, feedback was a satisfactory explanatory device for the processes through which two or more systems couple with one another, so that one system's input is coupled with another system's output and vice versa. Ashby's model successfully accounted for the mutuality of organism and environment through a communicative setting. But this electro-mechanical representation of multi-level feedback did not focus sufficient attention on the boundary conditions by which an organism was coupled with its environment. The Ashby design obscured the fact that limit situations in biological and human learning are not of the same type as the 'levels' he designed for his homeostat.

For Bateson a learning system must include not only information of perturbation or change in variety, but also information as difference about the boundaries between organism and environment, as part to whole.[13] This feedback is crucial to biological and to human learning, for it provides news about boundaries between living organisms and their environment, the 'setting' of feedback. Without this organism-environment feedback loop – a feedback of the 'setting' of feedback – the relationship between information in the system and the meaning of the setting of relations in the system will remain confused. In fact, any participant-system relations which lack the reflexiveness to take the setting of their relationships into account will always be confused. Mutual reciprocity in the absence of such feedback can just as well lead to pathologies as to well-adjusted, stable settings, and participants in the system would never know the difference between the two.

THE FOUNDATIONAL SCIENCE

It was Bateson's belief that information theory and cybernetics would ensure a reflexive approach to the scientific conception of order. He spelled this out in a lengthy letter:

> I mentioned above the identity between information and negative entropy. Let me use that as an example of the change which takes place with the shift to reflexiveness. Nineteenth century physics was non-reflexive and regarded the theories of physics as a 'microscope' for the study and exploitation of matter. The second law of thermodynamics was accordingly phrased in terms of 'available energy' translatable into physical 'work' ... [then] the physicists (human beings) built their own value premises into the statement of the Second Law, when they phrased it in terms of 'available energy.' We can now see their phrasing as a special case of a much wider probability phenomenon. Further we note that the phenomenon is always *an interaction* between a purposive entity (man and an environment) so that whenever he makes evaluations (and all statements are wishes) he encounters this probability phenomenon and so on to the identity of information and negative entropy as a base for a new theory of value which will be based in human beings ... All right – there are two of the major shifts in the form of abstract statements – the shift to reflexiveness and the shift away from maximizing quantities of the gross type to ... the negatively entropic type. (Notebook 10c/49)

'Reflexiveness' occurs through feedback adjustments necessary to ensure continuance of a system's organization. A cybernetic system relates change in the states of the environment to its own internal organization. Therefore, cybernetic systems provide a series of formal concepts about self-organization. In a cybernetic system, the elemental units of the system, message 'bits,' move between relays which have their own energy source, and system 'states' derive from interconnections of messages in relays. Thus there is an elemental distinction to be made between those systems which require external sources of energy in order to work, and the 'work' of information systems.

Unfortunately cybernetics tended to assume that the network of human behaviour was coincident with the physical location of the signal and that implementation of monitoring and steering facilities was simply a matter of appropriate design.[14] Bateson wrote to Warren McCulloch that cybernetics must draw a clear distinction in its formulations between the material manifestations of a circuit and human principles of communication. A signal must be kept distinct from verbal communication, for the moment the latter is given a physical topological form, 'we are lost.' The propositions of communication existing in human interaction were in many instances quite different from those of communication in a wired physical circuit. Fictions and lies, for example, both usual aspects of human communication, could not be represented as bits - physical signals in topological circuits (Letters, 931-4/1946).

The formal theories which lay behind its applications were an important step in the advancement of epistemology, Bateson believed. Despite its technocratic mode, cybernetics possessed four essential characteristics for any scientific theory in the mid-twentieth century.[15] In the first place, 'steady states' of cybernetic feedback systems are non-linear. Before cybernetics, social sciences had borrowed stability concepts from the linear dynamics of mechanical processes. In linear dynamics, an ordered state was said to be in 'balanced equilibrium' with other ordered states of the system. Society was said to undergo change in its parts around an imaginary mechanical fulcrum, while its processes of social change were 'a balance of relations' between prior events and subsequent events. By contrast, cybernetic models of order are based on inherent circularites, oscillations, and dynamic thresholds.

Second, cybernetics creates a whole new language with which to think about structures and processes. Instead of 'entities' interacting in a system, there are 'relationships' between parts and the whole of a system. In place of 'individuals,' there are 'systemic' units. In the place of 'facts,' there are 'messages.' In the place of 'transfer of energy,' there is the 'transmission of information.' And in place of 'objects' external to the realm of observation, there are 'structures' implicating the presence of the observer.

In place of 'linear causality,' typical of mechanical or energetic systems, the significant characteristics of a cybernetic system are 'events with constraint.' The notion of constraints transforms concepts about cause-and-effect. Causal processes in cybernetic systems arise from temporal sequences in the circularities of information flow. The repetitions of feedback can be considered as a form of 'anticipation' of the system, and are the primary means by which the system takes 'purpose' into account.[16] Information loops 'anticipate' system output by feeding information back to input in order to correct deviance or error.

A third significant characteristic is the repudiation of stimulus-response as a model of human behaviour in the social sciences. Models of stimulus-response presupposed that an external push of energy initiated some form of 'tension reflex' in the individual and that 'response' in human behaviour occurred as an effect of these external pushes of energy. Analysis of stimulus-response is always positivist for it requires the observer to relate causal effects to definite stimuli in space and time. A cybernetic system which anticipates deviations turns positivistic explanation back to front for behavioural causes are a result of non-locatable 'error activation.'

Finally, cybernetic systems achieve a 'shift away from maximizing quantities of the gross type'; that is, information systems achieve economies without imputing assumptions of utility. By this Bateson means that energy systems are assumed to maximize their efficiencies according to some maximal rate of energy flow. The efficiencies of the system are given a value in terms of 'work,' and the most obvious medium of value linking 'work' to maximized energy flow is money. Information systems, by contrast, do not derive utility from maximizing the rate of their performance in quite the same way. There is always a qualitative aspect to the organization of cybernetic systems. The ability to learn, for example, does not yield the same sort of quantitative efficiencies so easily evaluated in energy system performance.

A BRIEF CEREMONY - 1984

Today the American Society of Cybernetics is perfectly content to run an annual conference on 'ecological understanding of ecology' on the grounds that an ecological approach is fundamental to an understanding of any self-organizing system. This transformation in cybernetic propositions is sometimes referred to as the difference between 'first-order cybernetics' and 'second-order cybernetics.' First-order cybernetics never took up a critique of the scientist's unexamined belief in 'control' of the system. And it held fast to principles which drew a tight relation between transmission of information in a channel and the utilization of energy. In a first-order cybernetic system, stability

- its very orderliness and constancy - was defined in opposition to runaway or to 'noise.' 'Noise' in any communication channel obscured patterns of information and rendered messages meaningless.

Bateson's position is that once scientists begin to talk about the subject of feedback and control, they inevitably become part of the context of 'control.' It follows from this that any scientist who attempts to manage or control environment must inevitably include himself or herself as subjects of control. In 'second-order cybernetics,' Wiener's applied principles of control are transformed. Not only must cybernetic systems always include an observer's relation to the system observed, but a fundamental criterion of 'control' must include awareness that the observer's presence creates a bias within the system as a whole. Thus, a second level of feedback relations, from system to observer's bias, must be taken into account in the overall explanation of the system investigated. The study must include a feedback loop which takes into account feedback of the conditions of feedback.

Bateson bemoaned the continual attention cyberneticians paid to feedback-as-control in technical systems. In his own eyes, an entire world view and its alternatives lay between Wiener and von Neumann. If cybernetics shifted too much towards the determinisms of von Neumann, then cybernetics would become equally dangerous, a model fraught with vast consequences. Von Neumann's game theory, for example, had escalated the arms race between the superpowers.[17] The cybernetic engineers subsequent lack of concern with epistemological issues of feedback, which Wiener had so cogently raised, was 'just another example of "mechy-machs" subduing the world so that it will fit that which the "mechy-machs" can deal with' (Letters, 207-19t/1971).

Bateson feared that cybernetics with 'the terribly rapid development of electronic devices and especially digital computers' would end up promoting the same sort of materialist superstitions as nineteenth-century sciences had, promoting the illusion that man was potentially 'captain, not only of his soul but of all that surrounds him' (Letters, 824-2/1973). Such a combination would lead inevitably to a greater sense of pride or *hubris*, in the tragic sense of that term. The epistemological notions of cybernetics, in Bateson's view, led to a quite different understanding of the place of humanity in the world. The epistemology of cybernetics enabled a glimpse at appropriate conditions for sustaining whole systems, especially relations between self-organizing systems in reciprocal relation with their environment.

In a brief ceremony in Philadelphia on 3 November 1984, Lois Bateson, his surviving wife, accepted a posthumous award. The American Society of Cybernetics had awarded Gregory Bateson the Norbert Wiener Prize for his outstanding contribution to cybernetics. The irony of the occasion, both date and circumstance, was evident to many of those present. As the conference revealed, first-order cybernetics lives on. Control theorists still defended their position, saying that their theories and models are perfectly adequate sketches of the necessary steps involved in translating thought into action and vice versa (Powers 1987: 13–14). On the occasion of the award, the two streams of cybernetics commonly labelled 'first order' and 'second order' passed each other by. Communication engineers, still rooted in first-order concepts of control, kept to the downstairs lobby. Those who had been touched by Bateson's 'ecosystemic therapy,' the family therapists, held their seminars upstairs. The family therapists seemed to express best the turn-around in cybernetic ideas which Bateson had accomplished. Their major topic of discussion was how models of family organization still leaned too much towards accommodating homeostasis and control and had not sufficiently incorporated metaphor and aesthetics, an important part of second-order cybernetics, as part of their therapeutic context.

On that occasion, ecologists were few in number. The debate over the missing components of the GAIA hypothesis, a debate which mirrors distinctions between first-order and second-order cybernetics over the nature of control, had yet to come. The major difference between the mammoth cybernetic system which Lovelock calls GAIA and Bateson's reflexive thermostat discussed in Appendix 1 lies in their respective embodiment of feedback. Lovelock proposes a physical embodiment of feedback loops, an internal system, a closed loop system of control. Homeostasis occurs through the corresponding feedback between climate change and biological systems causing that change. GAIA equals 'the wisdom of the body,' such that homeostasis, disrupted, would cause the 'vital organs' of the super-organism, GAIA, to malfunction.

By contrast, Bateson's reflexive homeostat denies determinism or control to the physical circuitry of that system. Bateson proceeds instead to examine how living organisms sense their mutual coordination and become open to news of change in a mutual setting. Bateson's 'mind' is relational: the process of monitoring, so crucial to any operation of a cybernetic system, is, in Bateson's view, a mechanism for the operation by which reflexive learning takes place in biological order. Bateson argues that only through reflexive learning could such biological systems strengthen and elaborate their patterns of organization.

Lovelock's position has resulted in a number of problems surrounding the GAIA hypothesis, which Bateson's reflexive homeostat avoids. If, following Lovelock, feedback loops are physical channels, composed of a trillion trillion tiny switches, a multitude of negative feedback cycles, which operate automatically through the biota of life, how then is humanity itself integrated into his super-organismic unity? Lovelock's dedication to the physical components of coupling in GAIA, the physical feedbacks between organisms and switches, pushes GAIA towards deterministic statements of 'superorganic being' for which he has been duly criticized.[18] Indeed, in his more recent book, *The Ages of Gaia*, Lovelock attempts to enlist Bateson's support in the revision of his own position. GAIA 'is in no way a sentient being, a surrogate God,' he says, although GAIA can be 'both spiritual and scientific' and is 'alive and part of the ineffable Universe and I am part of her' (Lovelock, 1990: 217–18). As we shall see, Bateson's perspective is that neither 'spiritual' nor 'scientific' (in the physical sense) will do in thinking about biological unity.

6

Communication and Its Embodiment

Ashby had presented only a technical model of homeostasis, and any attempt to make a cybernetic explanation of a technical homeostat available for natural systems would require an extensive elaboration of the communicative processes involved. The rules of coherence and order evoked by the study of cybernetic coupling in a mechanical or technical sense are much like the relation between a key and a lock. In mechanical objects, the 'opening power' of a key lies in the pattern of constraints of its configuration in relation to the form of the lock. A key has no 'power' to accomplish anything without matched configuration. The human and the biological world also presents innumerable processes of 'keys and locks,' but the matching process is a communicative one; before the matching takes place, the organism has to develop a 'readiness to receive.' The processes of communicative coupling in the human world develop in everyday learning of rules of relationship.

In Bateson's view, the formal rules of coupling, the rules of cybernetic order, can be carried over to any living system, including coupling between human communication systems, between a cultural system and a natural system, and between order and sub-orders in ecosystems.[1] Rules of coupling would also show how both modes of any communication system, the material and the ideal, were themselves embodied in patterns of interactive communication. Chapter 1 of this book told of the anger and disappointment Bateson felt at the publication of *The Pragmatics of Human Communication*, a book devoted to some of his ideas about communication, but in which the subject matter of communication had been torn out of the wider framework of his own thinking. *Pragmatics* presented communication as an autonomous sub-discipline, as if all communication was an activity being applied to some utilitarian end. No such subject as 'pragmatics' of communication existed in Bateson's mind. He was as much opposed to any 'applied social communication' as he was to applied cybernetics.

The theoretical problem was not to devise a pragmatics of communication. Rather, nineteenth-century study of linguistics had wrapped rules of communication into arbitrary definitions of linguistic codes and tied the problems of coding to an inflexible system of logic. This combination might provide a satisfactory understanding of communication as mechanical replay of acoustic sounds, or the overcoming of noise in a channel. But the definitions provided little understanding of why messages inform, what they mean, or why a 'readiness' develops to receive news.

Throughout this chapter, we shall see how Bateson reinterpreted abstract notions of communicative rules – codes, symbols, and semantics – in terms of a systemic and interactive interpretation of messages. Especially important in this context was Bateson's development of 'embodiment' of meaning. Unlike almost all communication theorists, and nearly all phenomenologists, Bateson rejected the concept of embodiment of meaning simply as a physical trace *in* the body, a sensation, or as a neural embodiment of a signal *in* the mind. Bateson proposed that, in addition, all embodiment was relational, a part of the patterns of messages or interpersonal perceptions that are established and maintained between members of a communicative system. These patterns derive from constant repetitions of communicative interaction, between communicators and between their levels, or contexts, of communication.

The most important outcome of this notion of embodiment was his hypothesis of double bind. Patterns of communication in systems of communication emerge from embodiments of our own ways of thinking and acting. In turn, the assumptions on which we base our own communicative relationships are coupled to assumptions of how we learn, and these, recursively, are drawn from our own epistemology, our ideas about how we know. This is what Bateson meant when he said that 'double bind' was a suitable model for our own survival. Our survival depends on our understanding that not only are we coupled to how we conceptualize ecological order but also to how we have embodied in our patterns of relationship our epistemological ideas of nature. Once prior rules of embodiment change, 'we are, as it seems, unfairly treated for some attitude or premise of relationship which was at some (near or distant) previous time appropriate' (GB, 1974i: 420).

So transformed, cybernetics becomes an explanatory epistemology for all communicative systems - human, animal, and other - found in nature. It also becomes explanatory of the patterning of boundaries between culture and nature. If the holism of the eighteenth century had been the 'great chain of being,' a rationalistic hierarchy covering all ideas, to the point of obsessive rationalism; and if the grand hierarchies of the nineteenth century were mainly in the field of natural history - biology, botany, geography, and geology; then the holism of the twentieth century lay in cybernetics. From cybernetics would emerge a new form of systemic thought characterized by a hierarchy of levels of communication ('General Theory of Human Behaviour,' CAF 132-B4/1957). And any science which cut into this unified field of inquiry totally missed the point, Bateson claimed.

Cybernetic ideas could at last detach the study of communication from the metaphysics of individualism, rationalism, and false objectivity found in conventional studies of linguistics and semantics. Once cybernetic rules of coupling and communication were understood, then people could dispense with the dualism of subject and object. Moreover, Bateson believed, the notion of communicative embodiment is a very great improvement over theories of material embodiment which have dominated Occidental thinking and which were largely responsible for our current environmental troubles (Draft memorandum for Mind/Body Conference, CAF 100/1976).[2]

THE BODY-MIND PROBLEM

The transcripts of the Macy conferences on cybernetics show that Bateson was always among the first to appreciate the ways in which cybernetic models could be translated from one field to another, a quality that is evident in all his later work. This was particularly noticeable in the case of Warren McCulloch's early contributions to the conferences and in the case of Ross Ashby's appearance at the Macy conferences in 1952.

McCulloch sought to bridge the gap between physical sensation and the existence of an 'idea,' a gap which hitherto had proved to be so intractable both experimentally and intellectually. The 'gap' was a primary reason for the conceptualization of mind as somehow separate from the body. McCulloch's major book, *Embodiments of Mind,* stresses the thesis that mind is propelled by the very nature of neural organization. Ideas arise initially as a result of constraint, McCulloch argues, and these ideas are neither singular nor unique. Ideas arise from prior constraints, which have prior constraints, and so on and so forth. In other words, all information in a system arises as a stochastic process – a process that is random and occurs in time as movement from prior paths, each path giving some selective elements of form to the overall pattern. Ideas, in this sense, are a form of determinate invariance opposed to 'noise' or to 'randomness' (McCulloch 1965: 256–75).[3]

There was a relationship between ideas as forms of invariance and the inherent circularity of the closed network of the nervous system. A physiological sensation does not simply travel in a straight line through the nervous system to the brain and then die away, as most psychological theories supposed, but propagates itself as an invariant form in a circular causal net. McCulloch pointed out that memory processes retain the form of an idea in a neuro-circuit of the brain, rather than a point to point correspondence with the event outside it. This was because the 'form' of an idea was trapped by the inherent circularity of the closed network of the nervous system.[4]

McCulloch's reverberating memory circuits provided a clear-cut alternative to the premises of behaviourism. As Bateson saw, the stimulus-response mechanism of the reflex arc, from which the premises of behaviourism derived, treated the input of sensation to the neuro-physiological system as an 'impulse' – similar to that of an external 'shot' of energy. McCulloch had made clear that determinate interconnection was absent in mental activity, so that the notion of an impulse travelling along a densely interconnected network no longer matched the topology of mind. Correspondingly, any philosophical notion which presumed tightly joined inferences moving 'ideas' causally along a determinate net was false. Causality in the nervous system rested on congruence between relations of temporal patterning. In McCulloch's argument, causal sequences did not proceed along links in a physiological network, from a measurable source of sensation to measurable effects.

McCulloch presented a firm challenge to Freud. Freud's hypotheses asserted that at no time do we forget 'a single jot or title' of what happens to us. If Freud were right, then in order for a person to hold the amount of information processed during a lifetime, the size of a person's head would have to be equal to that of a small elephant.

According to McCulloch, design of the nervous system embodies a set of principles which are in direct contrast to this. The design of the nervous system clearly demonstrates that enormous corruption of information will occur in any sort of communication via the senses.

To be specific, the eye relays to the brain about one-hundredth of its information, as a result of a constant checking and rechecking of the accuracy of the information which it receives. While overall information is decimated, usable information is enhanced. As a result, the chance that the usable information which the brain receives is in error is fantastically small, a billionth of a billionth of a tenth of one per cent. Usable information is a corollary of the primacy of redundancy in neural organization. Redundancy ensures that any element in the neural network is repeated, and repeated, and repeated. Instead of being a supernumerary feature of the neural network, the very primacy of its redundancy ensures an extremely high chance that whatever information the nervous system receives is coincident with something in the world, or, in the term of materialist philosophy, 'reality':

> The chief reason for the enormous reduction from afferent signals to efferent signals is the requirement of coincidence along the way. Every such requirement of coincidence ... increases the assurance which can be placed in any subsequent signal, for that signal must then be due to coincidence in the world impinging on our receptors ... we achieve an immense certainty that what we observe is due to something in the world. (McCulloch 1965: 147)

If massive redundancy and the constant washing out of random variations through coincidence detection precludes the usual notions of determinate interconnection, then, argues McCulloch, whatever the mind may be, it is not an embodiment of the logical principles of predictability on which Western science had built so much. Instead, the nervous system was fundamentally relational, deriving its order through congruence of patterned redundancy.

Since McCulloch repudiated the supposition that the physical presence of connectivity was fundamental to an explanation of the workings of the nervous system, Bateson believed most behavioural principles based on the notion of continuous implication would have to be revised. So, too, would that part of psychoanalysis which assumed that consciousness provided a continuity between the representation of the 'real world' outside individuals' bodies and the 'world' inside their heads. McCulloch and others had struck at the central dogma of Western science. By showing that the brain is not a separate centre of the body, but embraces ideas, feelings, memory, and aesthetics, they had totally reformulated body-mind dualism:

A brain, for example is not the controlling centre of a man's body, a brain is responding to events in the body which are reported by sense organs of one kind or another, and its responses feed back and affect that body at a time subsequent to the moment at which the deviations were reported. ('General Theory of Human Behaviour,' CAF 132-B4/1957)

'A queer business,' Bateson wrote in one of his early letters to McCulloch, 'how the world which previously contained elements of coherence becomes again a jigsaw puzzle when a new theoretical approach is devised, and then one has to go around picking up the pieces all over again' (Letters, 931-4/1946).

Nevertheless, McCulloch's new model of mind required additional features. Bateson worked on the idea that mind was not only embedded in the nervous system - and in the environment of that system - but merged into a chain of ideas 'so closely linked together that each is almost the same as each of the others. Each is almost a name for the others.' The others were 'evolutionary theory,' and 'epistemology.' All of this 'rolls along with,' partly determining and partly determined by, culture (Bk. Mss., box 5; 1987: 204.13).

CONTEXT AS A FRAMING DEVICE

Bateson's thinking was by now far beyond the well-formed notions of pattern and organization developed in his own disciplines of anthropology and psychology. Yet he could not give extended explanations of how his cybernetic theories of communication were interrelated with the grand hierarchies in biology and evolution, as he evidently wished to do.[5] He was able to outline some general ideas in his letters but could not explain to others the specific relevance of his research.

As a result, research was 'all over the place,' as his junior researcher at the Veterans Administration Hospital, John Weakland, put it. Investigations leapt from one subject to another. Yet Bateson was in no hurry to test cybernetic principles by using inductive methods in his research. Instead, he followed the methodological rules he had first laid down in his anthropological fieldwork, a method - as noted in chapter 2 – that distinguished empirical observations from fundamental principles, like 'territory' from 'map.'[6]

His project at the Veterans Administration Hospital was unique, for he went back to the fundamentals of signalling, symbol-using, and signification and together with his research team reformulated their boundaries of relevance. First, he had to gather together a number of ideas, all theoretically abstract, on which a mapping might be made. These ideas were drawn from gestalt psychology, game theory, Freudian psychoanalysis, theories of learning, and small group interactionism, as well as from the technical use of information mechanisms in electronic engineering such as scanning, relays, jamming, and coding.[7] The subject matter of research concerned a variety of communication exhibited by dogs, otters, monkeys, and wolves; as anthropology, it concerned the study of cultural aspects of alcoholism; and as linguistics, it concerned the study of paradoxes involved in the communication of play, humour, and jokes. All the bits and pieces of research eventually merged into a study of the paradoxical nature of metaphoric utterance by schizophrenics.

Second, Bateson needed to draw from cybernetics propositions sufficiently robust to demonstrate that mental disorder was in some way related to systemic communicative relations among human beings. Here it was evident that he would have to alter some aspects of cybernetic interpretation of communication. The Macy conferences on cybernetics had produced 'a number of very simple, elegant, and powerful ideas all of which have to do with the nature of communication in the widest sense of the word' (GB, 1971b: 4). They had also produced a mixed bag of ideas about self-correcting mechanisms which provided no more than a passing description of cybernetic 'territory' – electromechanical circuitry and networks.

Fortunately, Bateson's researchers created a virtue out of otherwise disconcerting circumstances. According to Weakland, they did not know exactly what they were doing, but their scattered approach gradually produced a notion of 'context' as a framing device in communication:

So without intending to, we slid into more and more interest in the context of messages. This is a very important step. It's completely opposed to the idea that: 'We must cut out something as *the* pure message and understand it in itself.' This [latter] is so much in line with the general thrust of what is considered 'real' science in the world. The way we were going, that didn't make any sense. We didn't really know how to study contexts. But we chose to proceed with something that seemed relevant. (Wilder and Weakland 1981: 51)

The way they had gone about their unfocused research proved valuable. Weakland recalled that if the research team had attempted to emulate the normal positivistic research procedures – clear hypotheses formed in advance, confirmed or disconfirmed, and then carefully revised in the light of statistical correlation – the notions of 'context' and 'meta-context' would never have had the density of interpretation they were able to give them. More than anything else the project was 'a process of digging ourselves out of the holes constituted by a bunch of preconceptions which prevented people from getting anywhere, holes that were dug by received wisdom' (Wilder and Weakland 1981: 46).

By the time he left the Veterans Administration Hospital at Palo Alto, Bateson and his research team had written up their groundbreaking papers on the communicative aspects of the psychopathology of schizophrenia and provided the fundamentals for an entirely new approach to therapy, based on understanding the systemic organization of communication in the family. During 1952–61 Bateson and his research team produced one contribution after the other, mostly theoretical, many deductive, but some based on research among psychiatric patients. The best-known of these concerned questions relating to the generation of double bind in family relationships.

CODING: ANALOGUE AND DIGITAL

Bateson believed that a holistic framework of inquiry must begin at the level of signals, rather than symbols and other forms of human cultural signification. He was by no means original in drawing these conclusions. Where he parted company with other interpreters was with the latter's insistence on a separation between human communication and biological signals. They claimed there was a distinction because animal communicative behaviour lay in the domain of 'instinct,' while semiotic or cultural communication lay in another domain, almost entirely detached from instinct. This dualism perpetrated the idea that signals are automatic triggering devices of a physical type, while language and symbols must be interpreted through a logic of contrast and discrimination unique to the human domain. This approach is especially apparent in modern social anthropology and many of its chief practitioners have reveled in semiotics and the study of symbolism 'where "instinct" ends and "culture" begins' (Leach 1976: 47–9).

Bateson countered this common rendition of the supposed dualism between instinct and cultural learning with a metalogue. An instinct is not that which is innate to nature. It is an 'explanatory hypothesis,' a term that can mean whatever a scientist wants it to mean. Trying to make animal signals an instinctual 'reality' divorced from other forms of communication is an example of false abstraction (*Steps* 1972: 38–58). The point was to link 'signal' to 'code' and interpret coding in terms other than physical manipulation of 'bits' of information. Today the word 'code' is so familiar as to need little descriptive elaboration, but at the time of the Macy conferences on cybernetics, the word was ambiguous. McCulloch introduced the term as a reduction device, as a means of describing how the neurophysiology of the brain reduces the information it receives from multiple end-organs in the retina and channels redundant information towards a single fibre in the optic nerve. He argued that organisms respond to the world in a manner quite different from that of physical objects, so that tracing the response of an organism to a source of the response required a different language for cause and effect. The 'cause' of events was not a 'thing' but a transform of certain selected characteristics of the impacting entity, as in a percept (CAF 1024-3g/1965). In McCulloch's vocabulary, the term 'code' became synonymous with 'transform' in the transmission of a signal, and indicated a transformation in the transmission of a signal around neurophysiological circuits of the brain.[8]

Bateson did his homework on the mathematical and linguistic connotations of the term 'code.' A code usually referred to ciphers, symbols, or words. Coding was characterized by substitution effects beginning with a given letter being substituted for another letter; in the second degree, some variable derived from a sequence governs the substitution, but the sequence variable may be derivative from other letters ordinally related to the first (Notebook 12/1949). Two significant aspects of coding were that substitutions had to remain systemic in all complex sequences, or no meaning could be derived from the coding. Second, perceptual coding of a whole unit, a gestalt, was such that the conditions of its meaning would always be ambivalent; a coded gestalt would always be disjunctive – never coincident

– with complex sequences in the actual signals.[9] For example, observers of a teletype message know nothing about the impulses being transmitted but can stand in front of a teletype machine and say, 'Letters of the alphabet are being transmitted.' The observers are imputing meaning from what they already know of how the signals are coded for transmission (Notebook 15/1951).

Mainstream cybernetics registered almost total lack of concern with ambivalence of meaning in messages. It treated the clarity of the information in a message as an equivalent of a mathematical computation of the signal strength to noise. The meaning of information in these terms was equivalent to the message encoded in the strength of a 'pulse' or impulse. Yet defining meaning simply as a 'signal-to-noise ratio' ignored all the crucial issues of perception and learning.[10] Information theory had to be taken out of the command-and-control context for which it had been first devised, and its descriptive features needed to be mapped onto another set of propositions which would be valid for ambiguous situations. 'To achieve any analogy between the mechanical computers and the brain it is necessary to insist that any receipt of information is, in the broad sense, a sort of learning' (Letters, 173-1d/1956). He was convinced that with due care the cybernetic idea of coding would expand conventional theories of learning.[11]

CODES AS RULES

Bateson's prior interest in theories of learning had attuned him to the varieties of possible contexts in which information was received, so that a first step in the reformulation had to be a switch in focus away from the 'source,' the conditions under which a signal was sent to the 'receiver,' to the multiple levels of meaning in each context of reception of a message. In order to accomplish this, Bateson redefined 'signal' as 'news,' a signal which proposes a state of affairs. 'Signal' could retain its feature as a 'command' if 'command' was taken to be an 'instruction' as to how to proceed. In this case, 'command' referred to a timing of events – as instruction for future action – and was segmented from 'report' of events or intentions even though the report and command segments of a message were received almost simultaneously. This double segmentation of signal as 'report' and 'command' remained consistent with McCulloch's analysis of signals in neural circuits only if his terms were reordered.[12]

Receipt of news had to be aligned with possible variation in the forms of coding. In the simple sense, news is not equivalent to 'receipt of a signal.' News always has the potential to change the state of the communicators either in regard to ideas which one or the other has or, as Bateson began to point out, in regard to the *relation* each has with the other. News, then, is not a 'receipt of an encoded signal' which the brain then decodes. Rather, 'news of a difference' in a communicative relationship could include silence (certainly a news of a difference, but extremely difficult to encode), or it could include a number of non-linguistic signals which accompany the linguistic content of the message.

The context in which the news is received must also include elements of belief. A very important stage of evolution occurs, Bateson said, when the organism ceases to respond 'automatically' to the mood-signs of another and becomes able to recognize a signal as a signal, 'that is to recognize that the other individual's and its own signals are only signals which can be trusted, distrusted, falsified, denied, amplified, corrected and so forth' (Notebook 16/1953; GB, 1955a; *Steps* 1972: 178). Belief in a message, involving awareness of the conditions under which a message is to be trusted or distrusted, is quite different from understanding the meaning of the content, for the conditions of belief do not strictly concern the linguistic content of the message. Conditions of belief arise from the relationships of communicators, a far more abstract set of conditions, which constitute an outer shell or meta-context of message reception. A signal can be believed, and if the same contexts of communication are repeated, or almost repeated, the communicators can learn the conditions under which receipt of a signal can be trusted. At the same time, learned sequences of trust can be falsified, giving rise to confusion as to what news can be believed by the communicators and what news must be discounted.

Bateson had decided that the cybernetic notion of code should be broadened to encompass belief. According to McCulloch, code had the strict meaning of any transform of information inside the head, but since the conditions of receipt of news must also include change or transforms in social relationships between communicators, so the notion of code must be enlarged to include transforms in interpersonal communication. This proved to be a key insight, for it enabled Bateson to focus on the thresholds between the 'inside' boundaries of brain (intrapersonal communication) and the 'outside' boundaries (interpersonal communication). The problem of transform in codes was to relate signals in the circuits of *intrapersonal* processes, the neurophysiology of the central nervous system, to signals in the relational world of communicators. Clearly the two types of signals were different, but Bateson believed the systematic difference in the communication processes between 'inside events' and 'outside events' could be investigated. And the types of coding could be compared.

The starting point for comparison was McCulloch's distinction between the 'report' aspect of neurophysiological signals and their 'command' aspect. If 'report' and 'command' in *intrapersonal* communication was compared to 'report' and 'command' in *interpersonal* communication, then it could be argued that the 'report' aspect in interpersonal communications conveys the content of information, whereas the 'command' aspect, which occurs with it, refers to what sort of message it is to be taken as. The command aspect refers to the relations between the communicators. By making signals attach to news, news to contexts of learning, and contexts of learning to propositions of belief, Bateson found little problem in moving quickly from mechanistic models of signal circuits to the sort of existential dilemmas of paradox, hallucination, and other pathologies of thinking that often occur in systems of communication such as human families or cultures. In short, Bateson transformed the understanding of code simply as physical constraint in messaging to the notion of code as 'a rule' – in the sense of 'rules of a game.'

In his psychiatric research, Bateson noted that all rules of codification seemed to fit a set of relations between a speaker and the premises about which the speaker speaks. The fit between premises and rules of codification in communicative interaction was not immediately observable.[13] Only when there is a difference between persons is it possible for those persons in communication to achieve a new understanding of the way in which their own premises of knowing are codified (*Communication* 1951: 229). He coined a new term, 'context marker,' to describe this observation, the 'context marker' being used to distinguish implicit communication (coding from premises) from explicit messaging (coding relevant to interpersonal communication).

Context markers indicated that every coded message can only be understood if, in addition to explicit rules about what the code transforms, both sender and receiver share non-explicit rules for interpretation of the message. Without implicitly shared rules of interpretation to frame the explicit message, all communication would be too ambiguous. At the same time, these context markers did not all need to be linguistic, for non-explicit rules of interpersonal relationship may be conveyed in another code (Letters, 915–1b/1957). Other types of coding in mammalian communication, besides analogue and digital, could be used together in concurrent sequences in order to contrast explicit and implicit meaning of messages.

By the end of his term at Palo Alto, Bateson was convinced that there can be no message material explicitly *standing for* anything, for no message is ever cut off from the whole to which it refers. Since a message is not the thing named – just as the map is not the territory – and since the reference to the 'thing' in any message can only be implied, all messages are always and only about referents in other message material. An explicit message can be meaningful only in terms of the total relationship of message, as 'part' to the whole system of messages to which it refers. In this case, 'meaning' must also have a set of rules about how to relate part to whole in communicative contexts.

Thus all communication occurs in a context of message-plus-referent, and the meaning in a single message is that which creates a mutual overlap among other messages to which it may refer. This forced Bateson to revise some of his earlier work. Previously he had described some aspects of the message material as 'meta-message,' a message which acts as a 'higher' context for another message in a system where each message is concrete and of a lower order than the referent to which it is attached. Now he expressed this as 'meta-communication,' by which he meant interactive sequences among communicators framed the 'higher' significance of the communication through registering relationship.

DOUBLE BIND: THE IMPLICIT AND THE EXPLICIT IN COMMUNICATIVE RULES

A communication science embodying cybernetic principles had to combat any intellectual division between the individual as subject, the perceiver of beliefs and ideas, and the individual as object, the person constrained by social beliefs and ideas 'external' to individual percepts and premises. Yet these divisions seemed to be fundamental to Western social science, and were one of the reasons for sociology falling into the trap of representing social identity as a collective force external to the individual. To support their case, sociologists drew copious anaolgies between external value formation and grammatical rules in language.[14] The analogy was chosen because it is evident that there is little or no place for an individual role in grammatical construction of language. Self-evidently, the construction of grammar is a collectively structured phenomenon – so that, by analogy, there could be little individual participation in the construction of social values. Sociologists applied the same sort of argument to belief. Mainstream sociology and anthropology construed 'belief' as a type of deeply held, collectively structured value external to individual action. On the other hand, psychologists argued that perceptions and cognition lie entirely within an individual's head. Psychological analysis of cognition and perception was conducted almost entirely with reference to processes inside individual human brains.

As pointed out in chapter 2, once Bateson and Ruesch denied the externality of social values and argued that the very process of communication between individuals results in social construction of belief and knowledge, it became more evident that a belief was not a 'collective value' in the sociological sense. Nor should it be considered analogous to a semantic or grammatical rule. Instead, all communicative activity should be considered as as a set of propositions about the world or the self, whose validity depends on the subject's belief in them. It was these beliefs *about* the world that should be the major topic of investigation.

These then were the thoughts that entered into Bateson's initial approach to 'double bind.' Double bind, in Bateson's view, was never a matter of simple intellectual confusion or of being caught in a dilemma of 'I am damned if I do and I am damned if I don't.' Double bind was a situation in which simple dilemmas were compounded by falsified contexts, supported by patterns of interpersonal communication which ensured continuation of the denial that a falsified context existed. Initially, Bateson proposed that people suffer, or become frozen in a psychological sense, from the feeling of the 'weight' or 'force' of information. Since words or information had no force or weight of their own, they could not in and of themselves bring about this psychological condition. It was the interpersonal context constraining the content of the message which was responsible for the feeling of pain, immobility, or force. Herein lies the crux of Bateson's argument about embodiment of communication. The suffering or pain is felt in the individual, but that which is felt as physical manifestation derives as much from the surround of relations in an interpersonal field, as it does from organic sensation.

Bateson traces the pain to a sort of 'class' and 'meta-class' confusion stemming from an inability to contrast the content of communication with the social context in which it occurred. Paradox arises between what is actually said and persistent communicative interaction which is contrasted to it. The physical 'knot' creates a 'bind' which cannot be disentangled because the patterns of interactive communication cannot easily be reflected upon. When repeated contexts of communicative interaction occur, as in the setting of a family group, the bind becomes an habituated pattern and can engender pathology in communication. According to John Weakland,

> . . . the idea of a double bind came out of a very mixed background. We mixed in a little bit of direct contact with patients, a good deal of thinking about communication and its complexities and its different levels, Russell's Theory of Logical Types, and how things fitted together and what might lead to what. Lord knows it was a strange combination of observation and speculation, but I think that it was useful ... Because of our largely anthropological background, we naturally thought of things – in this case a style of communication – not in terms of what is *innate* in human nature, but in terms of how people *learn to behave* in the way they do ... one thing led to another. (Wilder and Weakland 1981: 53)

The anthropological context arose from study of cultural systems of belief, and from how 'myth,' 'ritual,' 'magic,' and 'phatic communion' were associated with social learning. Anthropologists had shown that most of these socially learned categories were not mutually exclusive but, like Chinese boxes, tended to fit or nest inside one another. Anthropologists had always looked at the instabilities surrounding patterns of learning in social change. At the same time, they ignored comparative questions about the way in which learned beliefs were nested and certainly did not bother to contrast the nesting of levels of belief in other societies with those of the Western world. Bateson believed important cultural comparisons could be made of the polarities of the differences within which fittedness occurred. In other words, the research employed both wide and narrow contexts, the wide context investigating how humour, play, metaphors, and even poetry and religious parables were all used to deal with ambiguity in social change. The narrow context concerned inability to resolve ambiguities in small group behaviour.

The comparative cultural framework of the project soon became displaced by the research team's theoretical interest in paradoxical communication. Eventually, the research project concentrated on specific links to the etiology of schizophrenia. The research team suggested that the abnormal communicative behaviour of schizophrenic patients was associated with a repetitive pattern of paradoxical injunctions occurring in some stage of the patients' life. Weakland maintains that the initial article in which the double bind appeared, 'Toward a Theory of Schizophrenia,' made headway because there had been little attention paid to relating schizophrenic behaviour to normal communicative behaviour.[15] This idea of schizophrenics being caught in an impossible situation seemed to fit the experience of many clinicians who had worked with such patients and their families. The generally accepted formulae of schizophrenic behaviour supposed that the breakdown in discrimination typical of schizophrenic behaviour had a relation to 'repression' in early childhood, but the Palo Alto research team portrayed regular and recurrent features of communicative relations which opened up whole new areas of inquiry. Unfortunately, the way in which the double bind hypothesis became attached specifically to schizophrenia proved to be its weakness.

In Bateson's view, the double bind hypothesis was a generic example of how people consciously or unconsciously see interactions between self and other. The explicit association of double bind with schizophrenia was less important than the elicitation of double bind as a symptom of 'thought disorders' wherever there are desperate struggles to escape control of a definition of relationship, or a definition of a relationship which seems impossible to reform. In Bateson's view, the existence of double binds is a symptom of recurrent dilemmas requiring a change in circumstance. He restated the case a decade or more later:

> In a word, any definition of DB must contain, first, a reflexive clause. A DB is a *context* for behaviour which has the effect upon the 'victim's' identification and understanding of contexts of behaviour ... 'context' is thus a subjective/objective word. On the one hand it is the structure of how the person (consciously and/or unconsciously) sees the interaction between self and other; and, on the other hand, it is the objective structure of that interaction. It follows that two persons can be in disagreement, conflict, or misunderstanding regarding the context which they share. One or both can be 'wrong' about the shape of the context ... From such considerations, it follows that we may encounter sequences in which the older-deutero learning is no longer appropriate. It is either unrewarded or is actively punished. We are, as it seems,

unfairly treated for some attitude or premise of relationship which was at some (near or distant) previous time appropriate. This is 'double bind' ... It is the precipitating circumstance for psychic *change*. (GB, 1974i: 419–20)

This statement goes some way towards indicating the nature of the bind which Bateson later perceived in the science of ecology. The bind is this: many scientists refuse to accept ecological interrelatedness and unity despite the fact that appearances show a unity of humanity and nature is self-evident. There are no discrete entities in this ecological unity, yet scientists continue to report ecological interrelations as if the processes which sustain living forms are extensions of matter and logically separated from the observations of observers – in other words, in terms of the old Cartesian dualism. And they feel defensive towards – even victims of – environmentalists proposing a change in the framework of inquiry.

Double bind links participants as subjects with premises and patterns of social interaction which they have learned through constant repetition, and which therefore seem to be 'objective' to them. The linkage between subject and object in double bind is one of its most important characteristics, especially in situations in which a victim is challenged to succeed, only to find that the binder subsequently disqualifies the victim's success. Traditional logic splits the domains of subjectivity and objectivity by using the axioms of identity and non-contradiction as criteria for making subject distinct from object. The logic in double bind does not use the axioms of identity. Instead the logic is one of context which enfolds 'objectivity' by transforming logical criteria of identity into psychological criteria of that which the subject takes into account and considers to be 'objective' in the given circumstances. In traditional logic, arguments about 'objective facts' are tested against 'real' situations 'out there.' In double bind, the psychological 'logic' rests upon distinctions which emerge from a contrast in perspectives of 'taking account,' that is, reflexiveness. The level of shared context of meaning is contrasted with patterns of learning, and inappropriateness in patterns of learning is punished (Wilden and Wilson, in Sluzki and Ransom, 1976: 278). Further discussion of the logic of double bind is contained in Appendix 3.

Bateson was disappointed – in some letters, angry – at the constant attempt to subject the double bind hypothesis to empirical exercises of counting double binds in a therapeutic situation (Letters, 52–31a/1971). He maintained that double binds '[are not] so clearly distinguishable in the complicated network of multiple levels of message in human discourse.' They were a *context* for behaviour. 'Context' itself is not a visible object, for any participant may define a particular context at one moment and redefine it at another.

Yet the lack of clear experimental association between double bind and schizophrenia disappointed practitioners of family therapy, so that by the mid-1970s double bind no longer remained the breakthrough it had originally been. The concept did remain sufficiently prominent, however, that several important conferences during the 1970s provided Bateson an opportunity to restate and defend his ideas.

REDUNDANCY AND METAPHOR

Bateson is sometimes portrayed as a communication theorist whose central concern was with signs and symbols as *structural constants* in the semiotics of messages (Innis 1985: x). That Bateson was interested in structure is correct, but to say he was interested in structural semantics is to seriously misconstrue his aims. Bateson was convinced that the abstract logic of semantics should never be taken as the ground on which to base a science of communication. Conventional semantic interpretations of communication focused on individual humans, expressing how they acted on events. Semantic theories also assumed that it is possible to model systemic characteristics of communicative interaction *at the same level of meaning as the interaction had for the communicators themselves* ('Changes in Human Relationship,' CAF 37-A2/1951). Bateson found this was not so. Objects, events, and actions could *not* themselves be directly translated into meaning. Messages could become meaningful only in relation to the whole matrix of communication, of which an important part was the interpersonal relation of the communicators. Yet Bateson found that humans have incredible difficulty in using pieces of communication – phonemes, words, sentences – to tell each other about these larger patterns or wholes of which the communicative pieces are parts. We all get into difficulty with the overlapping and extension of universals of human interaction.

The metaphysics of 'mentalist language' makes abstract representation of linguistic utterances correspond with objective criteria of 'truth.' Correlation of language with 'truth' has given speech and writing a special status in relation to logic and rationality. Bateson was suggesting that 'truth' is always relativistic and that the truth of the premise 'the word *cat* stands for that mammal' depends upon a convention between the communicators that it be true ... ' (Notebook 15/1951). According to the premises of semantics and other forms of mentalist language, communication appears to have a stand-alone 'objective' character, but in fact objectivity is constructed through relationships existing between communicators themselves. Objectivity results from the very acceptance of the premises of communication, which, in turn, reinforces the belief of 'truth' in both sender and receiver. If 'truth' is relativistic, there is no logic external to the communicative interaction to which the truth of any communication can be referred.

His reformulation of coding shifts definitions of codes to a second-order level: coding is always about the descriptive relationship between some message and its referent – it is an aspect of implied comparison with descriptions contained in other messages, not explicitly attached to a signal in a channel:

> If I tell you 'this piece of paper is square,' and you want to check the truth of my message, you will not compare my message with the paper. You will, either by perception, or use of instruments, prepare another description of the paper. You will then compare my description with that other. In other words, my description is not 'about' the paper. It is about other descriptions of the paper ... In this sense messages are always and only about other message material ... The referent or subject matter of meta-communication is always the redundancy-creating relationship between some lower order of message and its referent. It was surely a mistake to speak of a meta-message as being about another message ... it is about the relationship between some other message and its referent ... 'coding' is not a characteristic of a message but of a relationship between a message and its referent. The question is: into what universe or domain does what we used to call a 'meta-message' bring redundancy? (Letters, 593–17b/1970)

In this formulation, the 'meaning' of context is derived from the mutual overlap of the informational content of the message in the system of messages-plus-referents. The 'plus referents' are not only cognitive but perceptual as well. And Bateson recognized that such an explanation needed to be complemented by a rigorous exploration of redundancy in 'extrinsic' patterns.

Redundancy is a crucial aspect of the patterning of percepts. In the mid-1960s, Bateson wrote with delight to Lilly that he had completed a new article (GB, 1968a) which would 'turn information theory upside down,' for it would make 'what the engineers call "redundancy" but what I call "pattern" into the primary phenomenon of information,' although he noted that 'it needs to be married off to a corresponding hypothesis about what happens in the brain' (Letters, 858–144/1968). Bateson's translated McCulloch's terminology of 'the redundancy of circuits,' which the latter located inside the head, to an aspect of part-to-whole coding of percepts in communicative interactions. McCulloch's definitions of redundancy had drawn attention to the repetition of pathways, which gives the nervous system the capacity to forestall corruption of information. As a result of the constant checking and rechecking of information, the chance that information which the brain receives is subject to error is fantastically small.

Just as he had reformulated McCulloch's concepts of 'report' and 'command,' so Bateson enlarged McCulloch's concept of redundancy from coincidence of pathways 'inside' the brain to coincidence in messages between 'inside' and 'outside.' Redundancy ensures that when an observer perceives parts of a sequence or configuration he or she is able to guess at parts or a relation of the part to whole which cannot be immediately perceived.[16] Redundancy could arise from the type of coding employed (analogical, digital, ostensive, iconic, or hologramic); from causal correlation, such as in sequences of cause and effect; or, in biological systems, from evolutionary coding. What is true of a small system like the family is equally true of cultural order or yet again of natural order.

Bateson's new focal concept prompted him to demonstrate that perception of redundancies are important to a cognitive understanding of pattern, especially in art, ritual, and aesthetics. Still, he found it more difficult to demonstrate how perception of external redundancies are related to cognition and epistemology, for conventional argument fixes perception as beyond conscious control, of the same order as biological 'instinct.' A resolution came to him in the 1970s. His discussion of redundancy could be united with that of metaphor, so that together the two would provide a cross-contrast of pattern in any hierarchical order. Metaphor and redundancy would provide a double definition of pattern, he wrote. If the meaning derived from external patterning through redundancies is the result of the coincidence of integration (i.e., information coded in quite different shapes in several places), then metaphor as 'internal thought' derives meaning from a reordering of perspectives of coincidence. Together the two required a double definition, that of metaphor/redundancy (Notebook 52/1973).

Dictionary definitions refer to metaphor as an 'application of *name,* or descriptive term or phrase to an *object* or *action* to which it is literally not applicable.' Bateson obviously acknowledged this: every noun is in some sense a linguistic universal and, being a universal, invites analogies of one form or another.[17] Nevertheless, metaphor 'talks about' and in doing so re-unites subject with object and re-forms a unity between subject and object in another order of relation. By contrast, a language rife with universals tends to objectivize nouns and so split subject from object.

In its broader dimensions, the subject matter of metaphor is relationship. A metaphor is a signal in a system of communication in which the usual hierarchical order or classification of signals does not apply. A metaphor seems to be a statement of the following sort: we refer to a system and, instead of talking *about* that system, we talk *about* another. Within this other system, we then refer to some relationship which we suggest obtains within the first system. Therefore every complete metaphoric utterance is a statement of similarity or difference between these two relationships.[18]

Metaphoric utterance can be expressed in symbolic form as 'aRb = xRy,' where R stands for the relationship, a,b and x,y are parts of two different sorts of systems, and the = sign represents a 'talking about' something or other in ideas, images, or pictures. The important point is that metaphor does *not* express an identity of the form 'system a,b *is* system x,y.' Instead, 'we are saying x is to y, so a is to b' – and we point to the relationship between x and y and imply that it is the relationship which obtains between a and b ('Four Lectures,' CAF-126-E13/1955). What sort of similarity or difference exists in the relations in the two systems is a more complex issue to unravel:

> People use metaphors for the description and explanation of many different kinds of phenomena and indeed it is doubtful whether any use of language more extended and complex than simple affirmation or negation is possible without using metaphors, whether dead or alive, simple or complex. (Notebook 56/1974)

In fact, Bateson took the view that wherever there was a construction of classes and categories, the only possible way to avoid the use of metaphor would be to give an individual, unique, personal name to every object in the universe.

In one sense, metaphor is a means of uniting the experience of the individual with the system of order or knowledge of which that individual is a part. Metaphor is an 'ego function'; it is a corrective to rational material, a 'process superposed upon the workings of mind not basically constructed to observe discriminations which the ego [in the normal making of verbal messages] imposes' ('Four Lectures,' CAF 126-E18/1955). In another sense, metaphor is a means of relearning at another time an already established relationship. Here metaphor corresponds to the Freudian concept of 'latency':

Latency ... is one of the things that goes into the consciousness of a human being. And it's relating to this whole set that metaphor points ... You learn it and discover that it is a member of a class which you previously knew about ... so if I cross the bridge and have a panic [about crossing] this is in a sense another case of the thing being a recognizable member of an older box, old drama, or something. ('Dialogue between Werner Erhard and Gregory Bateson,' audiotape transcript, 3 Sept. 1976, p. 17)

Metaphor is a correspondence of form between something mentioned and some other thing mentioned. A usual occasion for this type of juxtaposition is dreaming – where metaphor is all unlabelled images. In dreams the metaphors juxtapose but conceal the implied logic of 'as ... ifness':

It is as if it [the as ... ifness] were never there. A dream is a dream is a dream and in the dream the dream has its own validity, whatever that may be . . .' (ibid.)

Dreams are a 'normal' form of metaphoric communication, and the fact that they are not accompanied by classifying signals is usually not worrisome. But the use of metaphor may itself become a vicious circle of communication. If a speaker uses the same form of metaphoric communication as metaphor itself, not labelling the 'as ... ifness' in communication with others, a pathology of communication will develop, as with schizophrenia:

Within the dream the dream is not a simile ... You can translate [the metaphor] into an 'as ... if' and it becomes more manageable ... [and one of the things I try to do] with psychotics is to persuade them that their metaphors are in fact similes. If they can grasp that then they've made an advance towards sanity. (ibid.)

The juxtapositions of metaphor are not necessarily confined to individual experience, as in dreaming or schizophrenia. Cultural order is rife with metaphors, and their juxtapositions are prominent in ritual. Or society at large may use metaphor, with a considerable admixture of more rational material, as in the communication of poetry and art, both of which modulate established social conventions.

7

Mind and Nature

Throughout the 1960s, Bateson was hoping that he might achieve a set of concepts about communication which so evidently fitted natural phenomena that he would be able to say that natural communication was isomorphic to human communication. He would attempt to address this question at a fundamental level, that of coding, feedback, and classification of types of feedback. The thrust of this proposal was radical. Bateson wanted not only to compare patterns of communicative behaviour among various species; but he wanted to compare all forms of behavioural communication in the animal world with genetic information so that 'there may be a case for saying that [all] our concepts of [biological] form and function are at least partly isomorphic with some of the tags (or system of tags) in the genotype or in control of growth' (Letters, 463-4b/1964).[1] He intended to carry his ideas of metaphor and redundancy into the realm of biology and show how these forms of human communication had their counterpart in evolution. As this chapter will show, Bateson had a major problem on his hands, for his 'partial isomorphism' would run directly against the central dogma of molecular biology.

Bateson's voluntary retirement from family therapy enabled him to turn his attention more fully to these questions. He had already shown that signals and codes were sufficiently abstract concepts that their relevance could extend beyond the bounds of specific human communication. His study had revealed that codes of communication were not static systems. Codes were like the 'rules of the game,' that is, shifting pacts and premises which govern how messages are to be made and interpreted (GB, 1971b: 23). To become a competent communicator, it was necessary to learn about these shifts and how shifts of pacts and premises altered meaning. The ongoing stream of communication exhibited patterns of complex relations, which together make up a system of premises, or as he put it (initially) an 'ecology of ideas.'

In 1963 Bateson decided he wanted to start new research in order to extend an 'ecology of ideas' to the context of interspecies communication. 'I have had my fill of the psychiatric, both doctors and patients and especially institutions ... ' he wrote; 'I need to think about phenomena uncomplicated by human language. So I am going to work on dolphins and octopuses' (Letters, 67–34/1963).[2] There was another motivation. As mentioned in chapter 1, his father, W.B., had tried to show that patterns and their variety were immanent in the order of living things. The repetitions of form in any living organism derived from regularities in growth and organization, said W.B., and a science of variation should begin by investigating these harmonies. He recognized in his father's ideas a profound concern to reorganize explanations of evolution to accord with 'morphogenesis,' generation of form and pattern. But his father had gone about his study of repetition in form in a strange manner. He had compared organized patterns of living forms to the complex symmetrical patterns assumed by particles in response to standing waves on a resonating plate – Chladni figures, as they were known. One of Bateson's endeavours as he turned to research on interspecies communication was to take on his father's somewhat eclectic approach to 'vibratory' and 'resonating' form to see if it could be better formulated in terms of information theory.

ANIMAL AND INTERSPECIES COMMUNICATION

It was not the first time that Bateson had taken up research on pattern and communication in animals. In fact, his very first published paper, written under the eye of his father in 1925, was on pattern in feathers of partridges. A quarter of a century later, shortly before his posting to the Veterans Administration Hospital in Palo Alto, he was conducting his own research on octopus communication. The aim of this earlier unfunded piece of research was to rewrite standard ideas about 'intention movements.' 'Intention movement' was a phoney notion, Bateson believed, because it lodged communication in the activity of individuals, and not in their relationships to each other (Letters, 1039–10a/1962). Octopuses display a number of communicative behaviours, each of which concerns the rules of their relationship to each other. For example, they signal 'I shall not hurt you' by exposing vulnerable parts to attack. Octopuses who confront one another pass through a sequence of hostile communications, minor battles in which no one is hurt. After this, the slightly stronger octopus very slowly and gently embraces the weaker. Then the weaker comes over and attacks the stronger with his vulnerable backside, in response to which the stronger retreats. Bateson's conclusion about this sequence was that the weaker has now said, 'Yes, I know you are not going to attack me,' and the stronger has said, 'That's right.'

Bateson's well-known article 'A Theory of Play and Fantasy,' based on his brief research in 1952 among monkeys at the Fleishhaker Zoo in San Francisco (Notebook 16/1953; *Steps* 1972: 177–93), demonstrated that the phenomenon of play among young monkeys could only occur if the participants were capable of metacommunication, that is, of exchanging signals which would carry the message 'This is play' and that 'these actions in which we now engage do not denote what is denoted by these [hostile] actions which these actions denote.' Animals use analogical codes, and this type of coding cannot denote the name of anything. The playful nip denotes the bite, but it does not denote what is denoted by the bite – which is an attack. Yet animals are able to signal 'this is not an attack' without use of linguistic negation, without use of the word *not* or any of the other forms of negation so prominent in linguistic or digital (i.e., language-type) codes.[3]

These initial observations on play among spider monkeys were extended to research on river otters. In the same year, Bateson began to investigate how much new learning a dog acquires when training with blind people. Bateson was interested in what he called the 'second order of learning,' by which he meant that an initial question – what change occurs in a dog when he hears a whistle' – becomes recast as 'what changes have occurred in the change [i.e., 'learning'] which the dog undergoes when he hears a whistle?' The scheme was to deduce the answer to the first problem from data collected to answer the second. The overall aim of the study was to get a firmer grasp on the notion of levels in communication and understand whether animals experience any situation akin to paradoxical communication among human beings (Notebook 24/1955).

In the mid-1960s, research on the forms of dolphin communication would take Bateson to St Thomas in the American Virgin Islands. He worked with John Lilly, who had two dolphin projects, one at St Thomas and the other in Florida. Later, Bateson would leave Lilly and move on to the Oceanic Research Center on Oahau in the State of Hawaii to do further work on cetaceans.

The phenomenon of signalling, both in animal communication and in interspecies communication, was well documented, but Bateson believed that other writers in the field of animal behaviour were all too ready to treat animal signals in the same terms as Pavlov explained the responses of his dogs to sounds in his laboratory. Pavlov's explanations had assumed that an impact of signals from an external source upon an animal resulted in automatic behaviour, an internal organic reflex response to the signal. Bateson believed that any relationship between signals and learning was far more complex, and he wanted to show how Pavlovian interpretation of signals and reflex response stemmed from an impoverished understanding of communication. Signalling among animals also had to be considered as an aspect of interactive messaging, and animal interaction was surprisingly rich in action sequences of a paralinguistic sort – communicating 'context' in animal relationships.[4]

Dolphins were particularly interesting to study because they had no external ears, and no facial expression. It is even difficult for a dolphin to 'wag his tail,' so that a dolphin is without the range of bodily postures on which terrestrial mammals rely. Yet it seemed that they had a vast range of sounds, and a brain designed for the analysis of sound. It was possible that in the course of evolution, dolphins had succeeded in substituting sound for the complex range of bodily postures and facial expressions upon which we and other terrestrial mammals relied so heavily (Letters, 941–7b/1964).

Because of the way in which animal coding differs from human paradigms, only some analogies could be drawn between human coding of information and animal coding. For example, animals use analogic and iconic codes extensively, whereas humans use digital coding extensively.[5] All mammals, including the human species, acquire information by way of different types of coding, but they have very different 'paradigms' for the different types of coding used. Bateson was convinced that language, the primary form of human communication, serves functions totally distinct from those of kinesics; thus it was unlikely that the characteristics of animal behaviour would throw much direct light on language or vice versa. While difference in coding paradigms leads to difficulties in enabling cross-communication between species, when the difficult attempts were made, it was '*insane* to handle a coding system of one kind as though it were a coding system of another' (Letters, 1192–12a/1967). Yet behaviourists always seemed to analyse animal behaviour in the same semiotic terms as those of linguistic messages passing between human beings, and to propose behavioural 'reflexes' to human voice.

Bateson arrived at John Lilly's research station to find the dolphin language research heavily weighted towards formulas of behaviourism, 'Skinnerboxese' rather than 'dolphinese,' as he put it. He persuaded the researchers to switch from their attempts to derive a language from combinations of sounds and to begin to observe patterns of sound characteristic of certain interactions. The most prominent of these was mother dolphin and infant, in which monitoring of dolphin clicks would, he believe, reveal how mother is 'mothering' her infant, while, at the same time, teaching the infant significant sounds. He proposed that research on interspecies communication should follow a similar line of inquiry. The pattern of transference between human beings and dolphins might be analogous to the pattern of relationship between mother dolphin and infant. A good starting point for inquiry would be for a researcher to climb into the pool with a dolphin, retaining in mind the research question 'Who do you think I am? Your mother?'

If the 'mothering' framework of inquiry succeeded, sounds emitted from mother could be contrasted with other types of signalling such as flipper movements, timing of approach to human beings, ventral display, and startle reaction. To Lilly's evident delight, Bateson's interactive, relational approach soon produced results. It is 'a definitive step forward [that] we have been struggling with from the beginning,' he wrote to Bateson. The researchers noticed that mother dolphins trained their infants 'between flippers.' When one of the female researchers, Patty, pretended to drown by floating face down in the water, one of the dolphins, Sissy, 'climbed on her back, put her flippers under her [Patty's] armpits, lifted her head out of the water (backwards and upwards) and then propelled her up the bank out of the pool' (Letters, Lilly to G.B., 858–17a/1964).

Among the interesting theoretical results Bateson derived from his animal research was the coining of a new term, 'context marker.' The term could be used for either animal or human communication to denote 'any percept by which an organism receives information regarding the contingency pattern of the situation in which he is placed.' The context marker could be digital, or it could be ostensive – the dog may know from the walk itself that he is going for a walk – or it could be analogical. Future research on dolphins could establish whether dolphins communicate messages by ostensive or analogic signals or whether, in addition, dolphin sounds permit digital context markers (Letters, 858–96a/1964).

EVOLUTIONARY CODING

An entirely different issue which Bateson took up at this time was the link between the two domains, genome and environment. He was determined to explain them both as formal analogues of communicative activity, because only by accounting for them in this manner could he satisfactorily break the dualisms which lay at the root of most explanations of evolution. Only when patterns which underlie expression of information in the gene are considered as being analogous to forms of communication among animals (or other biological organisms) in the environment could the gene – which is evidently a form of communication with its own type of expression – be reconciled with these other forms of communication. Drawing analogies between the gene as an information mechanism and gene as organized information exhibited among all living forms might give a clue as to how scientists mistook classifications of both phenomena. For example, modern biology described the gene as an information processing device but nevertheless reserved to it all the characteristics of a physicochemical 'bit'; as a physical bit, the gene was an organic molecule which was the carrier of information. Therefore, biologists classified the gene as a component of an 'internal' material order and never considered investigating the genome as part of a wider information order of 'internal-external' communication.

This turn of thought thrust Bateson's research into heated controversies over the interpretation of genome and environment in evolution. While Bateson was prepared for this, he encountered major problems in carrying out his ambitious comparison. These included both stating precisely the terms of his case, and also finding an adequate mode of interpretation through which he could translate the meaning and significance of his new communicative paradigm. As the next two chapters will show, part of the difficulty lay in the fact that until about 1969 Bateson was unaware of the unity in his own paradigm and appealed instead to bits and pieces of it. This was made more difficult by the fact that the cybernetic framework from which he had begun, and from which he drew his arguments, was not sufficiently flexible to provide all the analogies he required. Cybernetics grew 'slippery' at the edges of his explanation. He was led once more to reformulate basic cybernetic concepts – information, levels of ordering, step functions, survival circuit.

Moreover, the accessibility of his work grew even more difficult as he began to make another contrast in addition to the daunting comparison of genome/environment. He took the comparison 'genome/environment' and played this against the reflexive forms of communication he had elicited in human patterns of communication, namely 'metaphor/redundancy.' This second 'meta-' contrast required a form of communication so totally outside the field of biology – reflexive communication – that even friends and intellectual acquaintances who knew his train of thinking over a long period of time now found Bateson's inquiry difficult, if not impossible, to follow.

Let us begin with this apparent impossibility of contrasting 'biological descent' (genome/environment) with human reflexive communication (metaphor/redundancy). Bateson's position was that the the presence of any habituation, or change proceeding out of habituation, constitutes a form of 'learning,' and that learning is itself about a change in 'ideas.' Therefore if learning is apparent in evolution, reflexive communication ought not to be foreign to biological models of change, at least so far as being a type of operation found in nature to cope with change.

Considered from any perspective in the classification of evolutionary forms, ideas in the human mind cannot be distinct or separate from any other type of flow of ideas in biological patterns of communication. The problem was that human beings consider their own cognition as a form which is something 'other' than all the living circuits of information to which they belong. They cannot envisage how the patterning of the adaptation of organism to environment might be analagous to the relation of self to the circuits of information in the social world, yet alone the total circuit of survival – social-cum-biological world. But to think otherwise of survival patterning in the whole is not merely inconsistent, it is a pathology of thought, prompted by the dominance of Darwinian interpretations of evolution, of 'survival of the fittest.' 'We must change our language,' Bateson said, 'to fit the embodied organization of our image of the data' (Bk. Mss., box 5; 1987: 204.24).

Bateson wrote of his position that if he drew the attention of biologists to the fact that learning and evolution both involved information processes, he had little difficulty in getting heard. A familiar model in molecular biology, for example, is that of the genetic 'program' in the cytoplasm being similar in kind to an electronic computer program, an extension, Bateson said, of the von Neumann model of automata. Thus, both he and molecular biologists could agree that an understanding of information was crucial to genetics. Nonetheless, Bateson went on to say:

> If I assert that 'learning' and 'evolution' are partial formal analogues one of the other, I shall evoke rather more raising of eyebrows, expressions of doubt and perhaps downright disagreement. But if I assert flatly that 'ideas' are what 'survives' and are therefore the units of both evolution and learning I shall probably encounter serious opposition from professional biologists.' (Bk. Mss., box 5; 1987: 205.1)

Bateson agreed with biologists that physico-chemical processes provided the material pathways through which genes gave expression to form, but disagreed that actual ordering of these processes could be explained simply in terms of transmission of physico-chemical bits. Between the coding of information in the cytoplasm of the cell, and the domain of organism – environment relations – lay a vast field which classical biology had left unexplored. The problem was that all definitions of the central dogma of biology were linear and, though extremely complex, expressed a one-way translation of information from the genome to protein formation.[6] When genetic events are modelled as linear information processes, they take no account of feedback. They can only be explained in the language of positivistic science and that language is, by definition, entirely non-reflexive and reductionist. Therefore any statement about reflexive communication processes immediately violates the central dogma of molecular biology.[7]

One might expect Bateson to be caustic about any reductionist paradigm. The analysis of molecular biologists mostly reflected the intention of their research, he stated, which was to use genetics for applied purposes. Because of their applied bias, the idea predominant in their work was that the organism was a 'bag of separable tricks,' each dealing with specific environmental and physiological problems. Yet treating the organism as a sort of 'applied empiricist' in its evolutionary setting would never account for the stability of the genome. The genome had an interactive relationship with its environment, and questions of response to change in the genome could never be satisfactorily addressed if the gene was regarded merely as an isolated logico-chemical bit coding for protein activity. He was adamant: 'Any philosophy which would exploit, for pragmatic purposes, isolated parts of that which is beautiful is the philosophy of a whore; ... a hundred years of Darwin is too much' (Letters, 327-1b/1967).

Bateson began his analogy of evolutionary and cultural processes by tackling the issue of coding. It was an exemplary choice for it enabled Bateson to cut straight to the heart of opposed determinisms in evolutionary thinking – Darwin versus Lamarck. More specifically, Darwinists argue that the phylogeny of organisms is determined by selection at genetic levels, while Lamarckians argue that an organism's life activities determine which aspects of the outer world contribute to the organism's adaptations to its environment. In its most extreme statement, Lamarckism proposed that the somatic effects of use or disuse of limbs and organs were connected with inheritance of biological traits in a phenotype.

Bateson attempted to resolve the old dualism of 'inner' versus 'outer' determinisms of adaptation by showing how genetic selection and behavioural activity in the environment (adaptation) could be treated as complementary – if both genome and somatic adaptation were regarded as differing types of feedback. The question at issue seemed to be that of finding the rules under which the two transforms occurred. He argued that there is an overall matrix, *genetic times environmental* (G × E), in which cybernetic feedback occurs. The interaction of genome with the environment is concerned with a proposition or statement of relationships between parts of the system to which it belongs. It also has important self-correcting feedbacks in this system of relationships. The reciprocal relationship of environment to genome is equally a proposition about relationship and a self-correcting feedback system. However, the reciprocal transform – of environment to genome – was a little more difficult to comprehend than genome to environment.

Western biology is totally familiar with the notion that very abstract components of a structure, such as a gene, can transform concrete components, such as species response to environmental variation. Explaining the reciprocal process presents several problems. First it is necessary to agree with modern biology that the genome's interaction with its environment must not be conceived in the manner of direct encoding and decoding of a message from the environment. Any supposition of environmental change having direct effects on the genome is false and accounts for biologists justifiable rejection of Lamarck. Bateson accepted that something like a Weismann barrier is present in genetic organization, so that no direct feedback is possible from one generation's responses to the environment via the genotype to their offspring. Indeed, he made a point of stressing the fallacies of Lamarckian explanation and stating quite categorically that there can be *no direct communication* between somatotype to genotype: 'If Lamarckian inheritance were the rule, the whole servo-mechanism of the organism would soon become jammed and the species, having no flexibility, would become extinct' ('Some Problems of Nineteeth Century Thought,' CAF 306/1965).

At the same time there is a long-term feedback process in which somatic changes may partly affect the pathways of evolution. As he put it, somatic control proposes change in populations; genetic control disposes (*Mind* 1979: 220). In other words, somatic change deals with immediate adjustments at the most concrete levels - such as systemic bodily adjustment to living in high altitude climates - while genetic change, the most abstract component, deals with less reversible changes in adaptation. Evolution demonstrated two temporal processes, one genetic and the other somatic or environmental, the temporal ranges of which were different; and which had more than a single type of feedback. Together, feedback shifted patterns of information from the more concrete domain to the more abstract.

The opposed determinisms of Darwinism and Lamarck had arisen from the gestalt of biological science, whose focal references lie in images of materialism, so that processes of change are always interpreted as physical transformations. This is evident in the case of the molecular biologists' materialist representations of the information processing capacity of the genome. It is less obvious in Lamarckian interpretations, but they also propose that the transfer from parent to offspring is a material resemblance newly acquired in the parent's lifetime. Bateson confesses that he does not understand what is supposedly 'passed on' or 'inherited' as a result of environmental impact if 'inheritance' is defined as the passing on of material resemblances. In his imaginary dialogue between an unnamed biologist and an unnamed Lamarckian about the infamous case of the midwife toad, Bateson notes that the only satisfactory explanation of presence or absence of toad nuptial pads under different environmental circumstances must refer to the generations of toads passing on a 'difference' or piece of information under differing circumstances. It cannot refer to the physical impact of environment on the toad. Hence the subject matter of inheritance of acquired characteristics, like that of genetic inheritance and natural selection, is irrefutably communicative (*Mind* 1979: 151–2).

Bateson argued that acquired characteristics are a sort of framing device: they set the context for the selection of genetic changes: 'the acquisition of bad habits, at a social level, surely sets the context for selection of ultimately lethal genetic propensities.' His resolution of the clash between Lamarck, on the one side, and Darwin and Mendel, on the other, is regarded as a great contribution to the theory of evolution (Saunders 1985: 158). He had shown that it is useless to speak of organisms as being determined by their genes. At the same time, Lamarckian inheritance is fallacious because if it existed it would eat up the somatic flexibility of the organism by allowing all acquired changes to enter the genome. Bateson proposed that the two are complementary, once viewed as components in a multi-level communicative order. Feedback through which somatic changes occur acts at a more concrete level than genetic change; nevertheless, somatic changes partly determine pathways of evolution. Somatic change may, in fact, precede the genetic because at the population level, environment and experience will generate better adapted individuals on which genetic selection can work. This may account for the fact that the biological world looks like a product of Lamarckian evolution.

REFLEXIVENESS IN EVOLUTION

This shift from concrete to abstract, from somatotype to genotype, suggests how information necessary for evolution becomes coded in a reflexive manner. As mentioned above, from Bateson's perspective, there is a fundamental complementarity between genome and environment. A genome, like any part of an organism, cannot be distinct from its environment. Therefore, coding between genome and environment must incorporate complementarity. Bateson's view of evolutionary coding is that it takes place 'as if the organism inhabited a box into which the incoming information must be filtered.' The 'box' in which the organism lives is a type of thermostat. Instead of coding a direct description of the immediate environment, adaptation takes place in the same manner as any change in a thermostatic system. Consider the way humans code change. A person who cannot see the onset of a cold front can cope with differences in the weather outside by having an idea of what to do and by adjusting the thermostat inside the house. In this way, a person who is part of a wider environment than a house-room-thermostat-furnace system copes with the sensing of the difference in an appropriate manner. The person 'knows' that it has become colder before the snow appears outside the window.

A shark adapts to the hydrodynamic properties of water in the same way. The code into which the information is transformed is first a code of creature comfort-discomfort. Then the organism must meet this information with bodily changes. These changes could be relatively impermanent, as in the case of somatic adaptation, or they could be 'adaptive' on a more permanent basis, that is, involve genetic adaptation (Letters, 250–7b–3/1974). A shark, therefore, is a reciprocal transform of the hydrodynamics of water. For the shark, the process of adaptation is one of transforming coping information into referent information. The question 'how to cope in water' is resolved by changes which become the 'learned' measures, or 'names' of the input. In this sense, the evolution of the shark is 'learning' about 'the idea' of water.

By contrast, the conventional view holds that a shark is sufficiently distinct from its environment as to be able to code a description of water into a physico-chemical bit within the DNA directly. Bateson believed that if biologists began to accept that the genome was a coping device whose operational sequences concerned 'ideas' about survival in the environment, then materialist conceptions of genes as 'information bits' would no longer hold. Entities called genes in bioenergetics would then become 'questions about difference to which the answers are provided by their neighbourhood' (Letters, 1497–29/1970). As he stated, this proposition was by no means a proposal for a physico-chemical path running backwards from protein to DNA. Rather Bateson was attempting to reconceptualize the whole materialist notion of information in biology. Only when there was a wider accounting for feedback, such as he proposed, could molecular biology begin to understand the analogy he was making between evolutionary coding of ideas about survival, and cultural learning.

'TIME GRAINS'

Ironically, Bateson's views brought him into conflict with his long-time friend Conrad Waddington. Waddington, like Bateson, regarded the dualism between inherited and acquired characteristics as a phoney supposition. He, too, was in favour of linking somatic adaptation to some form of expression in the genotype, and concurred with the view that such transfers were long-term, occurring over many generations. The term Waddington coined for this process is 'genetic assimilation.' Genetic assimilation is recognized in theoretical biology mainly because Waddington, unlike Bateson, supported his concept of somatotype-genotype linkage through laboratory experimentation (Waddington 1975). Waddington's experiments on fruit flies suggested that there was indeed a time path over generations, a 'chreod' through which sudden environmental change could be translated into genetic response and copied into the genome. Waddington's chreodic explanation also suggested that at a deeper level, the ability to achieve somatic feedback was itself genotypically determined.

However, the talks between Bateson and Waddington about cybernetic feedback and genetic assimilation through chreods were a disaster for both. Waddington believed, mistakenly, that Bateson was reintroducing dualism by treating somatic adaptation and genotypic change as two entirely different processes (Letters, Waddington to G.B., 465-1/1962). Bateson composed a pained reply in which he went over his argument in meticulous detail. The question at issue, he explained, was whether feedback in the relation between genome and soma was brought about by more than one type of mechanism and, if so, whether it was important to distinguish these types. The nature of the distinction which he, Gregory Bateson, was thinking about was the difference between feedback from an output through reference mechanism to input, feedback in the ordinary sense of the term, and 'calibration.' The latter was a type of feedback which occurred through the resetting of the bias on the thermostatic device. The differences were differences of type of mechanism. He had no thought of separate mechanisms as between soma and genetics. He never sent his letter. The two friends did not speak to one another for another twelve years.[8]

Despite – or perhaps because of – Bateson's seeming inability to express his proposition about the two types of feedback in precise language, he continued to formulate his notions in letters to his colleagues rather than publish and be criticized. He wrote a year or so later to the renowned ethologist Konrad Lorenz that all feedback in servo-mechanisms was hierarchical, but biological hierarchies were more complex than circuit levels of electro-mechanical thermostats. The 'hierarchy' of evolution was a time series in which feedback must always be controlled by calibration, and calibration must always be controlled by feedback with longer and longer time series for each step. 'To shorten the time series in the upper levels of these hierarchies is to create chaos. For this reason the phenotype must never be allowed to tamper with the genome.'

There were several rules which could be derived from the existence of two types of servo-mechanisms, he told Lorenz, both of which promoted a shifting and sorting among different orders of information, genotype and somatotype. Adaptation to propositions about the environment which are continuously true is different from adaptation to propositions which are sometimes true and sometimes untrue. The rule is that when the environmental variable is constant, the 'economics of flexibility' will favour a shift from genome to soma (Baldwin effects).[9] But when the environmental variable fluctuates or is unpredictable, the organism is pushed towards a shift in the opposite direction, from soma to genome. These opposite effects (anti-Baldwin effects) increase the organism's requirement for voluntary control and attention in a situation of increasing uncertainty. Anti-Baldwin effects are 'uneconomical' (Letters, 876–1b/1966). Bateson acknowledged to Lorenz that his distinction between feedback and calibration was more complex than a straightforward description of Baldwin and anti-Baldwin effects would allow, but he thought his central point was clear enough.

As he thought further about the *types* of feedback exhibited in evolution, he began to translate his two cybernetic mechanisms into a conceptualization of feedback in ecosystems. The process enabled his own distinctions to become more clear.[10] Bateson began calling ecosystems 'bioentropic,' to distinguish them from the 'bioenergetic' systems predominant in the textbooks of conventional ecologists. In bioentropic systems, one type of feedback is genetic, which is at a different level from that type of feedback which refers to bodily adjustment, somatic feedback. As in all instances of nature, 'we meet both levels working along together, necessarily and mercifully isolated from each other by the communicational barrier between germ plasm and soma' (Letters, 1019–63a/1969). In nature, somatic feedback expresses the homeostatic adjustments in bodily organs resulting from superficial environmental change. For example, somatic feedback occurs when human beings move from sea level to a mountain area, and results in panting. Somatic adjustment over time has the potential of developing into a quasi-permanent condition, as in the case of the somatic enlargement of lung capacity typical of peoples who live at high altitudes. This somatic adjustment is usually called acclimation. Both types of somatic feedback are different from the long-term genetic adjustments that occur in 'the hard programming of the genome.'

'We need to know much more precisely than at present how change [in ecosystems] is related to *time*,' Bateson wrote in a memo to a zoologist at the Oceanic Institute in Hawaii, for 'the essence of the problem is that biological systems are commonly (?always) capable of both immediate adaptive change and acclimation. But how much adaptive change can be accomplished is limited.' There was another major issue: 'We badly need models of adaptation (at all biological levels) which will represent the processes where the organism modifies the environment to suit itself.' In all ecosystems there is a 'budget of flexibility,' but the commitments of this budget are continuously being set free by the demands for change at various levels of the system. Though the system can meet change, the questions to be asked are what circumstances of change determine what is 'too fast': 'Not only does evolutionary theory hinge upon the[se questions], but it also looks though Man in the 20th century is beginning to bump against the entropic budgets of his own body and of his environment' (Letters, 1019–63b/1969).

By now the whole notion of 'bioentropic' processes as interactive fields of both evolution and ecosystem was affirmed to his own satisfaction, but it would take more than a decade before publication of *Mind and Nature* would give these ideas full expression. Then Bateson would give depth to the characteristics of bioentropic systems – and of the effects of temporal change, that is, differing 'time grains' within them. *Mind and Nature* is a long excursus on the theme that though the 'time grain' of adaptation in human cultures is different from that of adaptation in ecological systems, patterns in both originate from a change in communicative order. In addition, the two conjoin as interdependent and interlocking subsystems. He would portray these through comparing human cultural learning and adaptation in evolution. The comparative characteristics would include survival circuits, the respective levels of feedback in biological and cultural systems, and resemblances and differences in how they cope with change. He would even develop a contrast between processes and structure in the two coupled systems in an attempt to make the contrast the basis of a dialectic congruent with patterns in both. The successes and failures of his proposed dialectic will be examined in subsequent chapters, but detailed discussion of his overall scheme of comparison can be found in Appendix 3.

DARWINISM VERSUS CO-EVOLUTION

In *Mind and Nature* Bateson develops a series of fine-grain distinctions to resolve prevailing dualisms of culture and nature. Humanity conceives that its own capacity for cultural performance is quite distinct from adaptations exhibited in other living forms. It attributes its own abilities for cultural learning to a narrowly defined capacity of cognition.[11] Against this stance, Bateson argues that cultural processes resemble processes of adaptation in all living systems, as a continuous and necessary sorting out of the general from the particular. Nature, too, has 'ideas' about adaptation, for without them there could be no stability and no response to change.

For example, that which humanity calls learning in culture is analogous to an 'economy in the adjustment' of any living system which has both rapid and slow changes in its environment' ('Culture and the Family,' CAF 74/1969). There are differences of logical type in the two sets of feedback, but differences of logical type also occur within the human cultural order and within natural processes, so that logical types are no barrier to the overall forms of comparison and contrast. Just as sequences in human communication are of different logical types from each other, and become entangled in patterns of human interaction, so too systemic coupling of patterns in evolution can be examined through levels of coupling and characteristic bias in the processes of their interaction. As communicative subsystems, human and natural 'time grains' are functionally connected through redundancy, and so converge in conjoint co-evolution.[12]

Bateson believed that all ideas about evolution have long-lived consequences for society because 'evolution is part of a chain of ideas so closely linked together with the study of how you and I seem to understand the world that each is almost the name for the others.' He wrote: 'Rough hew it how you will, all theories of evolution are also theories of mind and theories of God.' A key term to consider in this reflexive framework of understanding is the notion of survival, he said. Survival had always been a key idea expressing the unity of humanity and nature, but the concept had become eroded in the nineteenth century as a result of the evolutionary theories of Charles Darwin. Darwin was a major source of bad ideas in biological science because he redefined survival as a matter of the fitness of individual units.

Darwinian survival came to mean 'the struggle for existence' among individual organisms. The nineteenth century chose to interpret 'individual' as referring to either individual organisms and families, or to individual cultures and nations. Through Darwin's eyes, evolution was a projection of a line of origin, in which individual carriers of that line either survive or become extinct in progression. Darwin proposed that individual organisms possessing advantageous traits and behaviours will tend to have higher survival, and thus greater reproductive success, than organisms possessing less advantageous traits and behaviours. In Darwin's language, the struggle for existence was brought about by a natural mechanism of fitness – 'natural selection,' as he called it. Darwin's principle is more appropriate to harder sorts of rocks, such as granite, than to living things, Bateson said (*Mind* 1979: 103).

Darwin collapsed his argument about survival to fit the conventions of materialist logic. Natural selection, according to Darwin and his followers was defined as a 'cause' of material change in the world.[13] There were several major faults in Darwin's definition besides presenting natural selection as a progressive 'force' of nature. As we know today, natural selection works upon the *gene pool of a population* and not upon the phenotype, that is, individuals in the gene pool. Modern-day Darwinians may agree these faults are present in Darwin's original formulation of natural selection, but they are far from abandoning the hypothesis. They continue to think that the forces which work upon the gene pool are the same forces as those which work on the phenotype and that the revision was not, therefore, destructive of the overall hypothesis (Stebbins and Ayala 1985: 72–85).

Bateson points out that there is always a logical distinction to be made between an individual as a member of a species and the species itself. In the case of gene pool and phenotype, the logical type affecting one cannot account for the the nature of the transformation or change of the other. Selection of new features of anatomy or physiology is essentially conservative in the context of the gene pool, and selection will favour those new items which do not upset the old forms. By contrast, the creature itself, the phenotype, must always achieve changes of its own body during its lifetime. It must acquire certain somatic characteristics by use, disuse, habit, hardship, and nurture.

These acquired characteristics can never be passed directly on to the offspring (*Mind* 1979: 220).

In addition, Bateson says, modern Darwinians do not appear to understand that events and objects *about* which message material communicates are not themselves present in the genetic program.[14] Yet they offer no hypothesis as to how natural selection contributes to the overall processes of organization that must be present in evolution. Darwin linked evolutionary 'traits' to the activity of single carriers, making the survival of the trait depend only on the reproductive success of the single carrier. There was no good *a priori* reason for Darwin to have framed the sequences of evolution in this manner. What appears to have happened is that Darwinians failed to recognize that an information pattern is not 'carried' as if it were physically embodied in a communication 'chain.'

This fallacious notion that information is a message carried in a communication chain is quite common in evolutionary analysis. And when inheritance and descent are defined in terms of this fallacy, as a community of genotypic messages linked in common membership to a 'communication chain,' natural selection is given a material basis which it ought not to have. The process of 'selection,' decision-taking, to which any theory of natural selection must point, must not be correlated with physical pathways in which 'selection' takes place. 'There are no monkeys in the theory of evolution' in the same sense that there are 'no organs in the corpus of genotypic message material, only *coded* representations, names, or whatnot of organs and their phenotypic relationships' (Notebook 34/ca. 1965).

No wonder, then, that Darwinians find co-evolutionary changes so difficult to explain. Darwinian evolution is always explained as an outcome of single events. For example, the evolutionary adaptation of *horses* and *grass* is explained as adaptation of individual things (that of 'horse' and that of 'grass') to each other. Such a single level analysis of traits and behaviours of individual organisms always poses problems of evolution at the wrong level of analysis, Bateson said. 'The horse' and 'the grass' emerge in Darwinian interpretation as involved in a battle between horses and grass (Letters, 1209–1/1972).

A co-evolutionary framework, he said, is very different.[15] All changes in co-evolutionary settings are really moves in the relationship of organism and environment to preserve a relationship, and to stabilize that relationship by varying it. Co-evolutionary change depends upon two contrasting sets of processes, the one set conserving developmental regularities, and the other facing outward towards the vagaries and demands of the environment. The two sets of processes in a co-evolutionary framework contrast with each other both in time sequences and in the way in which processes of selection work.

This is why Bateson's own definition of natural selection is the opposite of Darwin's proposition. In Bateson's reformulation, natural selection 'picks out the unfit for non-survival' (Letters, 463–4b/1964), the 'picking out' referring to a failure to maintain stable relations between organism and environment through the emergence of overwhelming dilemmas. Natural selection is the changes in 'horses' and 'grass,' each of which turn out to be *necessary moves* to preserve the continuity of their relation with each other. So, too, mind should preserve continuity of relations with nature.

His negative phrasing of Darwin's proposition draws attention to conditions which give rise to loss of order in ongoing change and fluctuation. Bateson believed that while Darwin's propositions about natural selection and survival may say something about change occurring in living structures, nineteenth-century evolutionary studies always wished to avoid discussion about breakdown. In nineteenth-century thinking, evolution was connected in one way or another to notions of progressive development or progress. Darwin's 'mechanism' of natural selection was no different, and its implied reference to progress was a substitute for propositions about breakdown or dissolution, the finality of which was simply not considered.

In the legacy of bad ideas which followed from Darwin's theories, the notion that adaptation signified a battle between the organism and its environment is the most lethal, Bateson argued. Darwin and his followers had broken down a vast ecological complex of events into activities of single living units and then, through their particular definition of survival, re-synthesized the complex of events into a single-unit activity – reproductive fitness. Darwin's conception of adaptation as individual 'fitness' accorded completely with the nineteenth-century view of progress as humanity's struggle to overcome the limitations of nature.

Our whole projection of evolutionary sequences must become transformed from these types of linear sequences of progression, Bateson believed. It is organism *plus* the environment which is the unit of survival, not reproductive fitness. In Bateson's view these false Darwinian premises were largely responsible for the degradation of our planetary ecology: 'the impact of *every* simplified biological or social dogma upon our society has contained the seeds of disaster - natural selection, economic determinism, territorial imperative, *laissez faire*, autocracy, democracy, individualism, operant conditioning, Lamarckian inheritance, the racial and genetic determination of character, and so on - every major theme of the life sciences proposes a path towards nightmares ... ' (Letters, 1015-23j/1969; Notebook 50/1972).

THE TURNING POINT

Bateson uses the term 'co-evolution' sparingly in *Mind*. He offers a definition of co-evolution as 'a stochastic system of evolutionary change in which two or more species interact in such a way that changes in species A set the stage for the natural selection of changes in species B. Later changes in species B, in turn, set the stage for the selecting of more similar changes in species A' (*Mind* 1979: 227). But according to the manuscript that he did not publish, 'The Evolutionary Idea,' the discussion of co-evolution was to have included a lengthy commentary on its 'appropriate syntax,' and according to his notes, such a syntax involved the analogy of co-learning between animals.

Another important dimension of co-evolutionary relations is that co-evolutionary coupling, as in any informational process, may compound its own errors. Compounding of errors could also lead to breakdown. As mentioned in chapter 3, Bateson often referred to the situation of the fabulous 'bread-and-butterfly' which Lewis Carroll humorously portrayed in *Alice in Wonderland*. This fable, in Bateson's eyes, was a moral about how dilemmas always intrude into survival of steady-state relations. Whether or not Lewis Carroll intended dilemmas to be represented in this way, Bateson's interpretation emphasizes that the study of evolutionary theory is a prime example of how reductionism leads to endless pitfalls in thought. Evolution is a systemic problem whose terms can only be considered both relationally and reflexively. Reflexively, the study of evolution is a means for unearthing all the processes we call 'knowing' and is especially significant in understanding the relationship of the knower to what is known: 'that in uttering evolutionary theory the appropriate syntax will consist of subject-predicate sentences in which the subject will always be a relationship' (Bk. Mss., box 5; 1987: 205.27).

Darwinian theories of evolution did not permit any reflection on how human beings perceived the 'rules' of evolution. Darwin and his followers did not permit any consideration of reflexive factors because they believed that all biological existence had to accord with their materialist explanation of selection and adaptation. Yet our survival, said Bateson, depends on understanding that we are coupled to embodiments of our own ways of thinking and acting with respect to our perceptions of evolutionary process. And when our perceptions of the rules of evolution seem to restrict boundaries of discussion to materialist formulae, our own survival is threatened.

Bateson also noted that he had had the luck to publish as science began to turn in his direction. In this respect, many biologists would agree that the certitudes of Darwinian notions of adaptation, which had seemed so secure in the science of 1950s, were under increasing attack by the time that Bateson was writing *Mind*. Niles Eldredge and Stephen J. Gould, two prominent natural historians otherwise committed to Darwin, had already pointed out that the Darwinian insistence on smoooth continuities of evolutionary adaptation must be set against the 'herky-jerky' pattern of the fossil record. The latter must be taken as the primary datum (Eldredge 1985: 193–223). In fact, all temporal perspectives of evolution should be based on what was known, and not on what was assumed by Darwinian theory.[16]

Dissent was apparent, too, in the arcane area of systematic biology. A new type of taxonomy, called cladistics, began to compete against the traditional program of evolutionary systematics which had given so much support to Darwin's views. The British Museum of Natural History, long recognized as a monument to Darwinian conceptions of evolution, decided to put on an exhibition reflecting the position of the cladists. The exhibition aroused a storm of protest. It exhibited evolution as a set of relations among living forms, based on apparent differences and resemblances between phyla, rather than on the Darwinian notions of ancestral forms of phyla. The exhibition, as one supporter put it, began to 'free taxonomy from the subjective, authoritarian, narrative explanations and paraphyletic taxa common in evolutionary taxonomy' (Schafersman 1985: 193).

At the same time, dissident molecular biologists began to doubt Darwinian propositions of natural selection. The dissidents argued that at the genetic level a 'random drift' hypothesis better suited the data of molecular biology than the neo-Darwinian concept of mutation and natural selection. The dissidents termed their position 'neutral selection.' As one of the more prominent neutral selectionists put it: while natural selection may still act directly on phenotypes, it has only a secondary effect on the molecular constitution of genes. Since the latter are subject to selection only through their effect on phenotypes, at the level of molecular constitution of genes, 'evolutionary changes are mainly caused by random fixation of selectively equivalent or nearly equivalent mutant alleles ... random genetic drift prevails' (Kimura 1985: 87).

Finally, there was a significant trend to take biology away from the realm of physics and to re-establish theoretical biology on another basis.[17] The widespread evidence available showed that new hypotheses were required, and that the new hypotheses would have to be more 'ecological.' That is to say, they would have to explain transformations in the fossil record in terms of similarities of common structures apparent in the plant and animal kingdom (cladistics), long periods of stasis or random drift in genetics (neutral selection), and the inseparable linkage of organism with environment (morphogenesis). According to this new 'ecological' approach, the neo-Darwinians remained entrenched in the mathematics of genetics without saying anything about the morphology of animals. They did not look at the way an organism develops from embryo to adult; nor did they consider why there seemed to be preferred forms in nature (Peter Saunders in Hitching 1982: 147). In fact, Darwinists said very little about any of the key evolutionary issues.

Still, Bateson's own ecological view of evolution went far beyond this nascent ecologism in biology. He maintained that dilemmas of the evolutionary record arise from the survival of the larger system being always dependent on variability and change in its constituent subsystems. As in any communicational system, observers of change of both large and constituent systems constantly find themselves in trouble deciding 'what' is changing. In a perfect setting, a large system forms a 'ground' for the small system. If the whole system can be conceptually stopped in its movement, then the contrast between figure and ground is sufficient that changes in the small system can be distinguished from change in the large. The problem is that temporal differences, 'time grains' in evolution, complicate observation. As with any communicative system, it becomes very difficult to discern which subsystems remain stable in their coupling or which undergo change (*Steps* 1972: 339).[18]

There is no easy route to grasping systemness, Bateson wrote later. It was easy to propose connectivity and interrelatedness in the biosphere but not easy to avoid simplistic formulae for expressing this unity. Systemic interrelatedness is a fundamental condition. Yet co-evolution between organism and environment confounds clear distinction in any particular evolutionary context between that which is the figure and that which is the ground. To the resolution of these evolutionary paradoxes Bateson had brought all he had learned about coding, context, metaphor, redundancy, and logical typing. If, by examination of communicative patterns of natural order, human beings began to recognize themselves as being both within part and product of a conjoined system, then no longer could they hold that they are observers split from the 'object' of their investigation. They must perceive themselves as part of that which they behold. In Bateson's words, all the new answers require us to know who we are as part of our own environment (Notebook 51/1973). Or, as other ecologists have put it, expressing similar themes:

> What all this suggests is that our assumptions of separateness are unacceptably simplistic, and that we might more closely approximate the facts of our existence by regarding ourselves less as objects than as sets of relationships, or processes in time rather than static forms ... Without resorting to any kind of mysticism we still arrive at a realization of interrelatedness [of biological world and humanity] that challenges our Cartesian foundations. (Evernden 1985: 40)

And it is the recognition of our interrelatedness and the implications that we can draw from it which constitute 'the potentially subversive realization that ecology can offer.'

8

Recursion

We noted in the last chapter that as Bateson moved his sphere of interest towards reflexive processes of communication in the natural world, the framework of cybernetic explanation on which he had so long relied began to become slippery at the edges of explanation. This trend was even more strongly pronounced in his discussion of logical types, which, for more than twenty years, had provided an abstract structure through which he could analyse the complex interrelations between coding and rules of relationship. For reasons which will be discussed in more detail below, logical typing did not work as a formal structure in natural systems as well as it did in human systems of communication. Bateson's whole scheme required reciprocity both in the ordering of ideas and in describing relations between change and stability in human and natural systems, or it fell apart.

Thus, between the publication of *Steps* and the publication of *Mind*, there is a shift in his argument to make a more satisfactory matching between patterns found in ecosystems and concomitant ideas of behaviour and learning in cultural organization. Part of this shift in argument concerned Bateson's reconstruction of a concept of 'difference.' He lost no time in introducing and expanding the significance he attached to 'his reformulation of difference.' In fact, it is not too much to say that 'difference' was that analogue of a Newtonian particle for which he had searched for so long in the social sciences. The other argument concerned 'recursion.' In all his prior work, he had emphasized the importance of understanding the 'logic' in circularity, so that a notion of recursion could hardly be said to be new to him. What was new was his reconsideration of recursion as an 'abstract structure,' a principle of order which might replace that of logical typing. Bateson wrestled, uncertainly, with its consequences.

Witnessing Bateson's adjustments, as he twists and turns with the notions of 'difference' and 'recursion,' is in one sense looking over the shoulders of an extraordinary epistemologist as he wrestles with his own theories. Yet this process has merit beyond its academic content. We must recall the overall theme that Bateson had set himself once he moved into the study of biological and ecological systems: 'I shall argue that the immanent threat of ecological disaster is a product of epistemological error and, even more horrible than the apathy or addiction which makes it difficult, perhaps impossible, to meet this threat with appropriate action, is likewise a product of epistemological error' (Bk. Mss., box 5; 1987: 204.13).

His wrestle with theory was a critical endeavour going far beyond its content, for he sought to avert ecological disaster by re-placing the dominant discourse in ecology. Bateson's alternative epistemology emphasized that ecosystems were primarily informational, rather than material or energetic. The informational way of looking at ecosystems had several advantages. First of all, it is better able to provide clues as to thresholds of tolerance to change among the various levels of an ecosystem. Second, treating ecosystems as primarily oriented to information pathways enables the vast field of evolution to be an aid in understanding how information is packed within ecosystems. Third, looking at the various pathways of differences (information) in bioentropic systems renders clues about ecological degradation which are often not immediately discernible, and become even less discernible if one switches attention to an examination of energy budgets in ecosystems.

Although ecological systems, Bateson noted, do indeed become degraded when their energy budgets become depleted, the systems first become degraded through loss of organization among the components of the ecosystems. To understand stability, adaptation, and degradation in ecological systems, it is of primary importance to look at pathways of information and their 'budget of flexibility,' not at pathways of energy, such as food chains and nitrogen cycles. Degradation in time of ecological systems is primarily a result of the breakdown in interconnectedness among the total array of their relationships. Breakdown results first from a loss of ability to respond to change rather than from a loss of energy. He put forward this thesis in very clear terms: 'It is my personal belief that the entropic budget [of ecosystems] limits events within biological systems long before the energy budget starts to pinch' (Letters, 1019-63a, 66a/1969). Human beings or any other biological organisms are not directly adapted to the material or energetic surround in which they belong, for adaptation to any specific physical feature of an environment would raise the vulnerability of the organism to sudden changes in ecological setting. And, he stated, 'it is, in fact, biologically fatal to try to organize the system in any way which will use the lethal variables, such as starvation or oxygen lack, as the determinant of the adaptive event ... It is much safer to organize upon the multiple control of the adaptive event as control by some non-lethal variable, like appetite or [carbon dioxide excess]' (Letters, 207-19e/1971).

Biological systems control lethal variables through homeostatic circuits which are triggered by less lethal variables. Against these advantages, the major problem of ecosystems oriented towards multiple information pathways is that informational systems have difficulty in correcting minor pathologies. Thus a beneficial set of relations in a context of *appropriate* adaptation may rapidly lead to a quite different situation through formation of positive feedback loops. What began as adaptive behaviour may, at a later stage, induce runaway and in so doing move successful adaptation towards pathology. An analogue of this has already been presented in chapter 1. Bateson's essay on Alcoholics Anonymous shows how emergence of positive feedback loops ('One more little drink won't kill you') prompts runaway, leading towards some threshold in the system at which there is either death or a 'flip-flop' resulting in a new form of stability. Through the model of Alcoholics Anonymous, the pathologies of human addiction become a counterpart of the pathologies of inappropriate adaptation in the 'mind' of ecosystems.

Bateson's epistemology treats survival in ecosystems as the survival of relationships embodied in patterns of communication which are fostered by durability of descriptive propositions or ideas. By contrast, the dominant view in ecology has continued to focus upon the population growth or extinction of organisms, and species of organisms, in a bioenergetic environment. In Odum's terms (see Appendix 1), embodied energy in ecosystems represents a complex set of physical resources whose operations functionally interact to meet the physical necessities of life. The dominant view weds this conception of embodied energy in the environment to an interpretative field in which energy resources are measured by money. Such a 'logical approach' to the conversion of value between natural ecological systems and human systems enables the rate and flow of energy drawn from the environment to become a basis for allocating goods and services of all kinds in human societies.

Outside the dominant discourse, other ecologists have entirely rejected Odum's position: environmental values cannot be determined in relation to production factors, they say. Instead, they take the position that ecosystems have intrinsic value. Things are right in ecosystems when they tend to preserve the integrity, stability, and beauty of the biotic community, and wrong when they tend to do otherwise.[1] The notion of intrinsic value of ecosystems gives a predominance to psychological perception, aesthetic feeling, and cultural attachment to ecosystems over a biosphere valued for its resources and material components. Bateson would have evident sympathy with this position, for it proposes an idea of ecosystem integrity in which humanity is related to its environment. But there comes a point at which he parts company with the notion of the 'intrinsic value' of ecosystems. That point is reached where 'intrinsic value' is combined with assertions about spirituality in nature.

As will be discussed further in chapter 10, Bateson does not find 'reverance for nature' a suitable descriptive proposition – especially when its proponents believe that the intrinsic value of natural systems arises from a spiritual design lodged in nature. Bateson held that the biosphere has no specific location for a godlike monitor. Absolute distinctions between 'inside' and 'outside,' that is, a design within or a monitor without, are abolished in Bateson's co-evolutionary thinking. Hence his interest in providing an exact accounting of recursion. In general, he argued that both rationalists and those who derived their ecological sensibility from a reverance for design in nature assumed too rigid a distinction between activity 'inside' the mind of human beings and an undifferentiated environment 'outside' the mind. Western constructs always seem to presume that characteristic objects and events are external to our own sense organs, he said. Yet pen, paper, desk tops – which we classify by these names – are differences not really *in* the paper or *in* the desk top. 'They are *embodied* in interactions between paper and desk top, *and* in interactions between desk or paper and your sense organs' (GB, 1976c; *Sacred* 1991: 189). By extension, that which we classify as belonging to the natural world are not objects external to us, but rather an embodiment of an interaction between the natural world and sense organs. Properties are only differences and exist only in relationship.

The notion that rationality lodged inside our heads is the means by which we can distinguish our own condition from that of the surround is the other side of the coin to reverance for design in nature. It was evident to Bateson that our capacity for reflection on our own adaptation to nature, our capacity to be rational, was much more limited than we believed.[2] Rational conclusions required 'objectivity' of perspective gained by stepping outside systems and events. But ecosystems as great as the biosphere cannot be viewed from the outside. All construction of pattern in the system must be done from 'inside' the biosphere. Therefore observers making an observation of an ecosystem which is larger than themselves and of which they are part cannot help but re-enter their own description of that domain, a situation which dooms all prescriptions for rational discussion and, to the contrary, gives rise to errors of self-reference.[3]

Bateson believed that modern rationality is itself confused by its own myth – the necessity to separate human thought from nature. He held that the recursive interaction of sense organs with the natural world is a generalized phenomenon, one that is not reserved to the activity of humans. So, too, are the errors derived from this recursive interaction. True, nature does not 'think'; nor is nature reflective in the manner which rationalist traditions regard as necessary for the conduct of civilization. Instead, Bateson treats the question of 'inside' and 'outside' as contrasts in forms of mapping – cognition operating on internal patterning, perception operating on external patterning, the forms of nature proposing links between the inside and the outside and relations between the two. All together the contrasts yield an understanding of embodied interactions between organism and its environmental surround.

'[The epistemologist] knows, in all humility, that he has but a teaspoonful of knowledge of this vast ocean of mind and evolution; and he knows that error in these matters can propagate systems of cruelty and disaster' (Bk. Mss., box 5; 1987: 204.13). Bateson felt that the 'teaspoon of knowledge' he sought to gain during the last decade of his life must provide a better operational understanding of recursive features of embodied interactions; beyond operational understanding, humanity must derive a recursive epistemology to match.

DIFFERENCE - A TRULY PSYCHOLOGICAL CONCEPT

Bateson admitted that until the period immediately prior to writing 'A Re-examination of Bateson's Rule' (*Steps* 1972: 379–95), he was himself not sure how the cybernetic notions of information could be translated to the natural world. He was touching on old dilemmas. Was there *some* organizational principle flowing from the fact that living forms are *forms*? A line of inquiry which included both 'vitalism' at the turn of the twentieth century and the associated concept of 'entelechy' put forward by Hans Driesch argued that non-physical forms of regulation organized physical processes. Other biologists had considered these questions from a thermodynamic perspective.[4]

Bateson ruled out any principle of patterning which considered 'final cause' as a determinant of its antecedents. In fact, Bateson was opposed to any explanation of form which relied exclusively on non-physical causation.[5] But if patterning, shape, and order did not flow from the *generation of form per se*, morphogenesis, the connection between the generation of form and the principles of information theory was uncertain. Early cybernetics suggested that all communication was constructed from signals carried in a channel. As we have seen, Bateson knew that information in a channel was not simply a physical transmission of a bit of information but was also a 'trigger' for communicative meanings. Beyond this problem was an unresolved question: if communicative order was common to all living systems, how did signals trigger meaning in natural order?

It was not until 1969 that Bateson himself fully understood the answer. His resolution went approximately like this: if information is considered as variety, as in Ashby's definition of information, and if the information event is some type of selection of form in variety, then the 'form' of the form is 'triggered by difference.' An information event in natural order was triggered by form interacting with form, the interaction itself generating a contrast or comparison, which, in turn, embodied a difference, much as in any other type of communication.

This way of dealing with information, as the form of a form triggered by difference, meant that information, considered as 'difference,' could arise from the most simple acts of selection or comparison in any context of natural order. The initial problem he had worked on at the Veterans Administration Hospital in Palo Alto was how cybernetic signal events triggered meaning. Cybernetic events were enfolded in time series in a channel. In a technical situation, 'the technical term "information" may be succinctly defined *as any difference which makes a difference in some prior event*. This definition is fundamental for all analysis of [information in] cybernetic systems and organization' (*Steps* 1972: 381). In cybernetic understanding, the time series was 'error activated'; corrective action is brought about by the difference between some present state and some preferred state.[6]

The new way he had devised of dealing with information as the form of a form 'triggered' by difference gave an enormous flexibility to this whole construct. Information sent and received in classical cybernetics was almost always as a physical signal in a circuit, such as instructions for technical machines, or as 'news' in a spoken or visual interaction between two people in human communication. Bateson could now argue that 'message' or 'news' need not be tied to a specific circuit of senders and receivers. The triggering of 'difference' could occur in any information context through the simple means of comparison and contrast. These could include any means through which a process of perceiving difference occurred among animals or organisms in the natural world.

He could begin to think about contrasts in any form in nature and how pattern is derived from contrasts and interconnection. The supposed mystery of patterning of form in nature adapting to its environment could now be seen to be the embodiment of difference in patterns of relationship of organism and its environment; in these embodied patterns, which were physically located 'no-where,' living forms created their own organization. His essay on 'Bateson's Rule' showed that symmetries and assymetries of morphological forms can occur as a result of natural forms receiving information *from the outside* (an unfertilized frog's egg receives information from the entry of the spermatozoon), or it can occur *inside the system*, as a result of the natural propensity towards redundancy of form in natural systems. Redundancy was the rule rather than the exception in biological systems, and the presence or absence of bilateral symmetry in natural form could help explain how symmetry and asymmetry can occur: 'In a plant, the morphology of the fork *provides* information enabling the flower to be not radially but bilaterally symmetrical, i.e. information which will differentiate the "dorsal" standard from the ventral lip of the flower' (*Steps* 1972: 395). The essay contains a number of other examples of contrast between 'inside' and 'outside' as triggers for variety in natural form.

In later essays, Bateson makes more sense of why the morphogenesis of natural form yields so readily to the analogy of communication in human conversation. The interaction of units of embryology could be described in terms of the contrast of 'questions and answers' triggered by comparison and contrast. The unit of embryology is neither just the egg nor just the sperm, each with its individual characteristics considered separately. The genetic code in the unfertilized egg has sufficient information to pose a question. It sets the egg to a readiness to receive a piece of information. Since the genetic code itself contains no answer to a question, the genetic code 'must wait for something outside the egg, a spermatozoon a camel-hair's fiber, to fix it.' In order to develop, 'that unit [of morphogenesis] is the egg *plus* the answer. And without the egg plus the answer, you cannot move on to the next phase' (*Sacred* 1991: 179).

The first of these contrasts of difference, he notes, is between the sensing of a pattern of activity 'outside' – the perceived redundancies and differences of form – and the coding of a signal 'inside,' that is, forms of naming and classification. The second of these contrasts is more difficult to grasp. It concerns contrasts in the very act of communication. There is a contrast between descriptive process in human language and communicative organization in nature. Contrasts in the latter case emerge through communication which is clearly injunctive (readiness, question, plus the answer). Contrasts in the former case also emerge through their own self-description. Yet both forms of naming and classification were needed 'to create the language in which we can talk about evolution, about morphogenesis, about epistemology and about mind/body' (*Sacred* 1991: 181).

His new concept of difference could also resolve questions of how meanings are triggered in messages:

> ... difference is the subtle and psychological matter. Wherever difference may be 'it' can trigger the degradation of energy without itself self-supplying energy. In other words difference is a truly psychological concept ... so long as we talk about difference do not pretend that difference is somehow 'physical.' We should be talking about psychology ... difference is neither in the outside world, nor solely in the inside world but is created by an act of comparison and this act is an event in time – an act of scanning. Whether there are static differences 'out there' it is not so important for us as psychologists as the generalizing that only changes can enter into our perception. [And] that any difference which makes a difference is 'information' (there may be

other differences, but these do not concern us as psychologists). ('Some Thoughts about Intermittent Reinforcement,' CAF 308/1971)

Bateson's notion of difference is quite clearly a psychological or experiential concept attached to a technical concept of information which *per se* redefines conventional notions of information in a semiotic field. Nearly all other theorists of mass communication, whether structuralists and postmodern deconstructionists, linguists or philosophers, Marxist proponents of communication as culture, or those giving anthropological versions of culture, have tied their analysis to a conception of communication as 'discourse' – communication strictly conceived as some form of agency in a sender-to-receiver process. Bateson, through his notion of difference as any event triggered through formative comparison, frees himself from these anthropomorphic limitations.[7]

As mentioned above, it was not until 1969 that Bateson himself fully understood how his self-revelation would achieve an epistemological 'monism.' Bateson attributes his insight to his review of material in preparation for the Korzybski Memorial Lecture in 1969. As he explained in the Korzybski lecture, and reiterated later:

Only *news of a difference* can enter into man's sense organs, his mapping, into his mind ... Only difference can effect and trigger an end organ – so all our information (our universe of perception) is built on differences. Difference is 'super-natural' i.e. outside the natural world as this is seen by the hard sciences. Difference is not located in x or y or in any space between. (Notebook 51/Fall 1973)

Until the Korzybski lecture, he assumed that comparison and contrast had to be mapped back onto some type of levels hypothesis – logical typing – in the physical circuit of communicators sending messages to each other.[8] Now he could see that the bridge between any map and any territory is *difference*. With the concept of 'difference,' Bateson could proceed to evolve a language able to discuss any procedure in which map became distinguished from territory and relate that context of mapping to the genesis of ideas. In particular, mapping difference gave rise to a deeper understanding of the process of classification in natural order than the somewhat mechanical examples of 'step functions' drawn from cybernetics permitted.

ABDUCTION AS QUALITATIVE METHOD

As Bateson developed his ideas about difference being triggered by comparisons and contrasts, so he needed to develop a methodology that would attach description by observers to his language of difference. The most important method discussed in *Mind and Nature* is that of 'abduction.' Bateson borrowed the term 'abduction' from the philosopher C.S. Peirce. Abduction is a method of constructing knowledge based upon consistencies in the evidence. Typically 'abduction' is used in law when an advocate makes a case on the relevance of resemblance in all facts being considered. Abduction is also used in philosophy when there is an attempt to pull together all the truths about what appears to be the case (the *verum factum* formula of Vico).[9]

As with other borrowed terminology, *creatura* for example, Bateson put the term to his own use. Abduction was a form of hypothesis construction that permitted a lateral extension of abstract components of description.[10] In Bateson's use of the term, so long as one event fell under the same rules as another event, 'certain formal characteristics of one component will be mirrored in the other.' In his view: 'Every abduction may be seen as double or multiple descriptions of some object or event or sequence. If I examine the social organization of an Australian tribe and examine the sketch of natural relations upon which totemism is based, I can see that the two bodies of knowledge are related abductively – both falling under the same rules' (Bk. Mss., box 6; 1987: 208.42).

Abduction was like qualitative modelling – a means of undertaking formal comparisons through contrasts, ratios, divergences of form, and convergences. His use of the techniques of abduction were remarkably similar to those of identifying 'resemblances' in a comparison of 'language games' which Wittgenstein had originally proposed.[11] In Wittgenstein's formulations, the comparer is always able to undertake comparison, even in situations in which comparison seems impossible. For the comparer is always in a position to form propositions about differences and resemblances – and if necessary, even invent new games when differences arise.[12]

The notion of resemblances derived through comparison of differences is vividly captured in Wittgenstein's image of the thread among the resemblances in language games; or, as Wittgenstein put it, in overlapping and criss-crossing fibres of a woven pattern. I think it is evident that Bateson chose the notion of 'the pattern which connects,' discussed in the next chapter, to be as close as possible to Wittgenstein's image of criss-crossing fibres of a woven pattern of resemblances. In an extract from an unpublished metalogue prepared for 'The Evolutionary Idea,' Bateson refers to abduction as an 'old friend.' He speaks of comparing a tobacco plant with a crab:

What I call my 'old friends,' what I look at in the woods, are *resemblances between* the differences. Or is it the resemblances between the differences between the resemblances between the differences? ... Each [crab] contains within itself many, many different decisions that somehow had to be made as it was growing ... If we could find some set of differences in the crab's anatomy and show that both sets of differences are cases under the same rule ... [that is] what is called abduction ... One half of the resemblances lie in the chromosomes [of the plant and the crab] ... the other resemblances are the outer effect of these microscopic resemblances ... what is called the phenotype. (Bk. Mss., box 5; 1987: 204.24)

In Bateson's 'abductive game' – if we may call it that – an observer puts into practice the method of drawing resemblances between differences, or 'the resemblances between the differences between the resemblances between the differences.' Abduction could also be used, more strictly, as a lateral extension of a network of interrelated propositions.

Bateson makes the case that abduction, unlike induction or deduction, is a process of modelling information which is characteristic *both* of the human species *and* of other creatures in their own environments. Abduction is not recognized within science as a method for validating descriptive models. Yet, he says, 'metaphor, dream, parable, allegory, the whole of art, the whole of science, the whole of religion, the whole of poetry, totemism ... the organization of facts in comparative anatomy – all these are instances or aggregates of instances of abduction within the human mental sphere' (*Mind* 1979: 142). In short, all are different means through which the threads of resemblance could be grasped.

Abduction is usually regarded as a method which yields tautology, for an abduction appeals to the validity of one statement in order to make the terms of other statements necessarily true. For any logician or scientist, this is a poor form of argument; logically, all verifiable reports should permit the test of causal links between the first and subsequent statements, and tautological statements do not allow this possibility. Bateson took the position that inductive science may abhor tautology, but nature does not. Logicians may regard any method which does not permit the insertion of independent criteria between the first and subsequent statements as suspect or falsifying, but this does not hold in nature. Tautology occurs in nature because nature does not 'think' in either inductive or deductive terms. In natural contexts, the formal 'cause' of that which is necessary may be defined by that which is necessary. Thus successful adaptation may be defined by that which has adapted successfully, namely, a successful process of matching. Or 'that which is necessary' could, for example, be a more fundamental form.

Logical procedures may require the matching of the premises of the tautology with the outside world, Bateson said, but he did not believe that one can separate the data series which represents the environment from the data series which represents the organism. Logicians' requirements for external validity are misleading, Bateson argued, because of their hidden supposition that 'truthfulness' only derives from external reality. Logicians thus ascribe to the external world 'a consistency which will somehow resemble that which obtains within the tautology' (Bk. Mss., box 5; 1987: 204.33). Yet, if these assumptions are reversed, they are just as valid: that is, consistency ascribed to the tautology can equally resemble that which obtains in the external world.

Bateson is arguing that there is no need to claim natural tautologies are invalid because they do not meet some definitional requirement present in human logic. Thus, if natural propositions seem to construct a tautology, then rather than rejecting this evidence, it seems appropriate to check lateral extensions of the tautology – for these will all be valid, at least in nature. Naturalists afraid of tautology will fail to see 'many important orders of phenomena' (Letters, 250–1a/1965). Natural tautologies require only that their internal terms be consistent, Bateson argued. Hence, a naturalist may look around the 'external' world for other examples of such a related network of propositions and make a lateral extension of the propositions drawn from one tautology to another. In this process of mapping, every abduction becomes a double or multiple description of some object or event or sequence. Far from being a falsification of the description of natural events, any mapping made through abduction was a meta-logical use of tautology. In the quotation above, Bateson even suggests that an abductive extension may yield a valid tautological proposition at another level of a natural hierarchy, a sort of second-order abduction, 'differences between the resemblances between the differences.'

MODULARITIES

Once he had conceived a new understanding of difference, he believed that patterns of difference and distinction in both the human communicative domain and the natural domain could prepare the way for an epistemological 'meta-dualism,' for a true monism with regard to the epistemology of *creatura*. A letter written in 1969 to the writer Paul Goodman aids in an understanding of what Bateson is talking about here:

> It is not that 'thesis' contains inevitably the seeds of its own confrontation. The point is that thesis and antithesis were initially split apart by a false dichotomy. William Blake argues somewhere that there were two orders of evil in the Garden of Eden. First, there was the false dichotomy between good and evil, and then there was the evil which constituted one horn of that dichotomy. But of course, if the dichotomy were false then the 'good' horn must always propose and generate the 'evil' horn. (Letters, 559–20a/1969)

One of the false dichotomies that Bateson spoke about in this letter was 'the two arms of the dualism secular versus sacred.' The final chapter of this book considers Bateson's monistic resolution of this dualism.[13] Yet a monistic epistemology needed not only to explain how a variety of forms built up into a whole, through difference, but also how the whole 'disseminated' into parts. More specifically, he required a means of comparing part with whole so that the 'difference,' the feedback of the comparison of part to whole, may be said to 're-enter' the part. The image here is of a reflexive loop which somehow acquires a contrast of self, in relation to system, as it spirals towards its own origin.

Even as early as 1965, as a result of his own work on animal communication, Bateson had begun to seek a new mathematics that might help him in his quest for another form of feedback that completes such transforms in recursion. He became attached to the theory of groups, which enables description of modularity in patterning. A good natural example of modularity is the human backbone. Each module of an overall pattern may have very similar characteristics, and even merge into one another. When the modules are put together, the overall pattern is distinctive from each of its individual modules, and yet the unity of the backbone gives form to the modularities of the parts. What interested Bateson in the mathematical theory of groups was its purely relational language, suited to describing situations in which the 'group' was totally defined by the relations between its members ('Notes on Group Theory,' CAF 208/1956).[14]

Bateson's own visual representation of group theory was the performance of a form of music called 'ringing the changes.' Bell-ringers still perform this music before church services in many parts of Great Britain, he noted. To 'ring the changes,' an order of bell ringing is arbitrarily selected, and a rule for the transformation of the order is agreed upon. The bells are sounded in the initial order, and then in the transformed order. The same rule of transformation is then applied to the second order to generate a third, and so on, until successive transformations bring the order back to that in which the playing of the bells started. 'The resulting music is, in fact, the product of a successive group of theoretical operations. It is a sequence determined by a purely relational recipe' (Notebook 35/1965).

The most important feature of the theory of groups was that the 'levels' of distinction in a modular pattern can be perceived and classified according to the overall frame or pattern of which each module is a part. Unlike the theory of logical types with which he had worked since 1948, modularity was an abstract typology of form easily transferable to studies of natural phenomena. Despite this benefit, the mathematical theory of groups was quite limiting, for though it described the relations of part-to-whole and whole-to-part quite well, and though it provided a focus on transformation, and transformations of transformations, it seemed to lack an adequate interrelation between causality, in its temporal dimension, and classification. Thus, for Bateson at least, what was appropriate for an understanding of a backbone did not necessarily yield an adequate extension to comparison and contrast in psychological contexts.[15]

We find this out in a discussion in a later notebook. The mathematics of the theory of groups made use of symbolic logic, but to use symbolic logic assumed that the focus of study is upon a timeless and non-paradoxical world (Notebook 61/Fall 1975). What most interested Bateson was the interrelation between timeless classification and the temporal nature of causal sequences of 'if ... then.' For when these sequences were juxtaposed with classifications born of tradition or habit, they yielded the psychological domains of paradox and falsified perceptions characteristic of double binds. Symbolic logic in the theory of groups did not yield a calculus that enabled temporalities to be inserted into the sets of logical relations it evoked; the logic assumed a timelessness in its ordering properties - and this led him to turn towards other ways of depicting order that might take time into account.

The general solution he had always favoured was to consider a third term which would oscillate or mediate between the initial terms; for example, the 'self' that oscillates between the two-dimensional propositions of class and its members found in the paradoxes of Russell's logical types. As discussed in chapter 6, his prior study of communication had made a link between metaphor and redundancy. Their cross-correlation - between the pattern of metaphor as 'inside' and redundancy as 'outside' - was, he believed, a necessary component of all patterns of communication. Thus, Bateson turned once again to his notion of redundancy, noting that a comparison of recurrence or redundancies really incorporates two steps. The first contrast in redundancy seems two-dimensional: it is a relation between part and whole comparable to level and meta-level. But this is immediately followed by another comparison, which contrasts the redundancies of part and whole to the environment of the whole. This provides a three-term contrast. Rather than a simple contrast of subject/object or presence/absence, redundancy expands contrast to a third domain, in which that perceived as part or whole is compared to a second-order set of processes about formation of wholes.

The triadic dimension implied a second order of comparison built upon the initial distinction or, as he puts it in his notebook: [(part-whole) /=/ environment of whole]. Clearly three-dimensional contrasts derived from first- and second-order comparisons were much more appropriate to studies of natural order and ecosystems than the 'steps' of logical types. And unlike a ladder of types, the process of comparing first-order distinctions with a second-order formation derived from redundancy is reciprocal among all contrasts and comparisons. Redundancy permits a hidden third term to appear in the time intervals of the contrast. Contrasts emerge when patterns of redundancies learned in one *particular* context are compared to patterns of redundancies discerned in formation of a *whole*, and the difference between the two contrasted. In this way, the comparison of part-whole with formation of whole creates a feedback in which the *whole 're-enters' the part*. Bateson suggested these processes of comparison provide an ordering of recursion.

AUTOPOIESIS: THE BOOTSTRAPPING OF FORM

During the 1970s, other versions of recursion began to emerge. One of these seemed particularly favourable to explaining the embodiment of form in biological organization. Two Chileans, Humberto Maturana and Francisco Varela, developed their notions of recursion through a critique of classical cybernetics more radical than Bateson's own.

Maturana had at one time been a research student with Warren McCulloch and was well aware of the history of cybernetics. Varela and Bateson met when they both were teaching in the summer program of the Naropa Institute in Boulder, Colorado. The Naropa Institute gathered teachers and students for discussion in an informal atmosphere on the general question of the intellectual relationship between cognitive sciences and the Buddhist traditions of meditative psychology.

Maturana and Varela argued that any biological organization described by high density networks of mutually interconnected feedback loops is for all intents and purposes organizationally closed. Closure, in turn, indicates a condition of autonomy. Typically autonomous systems have pervasive circularities, which are almost entirely absent from the systems described by physics, but are rampant in biology and in all natural systems. Closure also indicated that natural forms 'bootstrap' their own organization through a continual process of mutual fittedness and recursive looping. Maturana refers to this propensity in natural systems as the propensity towards mutual 'stickiness.' The metaphor most used in human experience to illustrate this propensity is that of 'love.'

Maturana and Varela contended that the question of system closure, together with its pervasive logic of 'stickiness' and looping, was one which cybernetics had found difficult to resolve. Ashby and Wiener had noted the closure of cybernetic systems, but only as a phenomenon involved in how systems underwent reorganization to maintain system stability. Neither of them considered closure from a perspective of system bootstrapping. In the Ashby-Wiener perspective, cybernetic systems had to be 'open' to changes in their environment in order to be survival-worthy.

The two Chileans concentrated their attention on a particular class of autonomous systems which they defined in terms of a process they called *autopoiesis*: or systems which produce their own identity. For example, the human nervous system neither 'extracts' nor abstracts distance as a characteristic of the environment as it orders spatial relations, they said. Rather, the human nervous system *generates* perception of distance as a mode of behaviour compatible with its environment. Despite any subsequent perturbations, the nervous system is able to *organize invariances* out of the mode of behaviour it has generated.

This version of recursion did not rely on propositions about information circuits, on which Bateson's ideas were predicated. Maturana and Varela argued that information is not picked up from the environment; furthermore, there is no 'thing' inside the brain to which it can refer (no governor) in order to obtain an assignment of correspondence with 'reality' in the environment. Cognition in their view is 'presentational' in form. The human nervous system has neither input nor output; *it is a closed system*. That is to say, the nervous system is not 'informational' at all, for there can be no correspondence between the inside of the system and a given state of affairs external to it (Varela 1979: xv).

SELF-REFERENCING FEEDBACK

One of the keys to Maturana and Varela's notion of *autopoeisis* was the concept of a loop, a feature which could form varieties of pattern through redundant iterations, but which, as they pointed out, did not need to be a loop carrying 'news.' Instead of concentrating on informational correspondence, the relation between inside and outside, Maturana and Varela simply stated that systems generate and define their own identity as a condition of their own organization.

Bateson had already received a useful lesson on the differing characteristics of loops and cybernetic circuits in a group seminar held in Hawaii in 1969. One demonstration at that seminar was that of a television camera pointed at its own monitor.[16] Bateson immediately appreciated the difference between loop and circuit. In the case of the TV camera pointing at its own monitor, a simple 'self-referencing' system picks up any distortion in the original external pattern and feeds back to that distortion the record of having observed the distortion. The self-referencing feedback has the effect of amplifying the distortion in each 'loop' of the record. Since the TV camera pointed at its own monitor is a continuous loop of self-reference, the interaction between TV camera and monitor creates a runaway pattern of distortion with a high number of unpredictabilities. The conditions of distorted runaway through self-referencing loops can be touched off by the slightest conditions of change.

The members of the Hawaii seminar pointed out that the recursive tangles in this simple demonstration would be much more likely to be the sort of recursive tangles found in ecosystems than the distortions occurring through errors in cybernetic circuits. Whatever Bateson's attachment to Ashby's model of step functions, the Ashby formulation did not in any way emulate this sort of unpredictability of patterning. These unpredictable patterns result from a visual recorder perceiving patterns in an external record and then referring copies of those perceived patterns back to the external record in a continuous loop. The tangles were tangles of perceptual self-reference.

The Hawaii seminar also noted that servo-circuits considered as 'loops' define all those conditions in which nature 'plays with itself.' Loops are 'noise eating.' Any natural system can make a new pattern or rhythm out of the noisiness or unformed variety of differences. When water or air goes around rocks, branches, or whatever and then meets itself, it noted, the unpredictability of such natural loopiness is similar to the unpredictable self-referent loops of the servo-circuit of TV camera and monitor. 'Recursive' playfulness of this sort is a means of ordering which 'creates the noise out of the responses to which the adaptation is chosen.' It is also 'the device whereby the adaptive act becomes more economical ... cf. habit formation' (Letters, 207–19g/1971).

The loopiness of water or air going around rocks and branches also provided a model for loops of self-reference in human communication. Any human loop of self-reference requires noise eating; noise eating is a constant endeavour in creating patterns of order, yet the slightest condition of difference, even the presence of noise in the loop, touches off a process of self-referencing. In short, the loopiness of self-referencing or recursive systems explains why it is necessary for human beings to construct maps of maps of maps.

Interestingly, despite the rapidity with which distortions occur in loops, the pattern of distortions in the self-referencing recursions seemed to have clearly defined upper and lower limits (Letters, 207–19n/1971). Bateson recognized that this form of recursion solved one of the major questions about natural form with which he had been wrestling for so long a time. In the language of mathematics, this form of recursion was a 're-entry' of the larger domain of form into the smaller form. By following recursive procedures, the mathematics of re-entry showed how tangles of 'chaos' – the apparent appearance of pattern in an otherwise absence of pattern, in undifferentiated sequences, or randomness – could be resolved.

From a psychological viewpoint, the display of self-referencing in these recursive tangles also provided an alternative way of looking at the dilemmas of reflexiveness. In a recursive tangle of this sort, the inability of an observer to get out of the loop was congruent with the possibility of any observation of recursive pattern 'meeting itself' within the loop. Any observation 'meeting itself' within the loop makes the recursive patterning extremely sensitive to difference.

RECURSIVE FITTEDNESS – A NEW BEGINNING

There was a long pause between 1973 and 1979 while Bateson considered the appropriateness of recursiveness and 'bootstrapping' as an alternative to his own arguments. By 1975 he clearly seemed to have accepted the importance of the concept of recursive looping. Thus, in a 1975 address to a meeting in London, he made extensive references to the topic:

> ... if you have something which acts on itself – which is recursive in this sort of way, it has existence. It has a degree of reality of its own existence which is different from the existence of a wave wandering across the depths of the ocean ... a system of causation turned in upon itself and controls itself ... [the unit about which we have to think] is in fact this unit in which the [temporal] causal system comes back upon itself – is, as they say, technically, recursive, when you have that you have the beginnings of an entity, so to speak, which can go on being, – what we mean by a unit in the behavioural sciences, in ecology, in evolution. It is a system which has the degree of turning-in upon itself that it can therefore roll along and be in some degree itself. (Notebook 62/1975)

Yet these new ideas of recursive causation left several issues unresolved, among them, his own belief that hierarchical levels are the only means through which a classification of process can occur. While writing *Mind*, he began to grapple with these issues in a more detailed manner. The mathematics of paradox – which was the impetus for the theory of logical types – has been resolved, he writes. Therefore he faced a new beginning: ' We start again.' But the world must recognize the great debt which epistemology always owes to Russell, Whitehead, Korzybski, Lewis Carroll, and Wittgenstein, who laboured with these issues. The problems of logical typing *are* still the problems of epistemology. Without the assumptions of logical typing, we do not know *how* we can know anything and without them we would never be sure that the images of dreams are of a different type from the images of perceptions (Bk. Mss., box 5; 1987: 206.6).

In the published version, he almost entirely edits out a crucial eight-page discussion of recursion and orders of recursiveness.[17] As is often the case, Bateson did not present the full array of issues to his readers, but this time he had several good reasons for his hesitations. Recursion as a process of continuous looping was a process without observable attributes of structure. Or rather, the relation between process and structure, between temporality and classification in a recursive system, could not be easily discerned. In some respects, the defects of the mathematics of recursion were similar to those of symbolic logic underlying the mathematics of modularity. And if Bateson were to agree to his monistic epistemology becoming based on 'recursive' structure – as a replacement for the 'abstract structure' of types displayed in *Principia Mathematica* – then that structure must be of a similar order of abstraction (Notebook 61/1975).[18]

Typically, the representations of recursion in mathematics emerged from the geometry inherent in material forms, such as the geometry of crystals. When a complex plane is mapped onto itself iteratively, the fractal geometry of crystals yields several forms of recursive accretion, as patterns emerge from multiple iteration of 're-entry' of form upon itself.[19] But the geometry of crystals was a poor model with which to think about recursion, Bateson believed. Recursive patterns depicted in fractal geometry emerged from the mapping of similarity onto similarities. The mapping of mathematical functions of similarity produced 'static spirals' quite untypical of natural forms. By contrast, the matrix from which differences are drawn, is, as Bateson put it, the 'resemblances between the differences between the resemblances between the differences.' *These are not equivalent to a mathematical function of similarity.*

Thus, of fractal geometry he wrote: '[its] key words are "Fibonacci Series" and "Golden Section." What comes out of all this is that a spiral is a figure which *retains its shape i.e. its proportion as it grows* in one dimension by addition at the open end. But really, you see, there are no truly static spirals ... symmetry and segmentation was somehow a result – a pay-off from the fact of *growth* and (b) that growth makes its formal demands and (c) that some of this is satisfied (in a mathematical, an ideal, sense) by spiral form' (Bk. Mss., box 6; 1987: 209.22).

Mathematics had little trouble with sets of similarities when they are drawn from material objects or processes. But patterns of difference and their recursive patterning in Bateson's vision do not derive from presence of form in an object. Instead, recursive pattern must emerge in a temporal relation between internal and external, or between differences in pattern perceived by an observer at one moment of time, comparing pattern now with pattern observed at a previous time. In short, recursive process in Bateson's vision should be analagous to those patterns of 'betweeness' characteristic of his own well-drawn version of learning and adaptation.

The processes of recursion must also include provision for on-going evolution of form, he says. We have been trained to think of recursive patterns as fixed affairs, he complains, instead of thinking of them as 'primarily a dance of interacting parts [and] only secondarily pegged down by various sorts of physical limits' (Bk. Mss., box 6; 1987: 209.22). The new mathematics of recursion had to be carefully watched. If the preference of mathematicians and scientists was to use 'frozen shapes' and to make these forms of recursion primary in their applications, then, by extension, study of the dance of interacting parts would disappear from ecological coupling between organism and the total system. The study of orders of recursion and their holistic interlinkage would revert to the old dualisms of organism versus the environment (Letters, 1175–7a/1977).

BIOLOGICAL AUTONOMY

A final problem for Bateson in Maturana and Varela's explanation of recursion was their proposition that observation of recursion is an experience 'bracketed from' the adaptations and transformations of recursive coupling. Maturana and Varela argued that the autopoietic domain was somehow indifferent to observers' news about organization of recursive systems (Varela 1979: 44ff). Maturana maintained that observation in science arises from experience, and causal explanation derives from explaining experiences with experience. For Maturana and Varela, the observer is an *operation in the living system of observers.* All attributions of causality are of a different order from the operations of autopoeisis. The domain of observation and attribution of causality is to be distinguished, indeed must be distinguished (bracketed), from the loops of biological connectedness characteristic of the domain of autopoiesis.

Autopoiesis implies that any reference to classification is in the domain of observation, not in the domain of recursive interaction of the natural form being observed. Links between the observer and the autopoietic system are only made through observers having the experience of connectedness that they wish to explain. According to Maturana, this experience is recursively constituted in observers - as a result of emotion and the feeling of connectedness with that which is observed. But such experiences, though they enter into descriptions and explanation, are bracketed from the ontogeny of autopoeisis.[20] The bootstrapping of autopoiesis, by contrast, is carried out according to the *internal* requirements of ordering in the system. In turn, interactions of an autonomous system are oriented towards the system's ontogenesis, or its history of structural unfolding.

If autopoietic systems 'bootstrap' their own environment, and if, as Maturana and Varela say, no descriptive classification is required in order for a system to undertake structural coupling, then there is no evident informational link, no double contrast, to be made between descriptions of the relations between the 'inside' and 'outside' linking the observer domain and the natural domain. Thus Bateson's arguments about metaphor and redundancy would have little merit. Furthermore, if *all* interactions of biological organisms which contribute to recursive structure, including the matching or coupling typical in biological phenomena, have no reference to adaptive information, then most of the abductions he had made from information theory and cybernetics were in trouble.

Bateson's stance was that the topology of injunctions which govern relations and thresholds in a natural system *is* - by abduction - of the same form as that of metaphors in language. The living system may well be self-ruling - Bateson granted this - but there is still a formal resemblance between the 'information in the processes we describe' and the language of autonomy in the system.[21] Moreover, the way that the observer describes the system does, in some way, affect the system so described. The interaction of observer and observed was important:

Such oscillating systems [as ecological systems] are operated by thresholds - not by states, but by *differences* and changes and even differences between changes. There is information not only in our words but also in the processes we describe. It's nice to have the explanation in step with the system of ideas within the process you are trying to explain ... Now if you are going to face oscillating systems, you meet a very curious circumstance – that a certain degree of *reality* is imparted to the 'system,' the chunk of living matter. There is a justification of some sort in drawing a line around it, perhaps in giving it a name. That justification is based on the fact of autonomy, of literal 'autonomy' in that the [topology of the] system names itself. The injunctions which govern the [topology of the] system necessarily are messages which *stand for* the name of the system. The system is auto-self-nomic, self-naming or self-ruling. And that is the only autonomy there is, as far as I know. It's recursiveness, and recursiveness is crucial to any system containing *if-then* links, where the 'then' is not logical but temporal 'then.' (GB 1977a; *Sacred* 1991: 181–2)

In short, all information *about* relations and their thresholds in the system resembles the recursive topology of the system.[22] The 'stands for' occurs both in 'the name of the system' and in the recursive process of mapping relations and thresholds within the system; as well, through classification of system autonomy. Through metaphor both observer and system have a sort of reciprocal interaction in which the coupling of one is not completely bracketed from the informational processing activities of the other.

Bateson's disagreement with Varela and Maturana did not stop him from recognizing the advances which they had made. In particular, he applauded Varela's 'Calculus for Self-Reference' and 'Star Logic,' both of which introduced a three-term system of logic for recursive self-reference. Varela's calculus resolved some of the more slippery problems left open by Russell's system of logical types. As Bateson said, Varela had produces a means by which 'time' could be incorporated into any logical situation involving 'either/or' decision-making: 'It could be argued today as a result of recent work, especially Spencer-Brown and Varela and Maturana that *time* can now be incorporated into logical systems ... ' (Notebook 61/1975).

Varela published 'A Calculus for Self-Reference' in 1975. Here he built on Spencer-Brown[23] by considering a three-valued logic of which one term would be a 'self-cross' occurring as an oscillation in time. As Varela noted, a three-valued logic abandons logical principles basic to common discourse about objectivity, but can be reconstructed to deal with common discourse in some other way. Hence Varela takes 'self-cross,' the *form* of self-reference, as the third value in itself. He argues that it marks a form of self-autonomy, rather than a form of anomaly – as is the case in Russell's theory of types (Varela 1975: 21). Others might call Varela's 'self-autonomy' self-perspective, or even consciousness. Bateson noted:

> [Spencer-Brown, Maturana, and Varela have succeeded but] I think only at the price of breaching the purely abstract character of the system ... some such device is necessary to keep the timeless logical typing of logic [i.e., its abstract structure] from the temporal character of cause and effect ... what is needed is a technique of presentation which will span the gap between the formalisms of Spencer-Brown and Varela and the formalisms of old-fashioned logic to disclose the structure of the mess which is created when both sets of formalisms interlock. (Notebook 61/1975)

From now on Bateson began to attend to 'the structure of the mess' and to 'span the gap.' But before he could proceed, he would have to extend the arguments in Varela's contrived calculus to conditions which accorded with ecological holism. This would involve a return to a discussion of the interrelation between perception, redundancy, and second-order comparison of environment of 'whole.' Ecological recursion had to be examined through a 'third mode,' an aesthetic of interconnectedness. Aesthetic wholes derived from recognition of 'the pattern which connects.' As to whether the study of aesthetics would enable an investigator to simulate 'stepping outside the system,' Bateson was unsure,[24] but it is 'to the pattern which connects' that we now turn.

9

The Pattern Which Connects

The appearance of Bateson as ecologist coincides with the publication in *Steps* of a selection of papers under the title 'Crisis in the Ecology of Mind.' As mentioned in chapter 4, Bateson regarded *Steps* primarily as a book on systems thinking, rather than about ecology, and it appeared precisely at the time when systems thinking was becoming embedded in computer technology. Though computers had been an integral part of defence planning for a couple of decades, the rapid and continuing reduction in size of computers and the comparative ease with which they could be handled was creating a sizeable civilian population familiar with basic notions of non-linear systems. Given some valid functions, computer programmers could design an 'algorithm' or set of rules which would simulate the non-linear dynamics of flows over 'time' within any given system. New models simulating non-linear systems soon began to challenge the orthodoxies of numerical computation and probability in economics and other social sciences.

The results were dramatic. Despite the absence of a fully developed mathematics, the ability of computer programs to simulate the dynamics of non-linear phenomena began to have a worldwide impact on international planning. Jay Forrester derived a program called DYNAMO, which permitted the user to generate resource flows in the world economy under differing conditions of consumption. Although a relatively simple program by today's standards, it provided a demonstration of the fact that there were systemic 'limits' to the global system of resource extraction. Within the space of a couple of years, a research institution using DYNAMO had effectively challenged the pervasive premise of unlimited industrial expansion which had underlain much of political economy for the preceding 150 years (King and Schneider 1991: xi). Forrester was unabashed in his promotion of computer-operated systems as a 'solution' to the complexities of non-linear thinking. He said the computer would become a role-player in all aspects of decision-making in society.

Bateson, by contrast, recognized that computer applications of systems thinking - the new triad of data, program, and output - would transform understanding of a field of relations. But he did not believe that computer application of system dynamics would, in and of itself, bring about a sufficiently deep understanding of industrial systems to change their premises - let alone the premises of ecology. If anything, Bateson became more negative as use of computer-oriented systems grew. All tools had the knack of taking over and controlling the philosophy of the user, he felt. He worried that the very same tools that supposedly extended the range of one's thinking would breed correlations in social and ecological fields without accompanying explanation (Letters, 1019-14b/1965).

In 1971 he wrote a metalogue which spells out a mistrust of cybernetic engineers, those who knew best how to apply systems theory.[1] All machines are 'single minded' and directed towards single purposes. They are anti-biological for that reason. Any argument that the solution to ecological crises lies in technical inventions, such as computers, simply amplifies systematic error. When compared to biological systems, technological solutions ignore the double adaptation required in evolution. Even attempts to hold constant the rate of technical change cannot lead to successful adaptation in an ecological setting invaded by technology. Successful evolutionary adaptation is never achieved by direct purposes, he pointed out, but by a sort of crabwise, sideways progression (CAF 186/1971).[2]

Apart from his lifetime mistrust of applied science, there was a deeper worry gnawing away at him. A combination of the new epistemology of systems with the old epistemology of power 'is fraught with great danger.' The trend may lead to a 'monstrous increase in the controlling of men by impersonal manipulation' (Letters, 1497-20b/1970). Systems theory was incomplete; it was only a basis for uncovering a larger dimension of embedded patterns, that is, some form of 'aesthetic determinism' in human and other biological affairs. It was to this study that his long-term research plans should now be directed, for aesthetics might provide a short-cut to a recognition of how false premises are built into ecosystemic order (Letters, 1015-23n/1969).

BATESON AND ENVIRONMENTAL ACTIVISM

Until the late 1960s, Bateson had been extremely cautious about going public on the ecology issue, urging members of the conferences he had put together in Austria in 1968 and 1969 to refrain from issuing press communiqués. As already mentioned, he had developed an understanding that significant changes in ecological understanding would not emerge through mere technological adjustments, nor newfangled planning procedures, nor simply through a political approach which emphasized the 'managing' of the environment.

His position was in contrast to social scientists in Europe who were already attempting to come to grips with a whole range of issues resulting from the apparent inability of governments to sustain the overall *quality of life*, or the quality of life to which the West had become accustomed since the end of the Second World War. The German communications theorist Jurgen Habermas noted that none of the conventional political parties seemed to be able to deal with these issues and for this reason 'life-world' issues, among them nascent environmentalism, were becoming the domain of extra-parliamentary social movements.[3]

While the rise of these movements was a social consequence of a recognition of breakdown, typically, the peace and environmental movements began with only a vague comprehension of how to involve the public in that understanding. But as debate continued in courtrooms, on TV, and in legal street protests, or a combination of these, their 'epistemological' vision became better focused. The notion of 'life-world' which the new social movements – the women's movement, human rights, the peace movement, and the environmental movement – wanted to express, contained within it a belief in cultural transformation (Harries-Jones 1991). The whole tenor of dissent began to switch away from an emphasis on class revolution, and Europe's most successful environmentalists, the German Green Party, would rise to prominence with a manifesto demanding restoration of 'a biologically intact environment in order to ensure human survival of future generations.' In other words, their project was primarily rooted in an epistemology of ecosystems, and not in various ideologies of social class.[4]

Their North American counterparts were aligned with student dissent against the Vietnam war and with the counter-culture movement. In the 1960s and 1970s Bateson did not believe any environmental change would be brought about by the counter-culture politics of the time. In fact, he regarded the counter-culture as anti-intellectual. He worried about 'the epistemology of the anti-intellectual wave which seems to be flooding in ... [of] encounter groups, hippies, much of modern art, student activists and probably Richard Nixon' (Letters, 771–6/1970). Nevertheless, he became more vocal and more 'political.' In Hawaii he declared to public officials that 'present-day politics and government constitute an eco-pathological system' and pressed for public education through small group seminars. He wrote to the Office of the Governor: 'We have little time to correct our courses ... I think that we have to convert between 50 and 100 leading citizens of this state to a new way of thinking. Until that is done the politics of drastic change should not even be considered' (Letters, 426–36a/1970). *Steps* includes several striking political statements, including the claim that planners are getting paid to make pathological trends more comfortable, and these changes are precisely those which can lead to more fundamental ecological pathology in a longer period of time (*Steps* 1972: 497). Ecologists contribute to this state of affairs by putting forward false explanations of ecosystems, Bateson said. Any explanation based *solely* on analysis of energy inputs and outputs would dramatically increase the chance of runaway ecological degradation.

Presenting his own ecological ideas to the public proved to be no easy task. His notion of ecosystem as an organized system of communication with an 'entropic (information) budget of flexibility' received a puzzled reception from ecologists. Most ecologists then, as now, thought of an ecosystem as a system responding to inputs and outputs of energy. As we have seen in the last chapter, Bateson was trying to persuade them that an ecosystem must be understood, in addition, as embodying circuits of information. These limit the dynamics of ecosystemic organization long before the energy budget of these systems begins to pinch.

'If you can put up with my obtuseness,' wrote one perplexed official of the Oceanic Institute in Hawaii, 'I need educating on parts of this. I must make it my own before I can sensibly plan programs to support it' (Letters, 1019–64/1969). (Bateson had become a member of the Oceanic Institute and of the East-West Center at the University of Hawaii following the unexpected collapse of John Lilly's project on dolphin communication.) He was trying to discuss the proposition that 'entropic budgets' or 'flexibility budgets were primary components of ecosystemic organization' (Letters, 1019–63a/1969).[5] His replies were often very precise, but the very precision in his replies increased incomprehensibility. Anyone who had not studied the compendium of his writing would find the following difficult to fathom:

I think that the criterion which describes whether the informational way of saying things has advantages which the bio-energetic way has not got, is whether an eco-system is defended by a hierarchy of levels of change ... For the individual organism this is certainly so, and I suspect it is also true for the eco-system. But perhaps the eco-system does the trick by having the individual organisms do it at their *somatic* level. The alternative would be that in the eco-system the deeper change might be achieved by altering the *relations* between organisms. (Letters, 1019–66a/1969)

Bateson's point here is that if an ecosystem has several levels of adaptation, then any single-level analysis - such as that given in an analysis of energy flows in an ecosystem - will be a very poor basis for describing overall ecological adaptation. The statistical data accompanying such analysis of energy flows will be correspondingly useless. Instead, ecologists should be looking into the various *orders* of adaptation and investigating how ecosystems 'economize' information budgets.

The perplexed administrator at the Oceanic Institute, to whom the reply was sent, judiciously decided to put this part of Bateson's argument to one side. Instead, his report stressed what he believed to be another of Bateson's themes - global monitoring. We shall be required to keep in mind a single question, he wrote in his report: How can man keep the environmental system of which he is a part in balance with the way that civilization survives?

'BLAMING OUR SILLY SELVES'

Finding a way to put his views across about the ecological predicament was important to Bateson:

I have been playing recently with the idea that the position of the scientific community *vis-a-vis* nature is comparable to the position of one complex culture in contact with another. In such a culture contact there are various tendencies towards oversimplification. The themes of the other culture which are actually complex patterns tend to be reified, and, especially the modes of interaction tend to become quantitative (money, trade, etc.) (Letters, 771–7/1971)

Bateson suggests that the inability to develop a 'higher' perspective is a culturally predisposed inability to perceive a perspective of the whole. The culture of the scientific community places its belief in the structure of rationality. Bateson was reaching for a set of cultural beliefs vis-à-vis nature which is based on credibility and trust, for he regarded credibility – as opposed to rationality – as the 'extra degree of freedom' available for humanity in its adaptation (survival relations) with nature. Yet 'trust' in the autonomy of ecosystems poses uneasy questions for humanity, for it requires that the integrity and autonomy of ecosystems be placed above the 'rational' desire to avoid death of individuals and death of species. Here, then, is a source for double binds in ecological systems. Double binds are associated with some combination of denial and inflexibility derived from the cultural predisposition about the salience of rationality and rejection of holism. Framed in this way, the reflexive conundrum is an inability, constrained by existing patterns of communicative interaction in society, to jump out of the dilemma and look back at the dilemma from a perspective of the system as a whole.

More specifically, Bateson begins to argue that scientists refuse to accept ecological interrelatedness and holism despite the fact that the biosphere is evidently an interconnected self-organizing system. Scientists continue to report ecological interrelations as if the processes which sustain living forms are extensions of matter – in other words, in terms of the old Cartesian dualism. Among the many times he put this point, it is most succinct in a letter written in 1977: 'One thing that will have to be watched – the preference, which is strong in scientists, for not looking at total systems. If they can, they will see their professional problems in dualist terms (organism versus environment etc.) and end up with a theoretical basis for assigning blame ... we have to get above even blaming our silly selves' (Letters, 1175–7a/1977).

The trail to be followed, then, is to ask how the culture of science contributes to a disregard of holism as a valid framework for interpretation and, in so doing, ensures that we become unaware of the mistakes in our own ecological perspective. Bateson needed to discover a way of probing epistemological fear, of relaxing premises of control among Western scientists. In particular, he needed to address the fear of 'vicious circles' in rational discourse, a fear that if self-organizing transformations of natural systems are intermingled with the human observation of them, humanity will somehow be unable to distinguish itself from pure process. Western science as science will become 'lost' - buried as it were among spontaneous circles of formation and change which owe nothing to the science of their observation.

In the final part of *Steps*, 'Crisis in the Ecology of Mind,' Bateson suggests several times some form of epistemological 'therapy' (*Steps* 1972: 487ff),[6] but this approach obviously lacked application. Clearly 'epistemological therapy' could not be translated into a program in which psychotherapists were scattered throughout society to conduct seminars on mistaken abstractions. But this did not prohibit a deeper theoretical study along these lines which, through comparison, would show how our own processes of perception contribute to a denial of the relevance of holism - and in so doing amplify ecological double binds.

ECOLOGICAL UNDERSTANDING - ETHICS OR AESTHETICS?

A series of switches in explanatory themes occur after the publication of *Steps*. The whole shift in Bateson's thinking was pushed along by a failed conference in 1969.[7] The question he wanted to examine in this conference was whether resolution of ecological issues should occur through an extension of moral prescription to the realms of natural order, or whether we should develop another form of ecological understanding which he called 'aesthetics.' In the former case, prescriptions to be followed would lie in the realm of a conscious plan of action which would draw up prescriptive rules and call them environmental ethics.

A good example of the ethical approach appears in the recent literature on sustainable development. Some ecologists have tried to place the concept of sustainable development outside the realm of energy economics by redefining sustainability in terms of ethical principles. Such principles incorporated into this new version of sustainable development state that the environment should be protected 'in such a condition and to such a degree that environmental capacities are maintained over time - at levels which give future generations the opportunity to enjoy an equal measure of environmental consumption with the present generation' (Jacobs 1993: 79ff). This incorporates the idea that equitable transactions with regard to the environment must exist between one human generation and the next. As an ethical principle, sustainability rules out long-term increases in pollution levels on the ground that their impact on ecosystems, or on human populations, should not be greater than they are now. Such a notion of intergenerational equity comes close to an idea of 'trust.'

Aesthetic constructs are based on different premises. Bateson pointed out in his memorandum to the conference, that there is a whole body of activity in our relations with ecosystems which is obviously neither conscious nor moral. Human beings experience this activity as the 'beautiful' and the 'ugly' in nature. We commonly call this experience the realm of aesthetics. Nevertheless, the realm of the aesthetic had always been interpreted as if it seemed 'to be more intimately concerned with the relationships which obtain within each particular case.' Bateson was by no means satisfied with this conventional interpretation. It was equally possible that aesthetics had systemic characteristics; if so, inclusion of aesthetic sensibility in scientific inquiry would open up a different level of scientific investigation.[8]

Bateson claimed that aesthetic knowledge could only be gained through attention to all the natural senses, conscious and unconscious, and suggested that existing methods of sensing employed by Western science were inadequate for proper scientific knowledge of ecosystems. The special emphasis on patterns and modulation of patterns typical of aesthetic sensibility closely related to the patterns inherent in a sense or rhythm of durational time. Aesthetics also validated an awareness of change, which cybernetics had set out to explore. Among the important sensibilities crucial to aesthetic understanding was awareness of change in homeostasis of ecosystem activity, which can, of itself, generate perception of pathologies. Pathologies of aesthetic perception, Bateson reminds his conferees, are the symptom of the system's attempt to cure itself. That which appears to be aesthetically monstruous may be a symptom of the system's attempt to cure itself, hence a component in systemic correction (*Sacred* 1991: 257).[9] In effect, 'action plans which ignore this characteristic [and fail to link it to study] of human perception are unlikely to be adopted, and even unlikely to be practicable' ('Moral and Aesthetic Structure,' CAF 198-A7/1968; *Sacred* 1991: 256-7). Through aesthetics, Bateson would validate a holistic approach to our ecological predicaments.

THE PROCESSES OF PERCEPTION

In and around the time of the publication of *Steps*, Bateson moved from his research post in Hawaii to the University of California, Santa

Cruz, to take a post in the Anthropology Department. The success of *Steps* gave him the 'voice' on ecological issues that he had lacked hitherto. With 'voice' came an income which, though limited, enabled him to continue to explore the subtle issues he was now raising.

His aesthetic approach required Bateson to return once more to take up issues of perception. Until the mid-1970s, definitions of perception in neuroscience remained wedded to the notion that 'seeing' was akin to photography. According to this line of argument, images from objects were supposedly impressed on the retina in the same way that impressions were formed on a photographic plate. Among the many features of the neuroscientific interpretation to which Bateson objected, two were crucial. First, he objected to the supposition that human beings were capable of direct perception of an external world. Second, he objected to the proposition that the process of 'seeing' was a process separate from 'making sense' of the received impressions, namely, the process of conception. In the standard neuroscientific interpretation, the resolution of visual objects was thought to be a separate process from the 'photography' of seeing (Zeki 1992: 69).[10]

A definition of perception which presumes some form of direct perception is an illusion, Bateson claimed. For this very reason, Bateson brushed lightly over scientific discussion of ontological limitations of perception. There were indeed ontological limitations. He often used the example of a frog, which was unable to perceive a stationary object in the field of vision and could only catch a fly when the fly moved. The end organs of a frog activate the optic nerve if and only if some object is moving within the field of vision. The frog's information is, therefore, partly sorted and prepared before it ever reaches the brain ('Higher Organization,' CAF 138-A7/1974). This was a general example of limitation in our abilities to perceive, he said, but his example was only an indication of the limitations of conscious control of our own vision. Other ecologists have used frogs to demonstrate ontological incapacities which threaten the frog's survival and, by implication, our own as well.[11]

Propositions of ontological limitation nearly all concerned themselves with properties of direct perception, and these Bateson disputed. If there is any importance to biological or ontological limitation, it is the fact that *biologically we are unable to discern an individual percept*, he said. He argued that well-established experiments on perceptual error had demonstrated that human beings do not see external objects, but only images of those 'objects.' This clearly indicates that human beings have no control over perceptual input. The experiments on perceptual error to which Bateson always referred were those of Adalbert Ames, Jr. Bateson himself noted that 'I personally did not believe that the images I saw were formed in my own head until I experienced the experiments [of perceptual illusion] of the late Adalbert Ames Jr' (CAF 138-A8/1974). But from his own experience with the Ames experiments on the illusions of perception, Bateson concluded that we only see the product of perceptual process, not the percept itself. Bateson was convinced that Ames had shown, once and for all, that we are neither able to discern the input ('impressions' from an external world) nor able to see individual images as output. All that we see are the images that emerge as the product of our perceptual process, a process which includes 'seeing' external events plus an interior 'imagining' of that which we see.[12]

Though we may cling fast to the notion of unmediated perception, Bateson said, there was no objective world out there, no '*Ding an sich*' ('reality' discerned through conscious inspection of the object-in-itself). The '*Ding*' is filtered out by the very nature of the way in which our processes of perceiving 'externally' are joined with our processes of knowing. Thus, instead of achieving direct perception, epistemology 'must always come between me and my organic perception of the world, and similarly must always come between me and any understanding of myself' (*Sacred*, 1991: 226, 227). The processes of knowing 'shape and limit what can get from the "outside" through our sense organs to inclusion in image or understanding.'

In short, epistemology affects the processes by which we perceive so that: ''Truth' in some very large and, for us, overriding sense is information not about *what* we perceive (the green leaves, the stone, that voice, that face) but about the *process* of perception' (ibid.). If we wished to evoke references to false perception of 'truth,' then we need look no further than errors in our own understanding of evolution. These clearly demonstrate that our percepts are in some way modified by our epistemology and bear a relationship to how we construct some of our most important concepts. We ourselves evolve in virtue of any design that we perceive in nature, he said.

The supposed separation between 'seeing' and 'making sense' – the second objection which Bateson had to conventional studies of perception – derived originally from 'the doctrine of two faculties.' This doctrine was put forward by Immanuel Kant, who held that one faculty, perception, was a passive process, while the other faculty, 'understanding,' was active. For Bateson, the Kantian attribution of passivity to perception was another example of the importance which Western science and philosophy attach to conscious control.[13]

Bateson supported, in a general way, some of the major propositions of gestalt psychology. Gestalt psychologists held to the proposition that human beings constructed the images that they 'saw.' Yet even the most notable of the gestalt psychologists had spoken of this process of perceptual construction as a passive affair.[14] The classic gestalt theorists had mis-identified the ontological limitation that *individual percepts cannot be seen* and called it an example of passive perceptual response: ' ... we are in general not conscious of the rules and premises which govern the making and interpretation of messages, and this is true both for the verbal message of coded communication and for the images which emerge in consciousness when we receive ostensive [image-like] messages' ('Four Lectures,' CAF 126-B11/1955).

It is evident from the discussion in chapter 2 that Bateson believed an absence of conscious control of perceptual process was not equivalent to 'passive process.' Both unconscious and conscious phases occurred in the process of perception. Much of input was, in fact, consciously scanned, but it was scanned only *after* it has been processed by the totally unconscious process of perception. The conscious 'eye/I' sees an unconsciously edited version of a small percentage of what affects the retina. 'As we move from the more conscious [aspects of interpreting messages] toward the more unconscious [processes of perception] we seem to be shifting our levels of abstraction from the more concrete towards the more abstract' (CAF 126-B10/1955). The significance of the study of perception lay not so much in its alleged separation from cognitive process – for that could be easily disproved – but that as the levels of abstraction increase, so difficulty in understanding the premises on which the messages are based, and in understanding the nature of the communication, increases.

Writing much later, Bateson offered an example of active perception by alluding to *moiré*. A *moiré* pattern is a repetitive design on a surface. If another repetitive pattern is put against it, much like two sheets of silk each with a repetitive pattern overlaid on top of each other, the total effect is to create a third pattern (Notebook 56/Fall 1974).[15] In Bateson's terms, this meant that patterns of redundancy of information (the external context) become overlaid with patterns formed in contexts of learning, and the whole yields a three-dimensional pattern. It is the interleaving of the two patterns of redundancy which yields a sense of creativity and beauty.

By abduction, Bateson considered *moiré* to be the counterpart of metaphor (Notebook 63 / late 1975). A longer exposition of what he means by *moiré* explains that the phenomenon can be demonstrated by a soft fabric, double woven in some way, in which one repetitive pattern is put against another repetitive pattern so that the combination of the two generates a third pattern: 'Such dynamic patterns, patterns of resonance and so forth, enable the building up a world of events in transit which is getting quite complex, quite lively and susceptible of explaining many things ... in the mammalian brain [the evidence is strong] such resonating systems exist in neural networks and may play a part in informational retrieval (i.e. recall). Whether such models , involving resonance, are relevant in evolution, morphogenesis and ecology is not known but probable' (Bk. Mss., box 5; 1987: 205.26). Much like a hologram, the two initial patterns interweave as they become woven into a larger whole – producing 'a double woven' vision.[16]

There are other images which flow from this example. As soon as people become aware that they contribute actively to their own perception, they become much closer to the world around them. The word 'objective' becomes obsolete; so also does the term 'subjective,' which normally confines self-reference to the skin-bound individual. Thus, individuals become aware that they are responsible for images of perception in quite a peculiar way. Not only are perceptions drawn from 'the outside,' but, recursively, they also impose pattern on the 'outside.' What emerges is a 'creative subjectivity' that is neither pure solipsism nor its opposite:

> In solipsism, you are ultimately isolated and alone, isolated by the premise 'I make it all up.' But at the other extreme, the opposite of solipsism, you would cease to exist, become nothing but a metaphoric feather blown by the winds of external 'reality.' (But in that region there are no metaphors!). Somewhere between there is a region where you are partly blown by the winds of reality and partly an artist creating a composite of inner and outer events. (GB, 1977c; *Sacred* 1991: 223)[17]

One of his replies to conventional interpretations of perception was that while perceptual experiences may indeed be subjective, the processes by which we perceive are not. In the human context, difference enters twice into the process of perception, Bateson said. In the first instance (in time), we subjectively perceive difference and differences that make a difference. In the second instance, a perception of change in the pattern of differences becomes the distinction on which percepts and premises are constructed. Through this 'product' of difference, the 'given' distinction enters into an aesthetic sensibility. Making visible these differences requires investigation of what sort of 'product' of interactions we sense through our aesthetic sensibility.[18]

His posthumous book, *Angels*, expands significantly upon these themes. 'We subtract or suppress awareness that perception is active and repress our notion that action is passive. This it is to be conscious?' he asks in an ironic manner (*Angels* UE no. 7). Once active perception is acknowledged as an important aspect or our construction of knowledge, this soon leads to a discussion of 'some *particular characteristics* which perception *lends* to the events of our own actions.' In other words, even though we have no control over our perceptions and even if our processes of perception are unconscious, the particular characteristics of the perceptions we have influence our interpretation of abstract order. He made a list of such characteristics: 'unity; beginning-and-end; intensity dimensions (duration and violence, etc); balance; irreversibility; precision; consciousness; effect; efficiency.'

In short, understanding the active nature of our own concrete perceptions is crucial to the way in which we make sense of aesthetics and of its corollary, systemic holism. Unfortunately for our understanding of holism, if perceptual processes are both unconscious and very abstract, aesthetic sensibility is even more abstract. While individuals may be shown the error in their perceptions by undergoing the experience of illusions and perceptual tricks that Bateson faced in the laboratory of Adalbert Ames, the illusions and errors of aesthetics, considered systemically, are far more difficult to investigate. Yet, Bateson argued, the epistemological features of aesthetics should not be taken for granted, and their errors, too, must be open to investigation.

PERCEPTION AS AN ECOLOGICAL PHENOMENON

If he were to be consistent, Bateson acknowledged that he would have to explain more clearly the ways in which 'active' processes of perception relate to natural ecological phenomena, and are not phenomena exclusive to the human realm. Bateson had already made notable contributions to a general discussion of perception among animals. But his discussion of perception among animals had been tailored to fit his overall arguments about analogue coding and its contribution to the process of learning. His discussion of logical typing in human family systems had been extended to explanations of 'play' among spider monkeys or mother-child relations among dolphins. His epistemology of mind, if it was to be monistic, had to be valid for all aspects of ecosystems, the plant kingdom as well as animals.

The boldness with which he pursued this new abduction is quite startling. A year before he died, he proposed that something similar to active perception obtains within the plant kingdom:

> ... if mind depends upon difference then to understand the ecology of the redwood forests etc. we must surely look for mechanisms by which differences and changes in utility supply are affective in triggering responses in growth and breeding of organisms. Static conditions can never be perceived. I am afraid this means rewriting most of conventional ecology ... It is easy to see that individual animals respond to differences in color, temperature etc. ... It will be more difficult to demonstrate that plants respond not to quantities of utilities [of energy] but to differences and changes in these quantities. (Letters, 1409–10b/1979)

There was, of course, little hope that he could conduct any empirical work on the issue, and such would most likely push him beyond accepted boundaries of empiricist generalization. A lengthy discussion of perception of change in an ecosystem appears in *Angels*. Here he suggests that the life of any ecological system, a meadow, for example, with its interacting multiplicity of species, is characterized by a dynamic pattern. The dynamic pattern is 'a sort of dance, rather formal, say a minuet [whose purpose or functioning] is to *detect* and *classify* other patterns of the dance.' The discussion appeared originally in a letter written to the ecologist John Todd:[19]

> Let me assume that [the life of a field of wheat is characterized by dynamic pattern], a sort of dance, rather formal, say a minuet. And that the purpose, functioning , etc., of this minuet is to *detect* and *classify* other patterns of dance. The meadow with its interacting multiplicity of species is unendingly dancing and thereby being bumped by information (i.e. news of change and contrast) 'about' the environment i.e. dynamic pattern is a sort of unlocalized sense organ ... Plants, I assume, receive only the command or injunctive – restraint

or release – aspect of information ... (*Angels* 1987: 198)

In this case, the meadow does in one sense 'perceive' through an unlocalized sense organ, that organ being sensitive to the resonance of the whole ecosystem of the meadow. The dynamic pattern as a whole is sensitive to the patterns of difference in the whole and able to receive injunctive commands – restraint or release – about 'change' (temporal difference) in the ecological climax (circuit of 'time grains') in which it grew.

Independent evidence is worth quoting in support of Bateson's abduction because of the unusual nature of his argument. The following evidence appeared a few years following Bateson's death. A zoologist investigating the mortality of hundreds of kudu, a kind of antelope, on game ranches in South Africa discovered that trees react to environmental stress by releasing chemical signals downwind to other trees (*Scientific American* [Dec. 1990]: 28). The prime food source for kudu are acacia trees. Acacia trees are able to produce tannin as a defence against herbivores, but, in most conditions, these tannin levels do not harm the kudu. Under extreme environmental stress, as in the case of the severe four-year drought which afflicted South Africa in the early 1980s, the leaves of the acacia trees step up their capacity to produce this toxin.

At high levels of toxin, the leaves have an unpleasant taste for kudu. Free-ranging kudu search for leaves that have low levels of tannin, but the antelopes that have been fenced in on game ranches have no choice but to eat the leaves that contain the poison. Acacia trees do not wait for kudu to graze before they step up their tannin levels. When an antelope forages on an acacia tree, the leaves emit ethylene. This compound acts as a signal that a herbivore is grazing. Other trees up to fifty metres downwind are able to sense the ethylene signal. The non-foraged trees then step up their own production of tannin before damage is done to their foliage.

The zoologist, Wouter van Hoven, transferred his field discovery to his laboratory (van Hoven 1991: 141–5). He found that the damaged leaves emit twenty times more ethylene that the undamaged ones. When an intact plant received the ethylene signal, tannin levels increased within thirty minutes. The tree kills the kudu and in so doing acts both as a population regulator and a signal of severe environmental stress. Thus the kudu-acacia syndrome could be considered as 'perception' of change, though van Hoven does not draw this conclusion.

Certainly it involves communication through perception of difference in the sense that Bateson suggested. Acacia trees sensing difference in quantities of differences cause triggering responses in growth and breeding of organisms. In addition, the more frequently a tree is browsed upon, the more tannin it produces, indicating that acacia trees are able to 'perceive' and respond to temporal fluctuations in kudu grazing patterns.

LAWS OF FORM: A LOGIC OF RECURSIVE UNITY

Several commentators have cited the great influence of Spencer-Brown's *Laws of Form* on Bateson's views about perception and difference during the 1970s. In fact, some interpreters of Bateson seize on Spencer-Brown and apply the latter's calculus of distinction holus-bolus to Bateson's ideas.[20] As explained in the previous chapter, Bateson recognized that the work of Spencer-Brown, and the work of Francisco Varela, explored a whole new area of recursion or feedback. Their respective calculi spelled out mathematical and logical notions of the functional 're-entry' of whole into part.

Bateson attended a successful conference with Spencer-Brown, the 'Om Conference,' held in 1973. While the 'Om Conference' was important in a sequence of events which pushed Bateson into an increasing attentiveness to the logic of 're-entry,' or recursive looping, all the evidence, including interviews on tape made at and shortly after the conference, points to his very circumspect approach to Spencer-Brown's views. Bateson acknowledged that, as a result of Spencer-Brown's work, time could be incorporated into logical systems. It was in that respect a breakthrough in logic. Once the notions of 're-entry' were explicated in a calculus, the ideas of Russell and Wittgenstein were vastly simplified.

Nevertheless, Spencer-Brown's logical calculus flattens the multi-level contexts of reflexiveness, he thought. Spencer-Brown stated at the 'Om Conference' that in the mathematics of *Laws of Form*, the initial distinction takes the form of an injunction or command. All subsequent description is part of a recursive operation in which description of the prior description is drawn from the initial distinction. But the making of the mark, the initial distinction/injunction, was purely arbitrary. Therefore the boundaries drawn by the mathematician between the inside and the outside of the mark were arbitrary as well.

In no case in Bateson's analyses were distinctions, 'the differences that made a difference,' or premises, or injunctions, arbitrary. They were always distinctions which arose from epistemology and for that very reason always ended up in tangles of paradoxical assertion. Discrepancies between logic and life are relevant precisely when paradoxes are to be investigated.[21] For, while logic may assume that the focus of study is upon a non-paradoxical world, temporal causality is always immersed in paradox (Notebook 61/1974). This, then, may account in part for Bateson's circumspect attitude towards *Laws of Form*.

Another problem was that, in keeping with its injunctive logic, *Laws of Form* was valid only for contexts in which digital information was employed. In his writings, Bateson had continually made the point that the human world of communication was both digital and analogue – an inter-penetration of opposites that often led to communicative contradictions. At the 'Om Conference,' he made the point that the animal world of communication was analogue alone. Digitized logical operators were of limited use in expressing analogue relations or ostensive communication in nature.[22] Nevertheless, the logic of *Laws of Form* supports the idea that living creatures must make a distinction in order to perceive any pattern. Living creatures draw distinctions because they are in many ways impelled towards making a distinction. *Laws of Form* also supports the notion that the initial distinction which we are impelled to draw will always cleave a pattern of a whole.

The logic of Spencer-Brown and Varela was important not so much in providing a new logical structure for Bateson's ecological thinking as in providing an important change in perspective about the nature of unity.[23] In his discussion of holism and unity, the Bateson of *Steps* had followed in the footsteps of his own arguments about cybernetic feedback and logical typing. The impetus of *Laws of Form* was to offer an alternative to this circular-causal perspective. Spencer-Brown enabled Bateson to assume a primal unity, the unity of form of a recursive order of a recursive biosphere – and then to account for dualisms as one aspect of its temporal ordering. It is a necessary act of faith to believe in monism, Bateson argued, but then our picture of the universe will always be split by our perceptions and cleaved by our use of classification:

> ... in whatever way you phrase it, 'difference' will always propose delimitation and boundaries. If our means of describing the world arises out of a notion of difference (or what G. Spencer-Brown's *Laws of Form* calls 'distinctions' and 'indication') then our picture of the universe will necessarily be particulate.

It becomes an act of faith to distrust language and believe in monism. Of necessity we shall split our descriptions when we talk about the universe. But there may be better and worse ways of doing this splitting of the universe into nameable parts. (GB, 1977c: 244; *Sacred* 1991: 222)

Thus acceptance of order, creativity, and resolution of paradox occur not simply as circular functions of a cybernetic homeostat. They can also come about through better awareness of the processes by which the unity of a more inclusive field is being split and torn.

FROM ACTIVE PERCEPTION TO ACTIVE AESTHETICS

Since the ecosystems of the biosphere are a unity, by definition, there must be a unitary perspective that accounts for all nature and for the many kinds of polarity inherent in the world and in our experience of it. This is perhaps why Bateson described his writing of *Angels* as a mapping of that 'fabric' of mental life 'which should never be torn by double binds, prying, appetitive consciousness, disorders of context, various species of vulgarity, reductionisms, competitition, appeals to fear, kitsch, commercialism, haste, violence, addiction and so on.' Of course, he adds, the phrase 'should never be torn' is wrong phrasing 'because the "tearing" can be the actual focus of the poem' (Letters, 10601/2-1/1980).

The 'tearing of the fabric,' a metaphor he uses several times in letters and draft manuscripts shortly before his death, seemed to have replaced the process of 'bottoming out,' described so vividly in his analysis of Alcoholics Anonymous, as the point from which the relations between parts of a system and a more inclusive system could be perceived. A unified view of nature must be able to unite the dualities throughout nature; it must account for new patterns of behaviour and new kinds of organisms which are themselves unities, wholes, or holons.

The meta-dualism, or recursive unity, which Bateson was exploring would bear many references to religion but is a far cry from the psychological realities of Saint Augustine or orthodox Christian conceptions of the Holy Trinity. Against the Christian conception of Holy Trinity, Bateson offers Shiva and Abraxas (a reference to the Gnostic figure mentioned in Carl Jung's 'Sermons to the Dead') as mythical figures embodying a 'third mode' of explanation, and as a 'symbol of the central fact that adaptation is the brother of addiction' (Letters, 127-5b/1980).[24] As mentioned in chapter 4, he refers to Abraxas as a Jungian syntax which, far from being a fairy-tale of the unconscious, is 'an accurate representation of the largest conceivable *gestalt* (or organized view of the cosmos – especially the biological world). There are no positive values which are not precisely balanced by destruction. All omlettes are made of broken eggs. And this Creator-Destroyer is God. Any other view is whistling in the dark, liberal pap, good intentions, and purposive prankishness' (Letters, 1488–32a,b/n.d. [Jan. 1974?]).

If valuing of life is at the root of aesthetics, then, more complexly, aesthetics is a valuing of life-and-death which is intimately related to the ways we can conceive the rhythms of life and death. 'Ugly,' by contrast, means some sort of contradiction of systemic rules and values and ultimately lethal contradiction (Letters, 670–2a/1979). Of the whole, aesthetics will always indicate the two-sided dance of Shiva, that is, beauty and destruction. And of the qualities of beauty and ugliness that pervade the biosphere, these primary rhythms of life and death are those to which we must pay particular attention; for these are the 'patterns which connect':

> In the old way of thinking, life and death were opposed to each other, [now] it is necessary to think of these as combined. That is, our god becomes Abraxas. Now the combination of life and death is one of those things that determine time grains, rhythms and also size grains. Death becomes a punctuator, a 4-d[imension] punctuator, and perception is totally changed when death is included in the picture and the thinker then approaches a phase state. (Letters, 207–19(l)/1971)

'The pattern which connects' is a feature evident in the embedded relations of natural order, and in the natural history of evolution: ' ... this notion is central to any thinking about what used to be called [in Darwin's day] natural selection' (Letters, 127–5b/1980). It is a pattern which we ourselves can pursue through qualitative comparison, both groping for and responding to 'the pattern which connects.'

> ... so by 'aesthetic' I mean responses to the *pattern which connects*. The pattern which connects is a meta-pattern. It is a pattern of patterns. It is that meta-pattern which defines the vast generalization that it is indeed *patterns which connect*. (GB, 1977c: 235, 239)

Bateson therefore is looking forward to a situation in which aesthetic explanation in ecology itself becomes recursive, in which, an understanding of aesthetic patterns of life-and-death becomes, recursively, that which yields a transformed understanding of *patterns which connect*. It is evident that this approach through aesthetics, rather than through moral prescription, enables Bateson to continue to advance his own epistemology, while avoiding the more obvious analysis of conflict and competition likely to arise between nation states as a result of ecological degradation.

The decision to avoid discussion of normative issues in global ecology is consistent with his antagonism towards all metaphors of social power, a position discussed extensively in chapter 2. Some may call this an absence of realism in Bateson's work. In the dominant view, Western society is organized around competitive exchange, and ecological solutions must be worked out with a logic of competition and modes of organization expressive of the efficiencies of that logic. Yet the virtue of Bateson's writing lies in is his precise demonstration of an alternative. In place of a logic of competitive efficiency and the rationalizations arising therefrom, he is able to show how patterns of systemic constraints in informational order can generate a logic that is able to test causal sequences, discern their contradicitons, and provide resolutions to such contradictons. From this, Bateson concludes that the causal efficacy of interpersonal relations do not need to be adjoined to competitive relations of social power; and what is true of interpersonal exchange is also true for international exchange.

The wider issue is to develop an approach to ecology in the absence of a logic of competition. As he put it, the solution to ecological issues must be ecological. Aesthetics provided such a framework. Within aesthetics it was possible to consider how to attach different notions of self to a different understanding of system, and through comparison of alternatives of self-in-relation-to-system promote epistemological understanding about relations of competitive individualism so predominant in occidental thinking, both in regard to theories of nature and in regard to theories of the human condition. Groping for the 'pattern which connects' is, in Bateson's view, synonymous with a systematic revaluation of life on the plant. The rhythms of life and death in a new ecological perspective become a recursive transform of the rhythms of life and death. Such a process of transformation cannot be entirely cognitive; the process is also perceptual – and implies revaluation of the good, the bad, and the beautiful. This, broadly speaking, is the central figure of Bateson's recursive epistemology.

10

Visions of Unity

An ecological perspective depends upon a view of the whole, but the very unity of the biosphere poses a conundrum for those who wish to depict it. The previous chapter presented a phase of Bateson's resolution of this conundrum, a move towards the opening up of an aesthetic field in which active processes of perception link the environmental surround to human activity. The 'uncovering' of abstract aesthetic patterns - patterns which connect - is not the same as subjective insight, he argued. Nor can this patterning be 'uncovered' by scientific description alone. Rather, aesthetic patterns are epistemological, and recursive. Thus, they require development of a recursive epistemogy in order to be comprehended.

This view of the whole, Bateson announced in his final chapter of *Mind,* had to accommodate aesthetics to the question of consciousness. If he could get this right, he suggested, he would have the reply to 'crude materialism.' Aesthetics and consciousness were, however, only two pieces of the conundrum. The reply to the questions of holism must be framed as a triad, of which the third term was the *sacred.* The '*sacred* (whatever that means),' he wrote, 'is surely related (somehow) to the *beautiful* (whatever that means)' in that the sacred is a sort of surface, or topology, on which both terms, beauty and consciousness, could be mapped. The 'whatever that means' had already been sketched out in many of Bateson's prior writings. Clearly 'the sacred' indicated a mapping prior to the emergence of dualistic thinking in Western civilization. The sacred, in some sense, meant a surface on which forms of nature are not appropriable. The Enlightment rationalists had assumed the opposite, that there was a secular realm divided from nature in which humanity could appropriate nature for its own benefit. But the sacred indicates a form in which life cannot be opposed to itself, in which even death is part of the rhythms of life. From interrelations of the triad of relations, consciousness and beauty, beauty and the sacred, sacred and consciousness, he would spin his next book, 'Where Angels Fear to Tread' (*Mind* 1979: 211, 213). It would be, he said, a search for clarity in those areas which had, until now, been the domain of religion. He preferred to view them as 'the eternal verities of life and environment.'

In choosing 'the sacred' as his third term, and the 'surface' of his map, Bateson caught a key expression which enters into a wide variety of writing about the environment. The notion that the Earth and its animate components are a sacred gift from the past and that these are the rightful inheritance of future generations has entered into a surprising array of documents, some issuing from national governments, some from the United Nations. Reference to the sacredness of life has also appeared in many of the pamphlets and booklets of non-governmental organizations of the environmental movement, often linked to the notion of Earth as 'our home.'

Presentation of the loss of the sacred, sacrilege or 'desacralization' of nature, is just as common in environmental advocacy. It appears in advocacy against genetic engineering, in protests against intrusion into natural variation by artificial generation of genetic transforms in a laboratory, and in moral arguments against too rapid development of bio-technology, the commercial production of life-forms. Desacralization is close to the notion of desecration. This term appears in the context of opposition to those who insist that the value of ecosystems should be determined by market price alone. Logging practices in North America have resulted in long and loud protest against desecration of forest areas. Here opposition to industrial forms of logging have made evident links between the beauty of undisturbed forest areas and the notion of the sacredness of nature. The most serious incidents have occurred wherever the logging companies have received permission from provincial governments to clear-cut one of the remaining stands of old-growth trees, areas hitherto untouched by logging. On the west coast of Canada, hundreds of people have been arrested and convicted for protesting against the logging companies. Some Canadian environmental groups have taken to running trails into areas which have been totally devastated by clear-cutting of the forest. The idea behind the trails is that when the public sees a large clear-cut, the sight of an old-growth forest irremediably destroyed will produce a visceral reaction against its desecration, and promote a deep-felt revulsion against this way of treating forest ecosystems. The success of such non-governmental advocacy groups suggests, in a very concrete manner, that the link between aesthetics and notions of the sacred is not merely contemplative, or ritualistic, but is, as Bateson proposed, a presage to environmental action.

Most of the environmental literature referring to the sacredness of nature, or desacralization and desecration, has sought to link the sacred to a call for environmental spiritualism. It has, in one way or another, suggested that it is time to acknowledge the reality and importance of spiritual values in ecological understanding and contended that a return to spiritual values is a precondition of any solution to the global eco-crisis. A spiritual return is encouraged in various ways. One obvious way is in a call for a return to Christian values, as is the case with Al Gore. Another proposal is to return to the spiritual values of First Nations, especially the spiritualism of American Indian peoples (Berry 1990; Mander 1991). A call for a return to spiritualism can also be found in pleas from native American Indian people themselves, who confront seemingly endless despoilation of their territory or resource areas attached to their reserve land. One such declaration from the people on the border of the United States and Canada calls spiritualism 'the highest form of political consciousness.'[1]

Other environmentalists have recommended spiritualism by invoking Eastern religions such as Buddhism and Taoism. One source of inspiration is the Dalai lama, the spiritual leader of Tibetan Buddhists, who speaks on ecological issues in spiritual guise. Religion is 'good heart,' he says. At an individual level, love and companionship are symbols of 'good heart.' 'Mother' is always a symbol of companionship and affection. 'Mother Earth' symbolizes companionship and affection in the world of nature. The unity of man and god, man and nature, and god and nature can be attained by linking all these symbols of spirituality so that the human condition becomes merged symbolically with the 'biocentric universe.'[2]

Those aligned with the New Age wing of the 'deep ecology' movement are particularly taken up with a search for ways in which Eastern religious concepts can be combined with Western sensibilities. They sometimes use the phrase 'going to the mountain' to describe a process of becoming more spiritually aware. By this they mean that human beings need to retreat into nature and meditate upon the serenity and untamed omnipresence of nature in order to develop aesthetic sensibilities. One such writer, Dolores La Chappelle, has found a happy combination of metaphor and literality and action in her Way of the Mountain Center at Silverton, Colorado, by promoting rituals of connectedness through climbing, skiing, and Tai Chi.

Another modern ecological philosopher from which deep ecologists draw inspiration is Arne Naess. He is also a proponent of 'going to the mountain' in order to develop feelings and understanding of ourselves as part of nature (Naess 1989: 3). Naess is a sophisticated philosopher, one who has attempted to weld Mahatma Ghandi's philosophy of non-violence with the philosophy of Spinoza, a unusual choice in that Spinoza was a rare example of Western 'spiritual rationalism.' As with his nineteenth-century predecessors, Naess discusses aesthetics ('beautiful action') as a medium or a path which leads from the immediate self into the vast world of nature. That 'way' Naess terms 'self-realisation!' This, he claims, evokes 'a condensed expression of the unity of certain social, psychological and ontological hypotheses ... [which] guarantees *beautiful action*.' According to Naess, 'beautiful acts are natural and by definition not squeezed forth through respect by moral laws foreign to mature human development. Instead they 'activate more of the [human] personality in relation to more of the [natural] milieu,' which in turn 'results in acting more consistently from oneself *as a whole*' – that is, 'self-realisation!' (Naess 1989: 86).[3]

There are several themes in all of these writings which cross over into Bateson's thinking. He would agree with Berry that the growth of rationalism, science, and technology has confined our vision compared to pre-rational, pre-industrial peoples, who had a much larger vision of their place within the biosphere. But altered consciousness in the West is not to be equated with an individual sensibility. The problem was more that of *con-sciousness* [*sic*], 'the circumstances that, when people engage together to plan action, their view of action and circumstance is filtered through language and probably narrowed by their conception of the immediate goal' (Letters, 732–2/1969). Bateson did not see this form of *con-sciousness* as an argument for a return to 'spiritualism.'

Consciousness was a pattern of communication that is always going to be selective, Bateson wrote, and if the cultural order selectively favoured action, technique, and rationalism over the qualities of mind attending to the sacred and the aesthetic, then this would have an influence on ecology of mind:

Consciousness is always going to be selective. When you get the other two, the sacred and the aesthetic, which are very closely related, you are partly standing off to see a whole. Consciousness is tending to focus in, whereas notions like the sacred and the beautiful tend to be looking for the larger, the whole. That is why I distrust consciousness as a prime guide. (GB, 1980b; *Sacred* 1991: 300)

Bateson remained true to his conviction that while the integral relations of humanity and the biosphere require exploration in a language and sensibility other than the rationalism and reductionism of modern-day science, that holism must still be described in the language of science, rather than that of 'spirituality.' He was adamant about this, even though the science he imagined was an absent science, since science itself was unable to indicate precisely what holism 'is.'

'LAST LECTURE'

In 1979 Bateson was invited to Dartington Hall in England to give a lecture on the open topic of 'What lecture would you give if it were your last?' It was an unusual occasion for him. His trips to England, his birthplace, were infrequent since he had taken up residence in the United States in the late 1930s. He remarked that returning to the place from which he had started was in some manner 'knowing the place for the first time.' Sadly, Bateson's 'Last Lecture' was indeed among the last to be published before his death.

In it he introduces the major theme of aesthetics that he was taking up in the manuscript of his final book, *Angels Fear.* Aesthetics provides a medium through which humanity can begin to understand the unity of the biosphere. Yet, when approaching unity and holism in the biosphere, our pragmatic, mechanistic civilization becomes overwhelmed by epistemological panic and does not know how to proceed. How then to overcome panic and pursue that path 'where even angels fear to tread'? His road to the discussion of unity would be to take regions of experience where configurations of holism already existed and examine them for clues. Christian religion and 'fate' – or, as he puts it, ideas of ECO, the gods of ecosystems – are such mediums of holism.

His 'Last Lecture' argues that matters of beauty are highly formal, and crucial to the entire political and ethical system in which we live:

[Looking] at the world with biological epistemology ... you will come into contact with concepts which the biologists don't look at at all. You will meet with *beauty* and *ugliness*. These may be real components in the world that you as a living creature live in. It's not a new idea that living things have an immanent beauty but it is revolutionary to assert, *as a scientist* – that matters of beauty are really highly formal, very real, and crucial to the entire political and ethical system in which we live. (*Sacred* 1991: 311)

The first question to be asked, Bateson states, is why science ignores the holistic forms we have available to help scientists think about unity in ecological systems. The answer, he believes, is that our scientific culture views the world in terms of *things* instead of relations. Modern thought enhances the logical relatedness of items and obscures the *relationship* between things mentioned. Even ordinary use of language in the Western world aids this deception. 'Thinking of things' is a hallmark of modern thought.

Scientists, therefore, prefer to submerge their own search for patterns of relation into the rubric 'method,' thus making the search for pattern a component part of scientific methodology. By this means, topics such as aesthetics and 'the sacred' are explicitly cut off and removed from scientific thinking, as something other than science. Contemporary scientific thinking therefore rips apart any expression of form and pattern and in so doing, tears the concept of the universe in which we live into rags.

For a 'Last Lecture,' the resumé he prepared beforehand is exceedingly brief, but it inserts Bateson, as subject, back into the system of ideas that he had himself explored:

Looking at all that with eyes changed by anthropology and [study of] dolphins and schizophrenia, I can see that I never traveled far from where I started.

What is form, pattern, purpose, organization and so on ...?

These were my questions when I started and still are my questions ... (Letters, 383-106/1979)

A published interview following the lecture picked up on this theme:[4]

I don't know what sort of child I was. Now I am in my seventies and a lot of things in the last five or ten years have been happening – not changes but sudden discoveries. You know one went off into the hills to find a donkey and at the age of seventy one discovered one had been riding on one for sixty years. I think what one did was in some way to give oneself permission to discover that one is riding on the donkey. That giving oneself permission is very close to ... things like art and things like poetry and rhythmic prayer ... They are *uncoveries* of that which one knew before. Then sacredness has something to do with this covering and uncovering deeper components. (GB, 1980b; *Sacred* 1991: 303; emphasis added)

The 'permission' he gave himself was emotional and personal. It will be recalled from chapter 1 that as a small boy his father had drummed into him the notion that the task of integrating aesthetics and science was not for ordinary human beings. His father had regarded science as 'easy and within the reach of ordinary people.' Art was something else again, a sort of wizardry. As for religions, Bateson's father was a blustering atheist – any concept of divinity remained remote in his thinking.

Throughout his own intellectual work, Gregory Bateson had continued to explore ways and means of making the connection between art and science. But taking on the issues of the unity between them meant stepping into a discourse which was shunned by most scientists of the twentieth century. Now, in his old age, he felt he was at last able to engage the topic in its full range.

TRANSCENDENT MIND

His 'Last Lecture' suggests that the way to construct such an absent science was to investigate a configuration or medium, which he called the sacred, in which he could compare visions of unity of the biosphere. As with any of his models or mappings, Bateson's version of 'the sacred' is not simply definitional, for, as he pointed out, to describe the sacred, or to attempt to give 'real answers,' would invalidate the nature of the inquiry. It would render the aesthetic nature of the sacred dead (GB, 1975a; *Sacred* 1991: 268).[5] Nor does he stop at an investigation of its recursive structure and of related processes of communication characteristic of 'the sacred,' although he includes such information. He also incorporates a model of 'the sacred' in terms of its own classification. By this means, he contrasts various visions of 'sacredness' and how they, as recursive phenomena, contribute to a science of recursive patterning.

Earlier papers suggested a starting point for his 'triad' of aesthetics, consciousness, and the sacred. From what is known through anthropological investigation, he observed, humans in early societies took clues from the natural world around them and applied these clues in a metaphoric way to their own society. That empathy with the natural world was a guide to their social organization and to their early theories of psychology. The first aesthetic unities are to be found in beliefs about totemism. From totemism, early societies then reversed their orientation to aesthetic unity. 'Animism' took the notion of personality or mind of humanity as its central figure and extended these notions to mountains, rivers, and forests. Unlike totemism, which extended relationship of environment to human society, animistic thinking took clues from the psychology of humanity and applied these to the world around. Bateson believed that while today the Western world may regard totemism and animism as nonsense, neither, in the end, was such a bad idea. Totemism 'made more sense than most of what we do today because the natural world around us really has this general systemic structure and therefore is an appropriate source of metaphor to enable man to understand himself in his social organization' (*Steps* 1972: 484). With the notion of transcendental gods came the separation of mind from the natural world. When mind was separated from the structure in which it is immanent, Bateson warns, humanity embarked on fundamental error, which in the end will surely hurt us.

What is a unitary perspective if that perspective rests on a monism which abjures the Christian conception of God? asks the noted biologist Rupert Sheldrake. Surely a unitary perspective *without God* must necessarily be close to views of nature *with such a God*? (Sheldrake 1991: 195–6). Bateson's views about transcendental explanations of unity were blunt: transcendent mind was fallacious. Whether a flight to metaphysics emerged out of religious thinking or whether it derived from the rationality of science itself, all transcendental approaches promoted fallacies in the understanding of connectivity and integration in the unity of the biosphere. And once scientists adopted a view of spiritual unity, they stopped wrestling with the problems of immanent holism of biological and ecological order.

Bateson noted that the cosmological thinking of physical science, although supposedly distinct from religion, often seemed to interleave with religious perspectives. When scientists' understanding of holism falters, they themselves often turn towards religion or to spirituality to complement incomplete holism in their thinking. For Bateson, the articles of Christian faith were a convenient means for completing theories of design which otherwise could not be satisfied by rational constructions of reductionist science. All bibles and sacred codes are a cause of error when putting forward the belief that the Body and the Soul are real existing principles (Notebook 40/1968). The metaphors of Holy Trinity rested on a dualism of transcendent God and material world, and like the dualisms of mind and body, for all its mystical underpinnings, the Holy Trinity was another dualistic theory of consciousness.[6] A notion of unity should never be a cause for enchainment in false notions of spirituality, he said.

Yet notions of transcendent mind had entered into some of the most various epistemologies which human culture had generated. For most human beings throughout history, the metaphors of religion had made it possible for ordinary people to think about integrated complexity in the cosmos in a way which would otherwise not have been possible (*Angels* 1987: 195ff). Religious viewpoints about unity and integration were, therefore, not to be dismissed out of hand. They too might yield clues as to how to proceed. If all esoteric ritual and transcendental paraphernalia were severed from religious expressions, it would become more evident how religions bring rigour to the profusion of everyday ideas. 'It is my thesis that [true] religion consists in recognizing not little bits of miracles ... but vast aggregates of organization having immanent mental characteristics' (*Angels* UE nos. 13–15).

FAITH AND ITS DEFENCES

Totemism and animism held great store in *the sacred* as a source for perceiving relations of unity. Bateson pointed out that whatever 'the sacred' may mean, it bonded together all sorts of values connected with love, hate, pain, and joy. Coming to grips with the notion of the sacred requires subtle understanding of the relation between prose (the indicative sense of consciousness) and the more abstract, more unconscious (in the sense of more unaware) parts of mind. 'The richest use of the word "sacred" is that use which will say what matters is the *combination* of the two, getting the two together' (GB, 1975a; *Sacred* 1991: 267).

Comparison of assumptions about 'the sacred' would include what he called 'various layerings of operation' of 'prose'-type consciousness, that is, perception and thought in the indicative mood, and the way it was bound with metaphors of unity and of the inviolate. Such a comparison of 'the sacred' could be abducted to a discussion of ecological unity in order 'to unravel ... something of the position and nature of the sacred in the ecological system' (GB, 1975a; *Sacred* 1991:

265). This comparison might then provide clues for a more adequate perspective on the biosphere as an immanent ecological whole.

Bateson proceeds, as he had always done, by taking up the 'negative example.' That is to say, he took errors in thought about the sacred as the central subject of his discussion. 'There is a very strong tendency in occidental cultures, and increasingly in oriental cultures, to misuse the sacred,' he notes (GB, 1975a; *Sacred* 1991: 270); though misuse of notions of the sacred had persisted throughout history.[7] Notions of the violation of the sacred provide that rich vein of thinking about the rules surrounding sacredness which a positivist discussion - attempts at definition and generalization of the notion of sacredness - would never reveal.

The early chapters in *Angels* present a combination of ideas about violations of sacredness, some of which are historical examples of violation of sacred forms, and some more current examples of violation of faith. Bateson begins by touching upon heresy in Pythagorean thought, heresies which concerned their magical attachment to number and forms of quantification. Next he considers heresy which created civil and political divisions between Protestant and Catholics in Europe over several centuries. Here the heresies concerned alternative interpretations of 'substantiality' in the performance of the mass. The heretical thinking of Protestantism was a clash about notions of thinking metaphorically, Bateson maintains.

Bateson proposes that the aggregate of propositions which are called 'sacred' in faiths or religious creeds is created by links drawn between perception and existence. It is these links of connectivity between perception and existence that we dare not doubt in a religious world. These links are of a very different sort than those drawn between cognitive knowledge and 'truth' in science. In the original manuscript of *Angels*, he notes:

> *Seeing is believing*. But faith is *believing* that seeing is believing ... It is a platitude to assert that every simple perception of motion, every link between perception and motion, every link from motion to perception is validated - made possible by faith in *preconception*. Hamlet reminds his mother: 'Sense sure you have, else you could have no motion.' The links between sense and motion are *sine qua non* of living and the links depend always upon preconceptions which are commonly *absolutely inaccessible* to consciousness, or voluntarily left unexamined in the immediacy of action. There is no *time* for more than a little consciousness. (*Angels* UE no. 9)

While it is commonly thought that faith is necessary for religion, he argues, the net of ritual, mythology, and mystification – what is ordinarily called religion – 'begins to show itself as a sort of cocoon woven to protect that more intimate – and utterly necessary faith [in the link between perceiving and the fire of existence]' (*Angels* UE no. 9). The form of religious communication, therefore, is that of command and injunctions surrounding defences of faith. Doubt is comfortingly excluded by the quasi-logical nature of the links of faith. Religions are concerned with faith, and faith with credibility, and credibility with preconception, and preconception with the products of unconscious image-making. The relations between 'what and what' registered in these sequences of connection are very different from those of conscious cognition. Yet they mark the sequences of the orientation or initial point from which faith spins out.

As with any recursive system, the first step of the 'recipe' of faith is the most important to identify, he said, for it is the step on which all other differences and distinctions are drawn.[8] When weaving a fabric of faith in religious understanding, the very first step is to imply a connection between perception and reality. 'Preconception' is the starting point for faith.[9] Bateson then underlines how important are unconscious processes implicated in the making of preconceptions. If one examines the images that enter into our preconceptions, then we must acknowledge that the products of these images enter into our preconceptions in a manner simply not accessible to our conscious inspection. We should not bemoan this aspect of unconscious image-making; rather, 'it is indeed a merciful dispensation that we do not know the processes of our creativity – which sometimes are the processes of self-defeat.' If we had continual awareness, the images that we form 'would cease to be credible' (*Angels* UE no. 9).

GAPS AND CONNECTIVITY

Next Bateson moves on to a discussion of ritual. Rituals always mark the boundary in religious expression. Between ordinary life with its controlled intentional communication and communication in the sacred realm, there is an interface or boundary, as in prayer. A wide range of anthropological literature notes the ways in which the activity of prayer marks a boundary of 'this world' and 'the other' and how prayer occurs at the conjunction of boundary or liminal zones.

The usual anthropological explanation is that liminal zones provide a bridge, or channel of communication, through which the power of the gods may be made available to otherwise impotent humanity (Leach 1976:81–93). Bateson repudiates this metaphor of 'bridging,' and in his version of interface, the conditions of liminality between supplicant and cosmos must be re-explained. In Bateson's version, the major characteristic of prayer is the requirement for silence. In the liminal zone, supplicants at the boundary of the sacred move from direct communication with each other to a form of non-communication between self and the other in which silence is the rule:

> *Noncommunication* of certain sorts is needed if we are to maintain the 'sacred.' Communication is undesirable, not because of fear, but because communication would somehow alter the nature of the ideas ... there are many matters in which *consciousness* is undesirable and silence is golden, so that secrecy can be used as a marker to tell us that we are approaching holy ground. (*Angels* 1987: 80–1)

In Bateson's interpretation, secrecy and silence, the non-communication of prayer, reveal a fundamental characteristic of all organization in very large systems. Continuity at the interface of the recursive must be offset by discontinuity.[10] There is a requirement for disjunction in boundaries between microcosm and macrocosm in ecosystems, and there is a requirement for non-communication between genetic process and somatic adaptation which is fundamental to the success of evolution. Without the presence of gaps, such as those found in the simple act of prayer, recursive systems dissolve into tangles of interconnectedness. Gaps are necessary in order that perceptual processes can mark distinctions and differences in system integration. Recursiveness certainly proposes patterns of continuity. Yet gaps and discontinuities are a condition of grasping such continuities of form. After all, Bateson suggested, there has to be some limitations to the coupling of recursive loops. Without limitations in the continuing interconnection of recursive loops, it would be impossible to undertake any description at all, or perceive any distinction in recursive patterning.[11]

In short, the pattern of communicative organization in religious systems reveals the same shape of continuity and discontinuity, of balance between direct communication and non-communication, that other examples of very large systems, such as evolution, demonstrate. If there were no gaps, then, by deduction, the propositions which Darwin put forward about evolution (that there are smooth continuities between individuals and species) would be sustained. He had indicated this in a letter to Konrad Lorenz a few years before: 'I am writing a book [*Angels*] to suggest that inside our minds there is something going on between our ideas which is very akin to what happens in the interaction of individuals and species in phylogeny. *Falsification* is also akin to natural selection' (Letters, 876-21/1976).

Bateson would have no Darwinian notions carried over from evolutionary thinking into the field of aesthetics he was attempting to portray. Equally he was opposed to propositions of continuous circularities between conscious and unconscious states that Jung put forward in his description of *mandalas*.[12] If the biosphere is perceived as a 'sacred unity' from which pattern and coupling of life derive, then in order to be comprehended, perception of its unity must also involve discontinuity in order to classify relations that are perceived. The interleaving of the two, continuous perception and discontinuous classification of the products of perception, is fundamental to a science of recursion.

SELF AND SYSTEM

Bateson noted that whenever a concept of unity emerges in religious thinking, the qualities imputed to religious 'unity' are almost always inferred as an extension of humanity's ideas about selfhood. The unity of self is always a material self, a physical embodiment of self, and the material embodiment is then transposed metaphorically to spiritual unity separated from self. The highly anthropomorphized expression of self buried in religious epistemology explains why religious understanding so often ends in paradoxical statements of oneness and separation.

Christian religious thinkers express the relation between God and communicants as that of the God in us and us in God. Here the self becomes so immersed in unity that all loops of difference between a transcendental being and communicants become submerged. On the other hand (as noted in chapter 4), Bateson observes that Christian thought proposes a duality between God as *logos* or 'the word' and the supplicants. Ritual action undertaken by individuals links supplicants with their God. Yet a paradox appears: systemic unity, predicated in the immersion of self-in-god, exhibits continual separation of components, in which one part is in conflict with the other. The Christian tradition attempts to remove this paradox through ritual processes in which humans admit their mistakes or error in acknowledging a relationship of unity, and are excused. Individuals plead forgiveness to the unity principle on the ground that 'we did not know' that our actions would lead to conflict, disorganization, terror, and fear for our own survival.

Bateson argues that the combination of individualism and dualism in Christian thinking is a major source of pathology. Like pathologies of Western scientific thinking, the errors stem either from false conceptualization of unity or, more usually, from collapsing systemic concepts of unity into parts and confusing system with its parts. As he had explained from the outset of his interest in ecological systems, a monistic principle is extremely important in ecology for otherwise a syndrome of roots for ecological and cultural pathology emerges. The 'syndrome' combines (1) the premise of transcendent mind; (2) the premise of enumerable 'wants'; and (3) the habit of conflictual polarization. These three elements of the syndrome mutually support each other and result in the formation of a unit 'I' (or 'my society' etc.) versus Nature or other societies or groups (Letters, 1192–24d/1968).

In particular, Western religion, like Western science, was embued with 'the false cult of the ego' (Notebook 35/1965). His objections to the cult of the ego were axiomatic: ' ... the moment the concept of self is mentioned as an object of action man is committed to the sacramental fallacy ... [through] identifying the symbol with the thing symbolized.' He takes up an investigation of what he called 'sacramental fallacies' of individualism when he discusses suicide, a subject which since the time of Durkheim has been recognized by sociologists as a classic *demonstration* of an author's position on the locus of the individual. Suicide, Bateson said in an unpublished paper, was the prime example of fallacious notions of the self, 'a logical error mistaking the symbol for the thing symbolized, and a sabotage of symbols of the self' ('Self and Suicide,' Notebook 35/1965). There were profound ramifications in promoting this sacramental fallacy. The West is tormented by the thought of the death of the individual person; and it fails to see that the death of individuals, and even of individual nations, is continually necessary to maintain any system. A false view of ego, and of individualism in general, in turn yields false conceptions of the power of action to transform systems.

An interesting indication of the depth of feeling with which he held this position occurred at a conference in Tucson, Arizona, in a dramatic confrontation between him and the psychologist Carl Rogers. After Rogers had presented his well-known position on 'personhood' and the 'whole person,' Bateson stepped to the podium and exclaimed that he, 'Gregory Bateson' did not exist in these terms – and certainly not as a 'whole person.' He was, instead a nexus in a floating web of ideas, some of which existed within his skin and some outside him. Rogers rebuked him by saying that Bateson had failed to realize that the self was also 'a nexus of feelings or personal meanings or whatever you want to call them and that these are just as important as your [nexus of] ideas.' Bateson replied that the 'person' was not contained within the personal, in Rogers sense of the term, for the mind of a 'person' is non-spatial, and could not be spatial 'when we face the very difficult formal problems of aesthetics' (Letters, 1217–2a, 3a/1975).[13]

Some years before, Bateson had explored the same position with the well-known linguist Kenneth Pike. At the end of a long exchange of letters, Pike agreed with Bateson that there is room for Bateson's kind of immanence in communicative systems. Yet the epistemologist must always preserve room for a kind or degree of transcendence. Pike argued that despite the metaphor of the church as 'the body of Christ,' there is always room for God and 'me' to be different in the Christian scheme of things. Thus 'man smeared into environment [Bateson's argument of organism plus environment] can be studied without denying the possibility that I and thou in the environment are not merely blurs ... ' Accordingly, Pike argued, it was perfectly acceptable to show that 'I' am related to 'the power' while at the same time showing that there is no God different from Totality.

Bateson replied that the whole of Pike's scheme was a desperate attempt to avoid the 'errors' of dualism and of setting the subsystem against the environment. Bateson retorted that it was we, human beings, who draw the lines of limitation. It is we who derive 'the criteria of "lines"' and classify them. And the boundaries we draw are partly diagrams to give ourselves a richer understanding of our own position in order. The boundaries we draw are also criteria of our own taste and aesthetics:

I feel it to be a strength of my system that it does not demand either empirical proof or 'faith.' All I ask is a change in how we cut the cake [that is] a change in what we select as units. I assert that the world makes better sense if the delimitation of units is drawn around subsystems, rather than across [individual] channels of communication ... Of course if you draw a limiting line around a subsystem you will inevitably be cutting all those channels which connect the subsystem to the large world ... [so that] you [are required to] re-draw the limiting lines to enclose the subsystem and the larger system together. (Letters, 1104–3a/1970)

Both Christian religion and science suppose that action can arise from the ego's initiation of cross-cutting ties within subsystems of the whole. Religious thought even assumes a continuum of links lying between the microcosm and the macrocosm. The prevailing view is of a vector of communicative activity between 'ego' and the Totality expressed in the 'power' of faith. Bateson denies the existence of such a communicative continuum.[14]

In other writing, he noted that we are 'seduced' into a belief in epistemological individualism. It is all the double binds that we experience in life which corrupt an awareness of systemic interrelatedness and seduce us into believing the propositions about 'ego' as individual (GB, in Brockman 1977: 247).[15] As long as the West remains tormented by a false pride in its individualism, it will pursue perversions of individualistic thinking. This tormented perspective can lead to strategies in which killing the whole biosphere becomes preferable to risking one's own skin (Letters, 1177–9a/1979).[16]

A TOPOLOGICAL PICTURE OF RECURSIVE COUPLING

In *Angels*, as in other writings, Bateson argues that concepts explicated in Greek myth and belief (*anangke*, *nemesis*, and *hubris*) were much closer to process in ecosystems than any of the concepts of process derived from Western religions (*Angels* UE nos. 13–15). The 'gods' of ecosystems, ECO, are much closer to Greek conceptions because in the Greek world-view necessity or fate permits no separation of premises from action. Unlike Christian conceptions of God, the unity of ecosystems cannot be mocked. As already mentioned in chapter 4, Bateson said:

The horrible thing about the god Eco – the gods of eco-systems, is that they have no free will, no sentimentality, they can be insane (which most gods are supposed to be incapable of). In St. Paul's phrase, they 'are not mocked.' So if you stand against the eco-system, it's no good saying you didn't mean it or you are sorry. (GB, 1975b: 29)

In the realm of ECO, the paradoxes of dualism and unity inherent in Christian conceptions of spirituality give way to a rigorous monism. Nevertheless, the very abstractness of this monism, and the way it is hidden from our sensing its necessities, creates difficulties in its comprehension. Bateson hoped that *Angels* – in addition to its comparison of matters of the sacred and of faith – would undertake an examination of the 'obscure rules' of unity and interconnection of 'the processes we call perceiving, knowing and acting ... [which] concern the preservation of the fine lines dividing the sacred from the secular, the aesthetic from the appetitive, the deliberate from the unconscious, and thought from feeling'; as well as of how 'the validity of our mental processes is jeopardized' when these rules are not observed (*Angels* 1987: 69).

Bateson reminds himself, on a draft page of *Angels*, that he would set out an algebra of these relations. Perhaps he had at the back of his mind the notion of Whitehead's 'universal algebra.' If so, it would be in a very different guise. Bateson's 'algebra' would be qualitative, an algebra of interconnected ideas and their various topologies. He would begin with 'internally necessary verities or necessities, such as difference, the ability to classify differences and so on' and map these epistemological necessities 'way down' to where Jung's distinction between *pleroma* and *creatura* joined with the distinctions between natural history and the foundations of mathematics:[17]

> ... we are collecting items for a list of verities, necessities, eternal verities if you will which are not immanent in the outside world, call it that for lack of a better word, but are immanent, rather, in the process by which what is immanent in the outside world becomes immanent in an inner world. (*Angels* UE no. 2)

From there Bateson proposed he would work his way up to visible aspects of aesthetic processes and what these might say about unity in the biosphere. An understanding of aesthetic process would enable the 'drawing of a line between pleroma and creatura.' Aesthetics, as a third mode of explanation, would implicate the recursion in the boundaries of the subdivisions, pleroma and creatura.

In the outcome, *Angels* does not accomplish this large schema. Instead we are left with fragments of an unfinished epistemology. Much of the book goes over themes he has introduced before. The order of discussion in *Angels* is difficult to comprehend. As editor, Mary Catherine Bateson comments in several places on other difficulties of editing the volume, particularly the fact that her father had not seemed to be explicit in drawing connections between his arguments and advancing an ecological epistemology. She attributes his around-aboutness to his penchant for metaphor and nesting one argument within another.

Some of the threads of Bateson's original construction are inevitably lost in the editing. Nevertheless, the book retains full exposition of Bateson 'tricks' as he 'works the metaphor' of sacredness – parables, anecdotes, stories, metalogues, and stories about change in his own understanding of perceptual process. It also retains Bateson's central abduction, that the notion of the sacred in religionus can, by abduction, tell us something general about 'the rules for joining together items of discourse, together with the natural history of what happens when items are joined together in inappropriate ways' (*Angels* 1987: 158).[18] By posing a boundary between the sacred and the profane world, religious thought prohibits the everyday profusion of personal opinions to cross boundaries of religious thinking and change its formal conceptions. In this sense, the sacred is a depiction of a field of interaction and interconnection of communicative processes which has its analogue in evolution, in the form of the Weismann barrier (M.C. Bateson 1988: 42). Religions recognize the necessity for coherence, the very abstract level of religious thought promoting the long-lived tautologies necessary for cosmological contemplation.

Mary Catherine Bateson points out that the original manuscript of *Angels* sketches a number of themes which are recapitulated in a single long chapter.[19] But she decided to separate the chapter – the recensus as Bateson called it in his notes – into separate chapters, placing some notes for interpretation in between, in the form of a metalogue. A different reading might mark this section 'Epitaph: notes on the obscurity of the matter for those who come after and propose to deal with recursive systems.'[20] Certainly Bateson develops his 'algebra of that which is to be described' in a manner that is at once familiar but unlike any other passage he wrote. He summarizes a methodological approach to communicative systems: 'I am trying,' he says, 'to investigate the communicational regularities of the biosphere, assuming that in so doing, I shall also be investigating interwoven regularities in a system so pervasive and so determinant that we may even apply the word "god" to it' (*Angels* 1987: 142). It is these regularities we must discover 'because they form a unity in which we make our home.'

The purpose of his recapitulation, Bateson suggests, is to 'give a sort of topological picture of the problems of describing any living thing.' Because he marks it 'algebra,' he is able to consider how the topology might bring some *x* into relation with some *y* and how the pattern of that interconnection might yield an overall approach. His *x* is equivalent to religion and his *y* equivalent to science. Thus he asks the question, can we recognize among the scientific findings enough of the basic principles of traditional religion to give a base for some rapprochement towards an understanding of 'communicational regularities of the biosphere'? In other words, if theistic religions were to abandon transcendental versions of humanity as primal models for their gods, would they still yield basic premises with regard to communicative orders that coincided with what we claim to know of cybernetics and systems theory? And vice versa: if science were to abandon some of its long held truths about its method and logic – which logic is valid for linear systems and which method is valid for quantitative observation of such systems – would it still yield algorithms of order that are of such pervasive regularity in communicative order that we may call them 'god-like'? These also would need to coincide with what we claim to know of cybernetics and systems theory; in particular, that all living systems are recursive.

A key term Bateson uses in his discussion of possible rapprochement between science, religion, and other epistemologies weaving into his topology is that of 'structure.' Broadly speaking, structure is a limitation or constraint. Structure, he notes, is an informational idea, but the information or injunction of structure is always at one remove from its referent, and insofar as 'the structure' is the name of some characteristic immanent in the referent, or the description of some relation ideally immanent in the referent, it is never true. This map is never the territory; and 'structure' – that which is named on the map – is always a somewhat flattened, abstracted version of 'truth'.

'Truth' stands for a perceived regularity, and while these regularities may indeed be immanent in pieces of matter, any process that has regularity 'has regularity because it is itself about its own regularities' (*Angels* 1987: 156). Many regularities in biology, for example, are part of – and contribute to – their own determination, and 'this *recursiveness* is close to the root of the notion of "structure"' (*Angels* 1987: 161).

The interesting phenomenon about structure is that it is only a notion that we create in our synthesis of descriptions from data which reach us through the filter of our sense organs. Yet, for all that, structure is a *determining* factor. Though we create the notion of structure in our synthesis of description from data, we also project this structure upon the 'outside' world. It is only a spin-off from our own perceptions and thought, yet, at the same time, '"structure" is a structuring word, and life is normative. To this extent life resembles many religions' (*Angels* 1987: 155):

> It is hard to keep clearly before the scientific mind the general epistemological verity: that the Ten Commandments, the rules of morphogenesis and embryology, and the premises of grammar in animal and human communication are all part of the vast mental process which is immanent in our world and all as real, *and as unreal*, as syllogistic logic. (*Angels* 1987: 162)

An understanding of structure does not end there, Bateson warns us. We can pull out structure from the ongoing organized flux of the universe and show how it is a synthesis of description. But we also need to put it back in again into a world fleshed out with life and happenings. By this means, we can compare that which we have called 'structure,' the pattern of descriptions and reports, with a totality of message systems in the world. This should remind us that the pattern of connected statements contained in the evidence we call structure is conspicuously full of gaps. No matter how much structure is added, and however minutely the specifications of structure are detailed, there will always be gaps in the pattern. All structure, as with all description, is always a miserable gathering of outlines. All description, all information, can only touch upon a few points in the matter being described, for if one is attempting a complete description, that which must be specified is everywhere and it is 'impossible to decide upon any general statement that will be a premise to all the details' (*Angels* 1987: 164). If structure, in the end, resembles only rules or injunctions through which we should consider sequences in these outlines, this sort of 'recipe' is as much as we can hope for.

Rules of relationship between items of ideational life are not unbreakable laws of nature, he goes on, for they may be, and often are, breached. To say that a description made by a biologist corresponds to the organism's own description is still not a claim to direct truth, for all biological descriptions are necessarily structural and to this extent falsify or simplify or generalize their referent (*Angels* 1987: 155). We may, however, learn about errors that result in simplification, falsification or over-generalization, and to this extent we can develop a strategy towards the elucidation of structure. Indeed, we must do so if we are to understand both the freedoms and the rigidities of living systems. As may be expected, Bateson is very cautious in putting forward any positive strategy for mapping structure, trusting instead to a process of trial and error, or 'groping' as he termed it. But he suggests that an appropriate strategy lay in coming to terms with what is required in order to talk about structure in a unity. When we begin to look at the larger fabric of the biosphere as a unity, we encounter only fragments of that unity. The danger at this point is to seize on these concrete fragments and to give names to them, or to assume that the name we give is somehow a real component in that structure. Instead, the recursive structure of any large ecosystem cannot be grasped through individual fragments that are separated from the system. Instead, all action in a recursive system lies at the interface of subsystems, the edges or boundaries between its subsystems, where both gaps and interconnection occur. Here 'difference' is to be found, and 'difference' in pattern of differences can be perceived. Only at the interface can 'change' be observed, and only at the interface do processes of recursion which transform the system as a whole take place (*Angels* UE no. 2). A further discussion of the details in his model of scanning the interface is contained in Appendix 4.

A RECURSIVE VISION

Somewhere in the pattern of questions we ask about recursive systems, Bateson suggests, questions tend to become answers – comparisons made between the pattern of questions and answers themselves yield a pattern of questioning and the transform of the pattern of comparison leads to the explanation itself.[21] From here explanation itself becomes recursive, linking the products of our perceptions about comparisons between questions and answers to comparison with other people's perceptions of them.

Such methods verge on runaway, and Bateson acknowledges the problem of runaway. But he notes that whenever the complexity of phenomena is beginning to run away with us, orthodox procedure reverts to reductionism. By contrast, aesthetics and the sacred enable us to stand off from the data and consider what sort of simplified (always oversimplified) mapping will do the least damage to the elegant interconnections of the observed world. These at least help us forge methods congruent with phenomena of living systems, even if there emerges in these methods an interlocking of two ouroborous – snakes who eat their own tails – recursive forms in recursive relationship.[22] But let us not pretend, he said, 'that mental phenomena can be backed onto the characteristics of free falls' (*Angels* UE no. 9).

Bateson's view was that certain truths can only be approached through recognizing the very patterns of 'interface' between one's own ongoing perception and thinking, and following the pattern of these through to the question asked. The very pattern of the interface, in some respects, models the answer to the question. The next step is more difficult, to create a method that goes beyond 'thinking about' in which we derive pattern of the recursion between subject and object, between the world inside and the world outside. How can we derive pattern that includes the experience of 'thinking about' the recursion? And how can such methods aid us in recognizing pathology and distinguish the pathological from sanity in a recursive world?

Bateson had both a short and a longer answer to the methodological issues of second-order recursion. The short answer is outlined in the previous chapter in the discussion of *moiré*, double vision. *Moiré* is an example of how overlay of perspectives creates depth, so that patterns which cannot be observed initially 'jump out' in the overlap. Multiple description provides the interleaving of perspective. In *Angels* he gives a longer argument. The original manuscript contains a half completed chapter in which he discusses a model of perceptual process in which structure would be pulled from the overlapping perspectives of a scan as the scan moves over boundaries of an interface.

A tiny indication of his method to uncover and match the two patterns of double vision occurs in an unpublished metalogue written at the end of *Mind and Nature*. He says:

> I am reminded of and enlightened about my own mental and unconscious processes by the shapes etc. of the animals and plants ... Organisms are embodied tautologies ... Between forms of living things and my conscious-unconscious mind are embodiments of tautologies. They bring the forms etc. into the domain of mind ... we have a hunch that if we knew about how ideas grew and differentiate, then we would know much more about how creatures grew and differentiate ... And about ecosystems. And about phylogeny. (Bk. Mss., box 5; 1987: 204. 24)

Seeing the world in this way proposes that we share embodied tautologies with nature, though that embodiment is not 'of a body' – physical sameness – but is organizational and systemic. Embodiment in the two cases appears to be distinct according to physical sensation. Uncovered, the distinctiveness simply reflects the sort of diversity one may expect in and between levels of an order. We just know too little about systemic embodiments of ideas, or how they grow, transform themselves, and become differentiated. As with all recursive systems, explanation should focus on transforms of these differences-distinctions, and processes by which distinctions arise and are superseded.

This is the crux of Bateson's message. Without expanding the recursive process of question and answer that leads to a recursive epistemology, we create our own dilemmas of ecological science. We confuse the forms of unity and differentiation, and the processes through which these forms come to be perceived. And in our confusion, we condemn our civilization to the insoluble dilemmas of the imaginary bread-and-butterfly.

The implications of Bateson's 'Way of Seeing' are numerous. We are all born of our ideas; we must look again to the defences we have constructed around them - our faith, our culture, and our technical order. *Yes*, we should refuse to continue sustaining a civilization whose dominant values are dualistic and whose total organization reflects its separation from, and control over, nature. Yes, we are a part of, but should not confuse ourselves with, the biocentric organization of our planet. The biosphere is loosely joined, and it is our adaptation to the meta-adapatation, the adaptation of the total adaptive system, that is going to kill us or let us live (*Sacred* 1991: 184). And *no*, we should not confuse recursive connectivity, the unity in ideas about recursion, with 'spirituality.'

In order to survive, we have to jump out of our predicament by the only means we have at our disposal. We must continue to weave our own metaphors - metaphors of the whole which bring to our attention how the various subsystems in the whole interleave and persist.[23] And we must find good methods to engage our current understanding of persistence. For persistence, survival itself, is evidence of healthy relationship.

APPENDIX 1

Two Models of Ecology Compared: Odum and Bateson

In Appendix 1, I propose to contrast an energy-driven model of an ecosystem (see p. 236) with an 'entropic model' of an ecosystem (see p. 239), one which Bateson held for many years. Energy-driven models of ecology presume that the planet is some form of biomachine. The release of energy from biomass drives the cycling of materials in the biosystem. Bateson's model proposes that organization of information is fundamental to ecosystem survival. He called this the 'entropy economics' of biological forms.

According to proponents of energy models of biosystems, embodied energy in biomass represents a complex set of physical resources whose operations, such as food production, functionally interact in order to meet the physical necessities of all living systems. In particular, energy flows in these models provide the 'life support system' for human beings. Thus Eugene Odum, writer of a well-known ecology textbook, states that embodied energy in a 'life support system,' is 'the single common denominator of life on earth ... something that is absolutely essential and involved in every action large or small ... All humans should understand the basic principles of energy transformations, because without energy, there can be no life' (Odum 1989: 67). Bateson is insistent that while energy is by no means absent from an ecosystem, the organization of information in ecosystems is more fundamental to their survival. His model concentrates attention on the predominant features of self-organization (auto-organization) in all biological forms, which, he argues, are all informational and communicative.

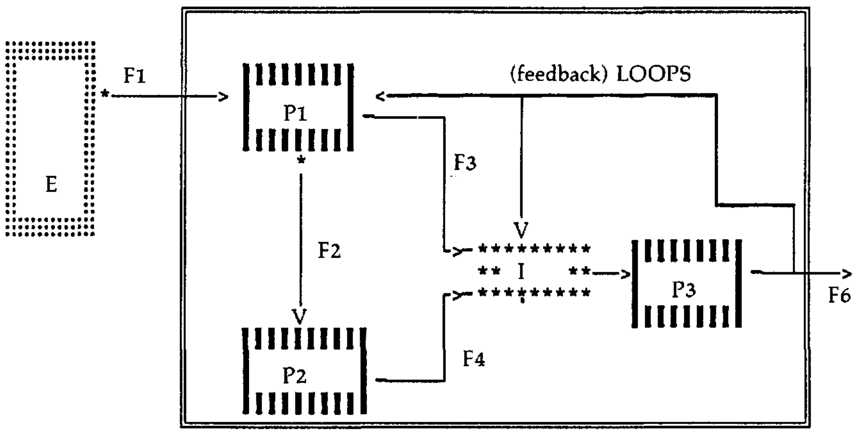
Odum creates a thermodynamic framework for thinking both about ecology as a system and, by extension, about how to change energy equations in the ecological system to cope with ecological degradation.

Odum's abiding concern is with an energy-flow model of ecosystems, compatible, on the one hand, with concepts of utility and, on the other, with 'servicing' the 'biomachine' - biomass - through an economics of energy conversion. A key concept in Odum's interpretation is *embodied energy,* defined as

> the energy required to generate a flow or maintain a process ... [in calorie equivalents which] estimated this way becomes an estimate of 'value'; since it represents how much energy of one kind has to be 'paid' to produce another, more 'valuable' form. (Odum 1989: 77)

Embodied energy represents all the work of the ecosystem, and 'since money and energy are related, using energy as a basis for evaluating and allocating goods and services of all kinds is a logical approach [to the conversion between natural ecological systems and human systems]' (Odum, 1989: 103). Odum's conversion factor provides a monetary 'value' for natural ecological systems. Any policy decisions which flowed from this approach would necessarily assume that ecological survival is primarily a question of monetary costs against human benefit.

MODEL 1
Systems Diagram Showing the Basic Components
in Modelling Ecosystems, According to Eugene Odum



E forces F flow pathways
P properties I interactions

ENTROPY ECONOMICS

By contrast, Bateson presents a simple house thermostat as a prototype model of ecosystem. Unlike Odum's energy model, which requires an initial energy input (E) flowing from outside the boundaries of an eco-subsystem, Bateson's model of a thermostat contains its own self-generating energy. Location of the energy source does not therefore require further elaboration in the model. In Odum's model, the various levels of organization are folded into a 'black box' of interactions (I). Bateson's model sufficiently unpacks the 'black box' – as any good cybernetic model should do – in order to discuss feedback in relation to the overall levels of structure in the model.

Bateson is insistent that there are many other values of ecosystem economics which become determinative before 'energy economics' in an ecological system begins to pinch. He called these other values the 'entropy economics' of biological forms.[1] 'Entropic budgets' represent uncommitted differences of ecological values. They could also be termed 'flexibility budgets' of ecosystems.

In arguing that information and energy give alternative perspectives of order, Bateson poses the distinction between negative entropy interpreted simply as 'available energy' (according to the Second Law of Thermodynamics) and negative entropy interpreted as information, that is, the transposed sign of order in entropic flow.[2]

Causal impacts on the budget of pathways of differences in entropic budgets are non-linear: there is a referencing up and down of a recursive hierarchy which can be glimpsed alternately as noise, or as bounded variation and pattern.

ENERGY VERSUS INFORMATION: THE MODELS COMPARED

The predominance of the energy factor is clearly displayed in Odum's model, reproduced above. The ecosystem is partitioned and classified in terms of its relation to energy flow. The properties of the ecosystem (P1, P2, P3) are the state variables of an ecological situation. The 'forcing functions' (E) are causal forces which drive the system, usually energy sources outside the immediate sub-ecosystem under consideration; for example, the solar system in relation to earth. The flow pathways (F) connect these 'forcing functions' (E) with material transfers within the ecosystem. Within the model there is a sort of 'black box' (I), where forces and properties interact in order to modify, amplify, or control energy flow. Finally, the model has feedback loops which return ecosystem output in a loop back to 'upstream' input. As Odum points out, his model could equally represent a grassland ecosystem or smog production in Los Angeles in terms of energy flow (1989: 34–6).

In the model sketched by Bateson, an ecosystem is a common set of communication events. It is built upon a prototype that Bateson called a house thermostat, but which is, more properly, a 'reflexive thermostat.' The model below arises from a question put to Bateson by ecologist John Todd in 1978. He asked whether there are possibilities of treating an ecological climax as a set of communication events. Bateson replied that, of course, there were obvious contrasts between the type of events one can call 'communication' in a natural ecosystem and the sort of events human beings usually refer to when speaking of 'communication.' One obvious difference was that 'ecosystems, such as meadows cannot ... move their end organs to scan the environment and thereby convert differences "out there" into *events* at the end organ' (Letters, 1407–2c/1978). That is to say, they cannot 'report' about that state of events. But they contain many possibilities for creating contrast when external states impinge on their internal differentiation.

Communication need not be defined exclusively in terms of 'reported' conversations. Communication between coupled subsystems can be said to exist in the more limited sense of 'linkage' in a network of events – as in a network of signals having the values of 'commands.' In this more limited sense of signal linkage, it is possible to examine a number of attributes concerning the *setting* of the system and its subsystems.

SOME FEATURES OF THE BATESON MODEL

The following features are characteristic of Bateson's model:

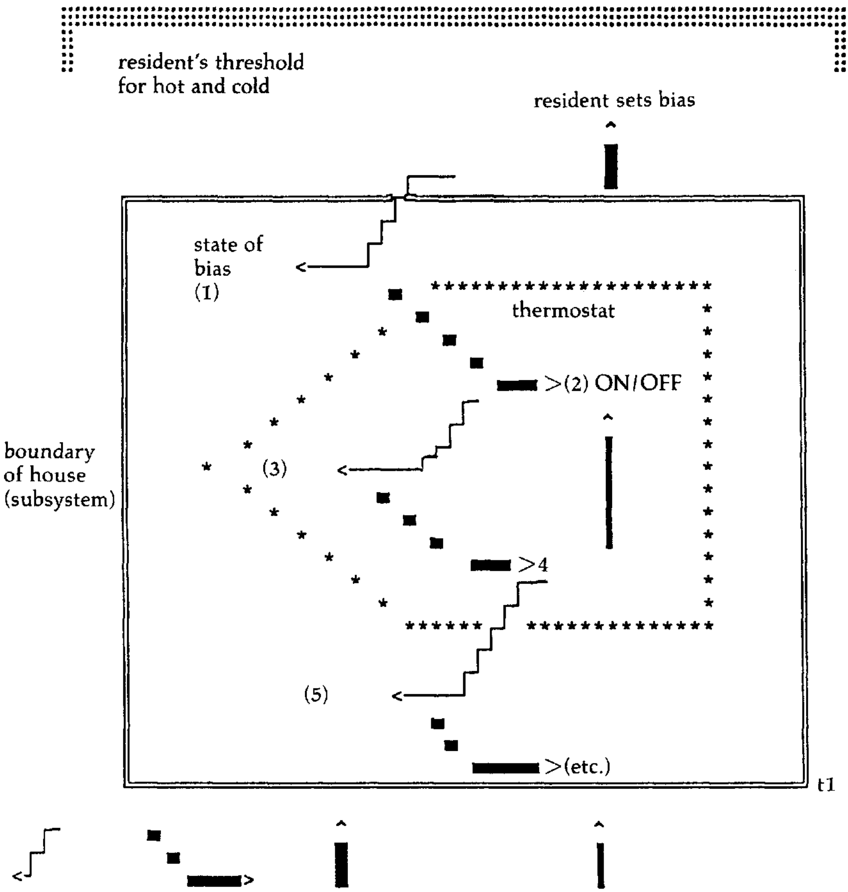
A) Communication regularities are organized; thus they cannot be considered like energy throughput, but are instead endogenous and non-linear in the model.

B) The model is a multi-level system with boundaries or thresholds registering several different types of subsystems. The types of subsystems include human beings (residents' threshold for hot and cold); a physical structure (the boundary of a house subsystem); an energy flux within the house subsystem (furnace, etc.); and a feedback device

MODEL 2
Bateson's Model of a House Thermostat as 'Structure'

STRUCTURE (thresholds, settings, states, etc.) FUNCTION (events, actions)

upper boundary of niche



events change setting (REVERSE)

setting determines an event (REVERSE)

an aggregate of events (subsystems) determines event in larger system

events determine a *crucial* event

which connects the various levels of the system (thermostat). Differences in type of subsystem – environmental, human, mechanical – do not prohibit their being adapted to one another. As in real ecosystems, the whole system is linked by feedback loops which rise or fall depending on the succession of events.

C) Because the thermostat is composed of human beings, it is reflexive over its various boundaries. The larger system includes both house and residents. For house residents, temperature rise or fall is a condition or a state. At this point, the resident may decide, taking all events into account, to alter the bias of the thermostat. In the event of such a change in an aggregate of events in the thermostat-furnace subsystem, the resident's sensing of temperature in the house then determines events in a smaller system. As in real ecosystems, human events in time have causal consequences. There is a possible reverse of this: the larger system also may sample events from an aggregate of the smaller subsystems (see below).

D) The 'setting of the system' is equivalent to its structure. Bateson explains the 'structure' of the ecosystem on the assumption that it is a very large communication system responsive to the *fittedness* of its integrated cycles. The setting includes the state of system thresholds, contrast between thresholds, and the readiness of the system to respond to change in the larger system of which it is a part.

E) A careful examination of structure as 'setting' goes some way towards indicating how change may occur in the system and also how all feedbacks within the system are related to change of threshold or system states. Change will occur in response to the system's and subsystems' sensing difference in time. One way change may arise is from a change in setting determining change in actions or events; alternatively change may arise from a change in events in a larger system altering the setting of events in a smaller. In both cases, change is an aspect of difference/time relations – the movement of a system in oscillation.

F) Time sequence in events is denoted in the model as a movement from *t* in the larger system, when the resident sets the bias of a thermostat, to *t1* in the smaller system.

G) The model is ordered temporally and by system thresholds to be read from 'top' to 'bottom.'[3] Ostensibly all interactions in the model occur in a zig-zag between those of setting thresholds and states, and those of flux, events, and actions. These are also termed a zig-zag between structure and (temporal) functions.

H) Settings and events 'top-downwards' are relatively easy to identify. In the largest system, if the resident of the house feels cold, the thermostat can be set according to the resident's particular bodily threshold of 'coldness.' This change in 'state of bias,' represented in the diagram as (1), determines an event in a subsystem. A switch goes on or off in the thermostat (2). This event then changes a setting on the furnace (3) and the furnace switch goes on or off.

I) When 'bottom-up' activity begins, the analysis becomes less familiar. The on/off event at the furnace determines whether temperature rises or falls (4). The difference, a result of rise or fall in temperature, is sensed not only within the thermostat-furnace subsystem but also in relation to the boundaries of the house, a larger subsystem.

J) The resident, who belongs to an even larger system, may also sense the difference between the house temperature and the weather outside. The feedback loops are multiple. One feedback loop simply returns the change in temperature to the bias of the thermostat (from 4 to 2) in the thermostat-furnace subsystem. In this event, a switch will go either on or off in the thermostat. The subsystem will continue in a self-maintaining oscillation, for when a rise in temperature of the house creates fluctuations, these are held between thresholds, or existing limits, set on the thermostat. Other feedback loops return 'temperature rise or fall' to the larger system (5).

SOME CONCLUSIONS ABOUT COMPARATIVE FEATURES

The Bateson model is deceptively simple but has the effect of turning inside out the energy emphasis in Odum's portrayal of an ecosystem. Odum's system model is a continuous flow energy system. Energy in Bateson's model is communicated as 'temperature rise or fall.' Oscillation may result in automatic changes in the setting of the thermostat, but such changes also include reflexiveness in the overall set of events, which is a different type of system oscillation. Within the furnace-thermostat subsystem, the self-maintaining energy flux or oscillation of the system permits a sort of continuous feedback in which an event determines other crucial events.

But between the furnace-thermostat subsystem and the thermostat-resident subsystem is a 'gap' in levels of the system as a whole. The two levels – resident and furnace-thermostat – may be adapted to one another, but it is clear that there is a gap between the levels in which adaptation occurs. Each level has a different type of communication linkage that is not congruent with the other. By comparison, in models where no gaps occur – in other words, where the energy is said to drive the whole system in a continuous manner – this type of 'communication' is totally disregarded.

The Bateson model highlights the nature of systemic interaction in ecological organization and the importance of feedback to the multi-level structure of a holistic system. It also poses interesting questions about feedback as linkage within the system.[4] For example, what if the direction of the zigs and the zags in this model were reversed, Bateson wrote to Todd, what could we possibly draw from this model about the nature of feedback in multi-level ecosystems which include human consciousness in ecological settings? Bateson suggests that this reversal of 'zig' in the feedback is perhaps a model of human consciousness in a schizophrenic mode.[5] Similarly, consider the 'zag' in the model – depicted as a downward arrow from left to right. A feedback loop moving in reverse direction from an event in a smaller system to an event *determining a setting* in the larger system is the equivalent of Lamarckian inheritance in evolution (see chapter 7 for a discussion). Any reversal of this sort in the world of either biology or ecology is lethal for survival.

Finally, ecological stability is affected by our own understanding of the organization of stable ecological processes. Only a change in understanding the fittedness of ecological stability will alter a highly organized non-linear ecosystem. It is these communication regularities that we must discover, for it is they which constitute its structure and 'form a unity in which we make our home.'

APPENDIX 2

Models of Recursive Hierarchy: Logical Types and Double Bind

Forms of logic provide and help maintain rationalizations for dominant political and socio-economic relations in any society – from which they are initially derived. Over the past three centuries, Western society has become organized on a basis of competitive exchange in interpersonal activity, an organizational mode which the West has progressively extended to cover nearly all values of goods and services arising in economic exchange. The competitive form has also become the predominant feature of relations between nation states. It is also exhibited in the West's characterization of relations between humanity and nature – the challenge of 'discovery,' the 'cutting edge' of technology, the 'frontier.' Though dominance of competitive relations in the organization of Western society does not exclude other forms of organized relations, for clearly there is cooperation as well, forms of cooperation are nearly always constrained or mediated by the logic of competition. This is one way of saying that rules and logic of competition are of a higher 'logical type' than cooperation (Wilden and Wilson 1976: 279).

The activity of the alcoholic with regard to 'pride in risk' examined in chapter 2, and Bateson's discussion of this syndrome, is a model for competitive behaviour. For the alcoholic, 'pride in performance' set against his/her ability to engage in controlled drinking generates an oscillation between 'being on the wagon' and 'being on the bottle.' Being 'on the wagon' may stop the alcoholic from drinking temporarily, but it does not stop the alcoholic from being part of the system of interaction with 'the other,' (the bottle), with which the alcoholic feels in competition. Hence validation of the alcoholic's self-control over the bottle can only be confirmed by taking the 'one little drink' that in turn prompts the whole oscillation of drink/dry. The actions of business corporations in competition with each other in the market economy is not unlike the addiction of the alcoholic. In business cycles, the oscillations of boom and depression are analagous to being 'on the wagon' and 'being on the bottle,' but here the business corporations' 'pride in performance' is expressed as a competitive cycle of 'challenge to invest' measured by an overall rate of profit.

Bateson's double bind is a departure from a perspective in which competitive relations are a dominant form. His double bind expresses sequences of activity, and a logic of their interrelation, which escape conventional sequences of interaction in relations of systemic competition. In the latter, the rules of the game (with regard to competition) are manipulated in order to create a 'level playing field' which, while it may not actually be present, supports an analytic logic of 'efficiencies' in the competitive field.

The major feature of double bind is its appeal to important features absent in competitive performance and which are unexpressed in the analytic logic of competitive 'efficiencies.' Double bind is, therefore, a means for transforming our perspective of causality in the absence of competition. Among the important features of double bind that go *unexpressed* in the one-dimensional efficiencies of analytic logic are the existence of levels in a system. In double bind these are ordered according to a hierarchy – or more correctly a heterarchy of levels. A hierarchy may be said to express a pattern of sequences, each within its own boundary, ordering events over a relatively long period of time; whereas the pattern of sequences ordering events in a heterarchy has only relative dominance in time. Heterarchical order is a common feature of human response in the shock syndrome. Shock very rapidly 'dominates' any other mode of organization in the human body – but the shock syndrome is not continually dominant in the human body.

Bateson's double bind takes advantage of systemic characteristics or constraints that exist in any informational order. From these constraints, the peculiar 'logic' of double bind is constructed. Double bind proposes that there are levels of logic, as there are levels of coding, levels of organization, and levels of communication. All of these create an enormous matrix of features which, if each level were a discrete set of attributes that had to be individually tagged for analytic purposes every time analysis was required, could hardly ever be taken into account. Fortunately, systemic characteristics or constraints permit an understanding of their coherence. Among the most prominent constraints is the existence of time (i.e., patterns of information always exist in temporally bounded circuits). Another constraint is that information patterns are learned and become habituated; thus they are often not consciously recognized when they occur. Another constraint is that in order for any information to have any meaning, the information messages must be framed and contextualized by several different interacting and integrated levels of the senses - speech, sight, hearing, 'body language' - *and by patterns of interaction among members of the communicating unit.* No communication can be understood simply at the manifest level at which it occurs. Each level contributes to the embodiment of organized paterns of communication.

A fourth important feature of informational order is that for any level to remain in stable relations with any other level, it cannot 'stay still.' Or, if it does stay still, it will be cut off from the environment of which it is a part. By definition, any communicator in a communicative order must vary patterns of relations in order for its various levels of relation to remain relatively stable. In short, a communicative order must maintain a *meta-stability* in relation to a supporting environment through constant variations of relations between its levels.

Because Bateson's alternative perspective evokes an organizational order which is recursive and multi-level, binds will always occur within that organizational form. Double binds are not the same as single binds. As Bateson defined a double bind, the bind is not simply an awkward situation in which we are 'damned if we do and damned if we don't.' Rather, oscillations occur as a result of dilemmas in which one would rather not choose between alternatives - i.e., dilemmas of the sort: between me, thee, and them - but in which the context of the situation forces choice. The context requires one to choose between two poles of the double bind, each of which exists at different levels of communicative interaction. The most typical of these is a choice between 'self' and/or system of communicative interaction of which 'self' is a part.

As an additional feature, the choice of either requires the subsequent choice of the other. Each half of the paradox of the double bind proposes the other, so that one ends up condemned to taking both halves when one would prefer not to take either (Wilden and Wilson 1976: 277). Typical examples abound in all family situations in which the constraint of never 'really' being able to opt out of being a family member is a sort of meta-constraint forcing necessity of choice. If one is able to jump out of a system of communication, then double binds do not occur. But, according to Bateson, double binds are generated in all living systems. As well as being typical of human communicative groups, they are ecosystemic, part of the relations between humanity and nature and part of the relations among species in evolution. In fact, Bateson referred to double bind as a sequence characteristic of all recursive systems (GB, 1978g[ii]: 234).

Is there a 'logic' that will attend to double bind and all other paradoxical situations of its type? It is at this point that Bateson begins to engage in experimentation, not of the empirical variety – although his colleagues at the Veterans Administration Hospital proceeded in that direction – so much as in experimental epistemology. The first source for Bateson's experimentation was Bertrand Russell's schema of logical types. The principle of logical typing is that a 'class' and the individual members who make up a 'class' must not be confused as belonging to the same 'set' of events or objects. If the confusion takes place, then a never-ending oscillation occurs. So, the name that is given to the 'class' must be distinguished from the boundaries of the event that is perceived to be 'a class.' A single chair does not, by a principle of exclusion, belong to the set of all chairs. A common gambit in a 'careful' conversation is to make generalizations about the behaviour of a class of people – 'men,' 'women' – but immediately proceed to exclude the individual man or woman holding the conversation.

Russell devised rules at the turn of this century to solve problems of this sort, which had arisen initially in the mathematical theory of sets. Russell had found paradoxes in 'the laws' which George Boole, the mathematician who created set theory, had formulated (Boole 1951 [1854]). The earnestness with which Russell pursued his endeavour was a result of the widely held belief at the time that mathematics and logic did indeed correspond with the laws of thought. Boole had called his book *The Laws of Thought;* hence, the principles governing 'thought' needed to be rescued from Russell's discovery of paradox within them. In Russell's scheme, every set would belong to a specific type. A set of the lowest 'type' could contain only 'objects' as members – but not another set. A set of the next type up – a meta-type – could contain objects, or sets of the lowest type, but certainly would not be allowed to contain itself. All self-reference was prohibited: a set of a given type could only contain sets of lower type or objects, and could not contain itself because it would have to belong to a type higher than its own type.

In the highly formal domain of set theory, which deals only with mathematical abstractions, the theory of types passes muster. It is when logical typing is extended to everyday language and communication that its usefulness as a 'correction' to the existence of paradox becomes questionable. Everyday use of language requires a knowledge of formal rules of grammar, but it does not require knowledge of a hierarchy of linguistic types to 'correct' paradoxical conversation. If this were the case, we would learn all about hierarchies of linguistic types in our first years of education. In fact, strict application of Russell's rules in everyday conversation would be absurd. Even a rather matter-of-fact sentence such as 'In this book, I criticize the theory of types' would be doubly forbidden by Russell's procedures. First, it mentions 'this book,' which can only be mentioned in a 'meta-book.' Second, it mentions 'me,' and 'I' cannot be allowed to speak of 'me' at all! Since it is nearly impossible to communicate at any meaningful social event without some form of self-reference, the 'solution' of banning paradox by resorting to a meta-dictionary to discuss the significance of the original communication is crude at best, and in everyday situations of social communication, absurd (Hofstadter 1979: 19ff).

Bateson clearly recognized the ham-fistedness of Russell's theory. Indeed, he argued that its significance lay in the fact that the abstract scheme of logic *did not work* when logical typing is used to analyse the *content* of everyday communication (Letters, 559–20a/1969).[1] And Bateson himself recognized the cumulative deficits of his analogy. For example, logical typing was a-temporal and therefore took no account of change in 'names' or 'classes,' whereas the resolution of double binds occurred in time – they exhibited temporal causality. In order to overcome this inflexibility in the Russell schema, Bateson encouraged his friend and colleague Tolly Holt, a computer scientist at the University of Pennsylvania, to produce a body of theorems analagous to Russell's calculus of propositions, so that any social or natural system was mapped according to temporal processes.[2]

A third and near fatal feature of logical typing was that Russell's scheme of typing was a *transitive* ladder which moved in discrete steps from members of a collection to a class and from a class to a 'meta'-class, a class of classes. This ran up against Bateson's other arguments about the *intransitivity* of values in a heterarchical order. Bateson would maintain that he never meant to indicate that there was any sequential relationship between levels in his version of steps of logical typing. A meta-level of learning is simply a different aspect of the description of the same process, he said. The levels in his (Bateson's) hierarchy were reciprocal – higher levels are also explanatory of lower levels, and vice versa. Any new learning is articulated with all that has gone before and will contain some overtones of all the levels.[3]

Bateson recognized that the absence of any analytic logic underpinning the semantics of communication gave an extraordinary flexibility to meaning in communicative sequences. Framing, or labelling, of messages becomes exceedingly complex, so that the framing message may become the message itself, or it may be falsified. The ability to discriminate the different classes of messages is a learned skill, and levels of learning and the typing of signals are inseperable phenomenon. Communicative relations were heterarchical, and in the case of the family, for example, the pattern of a 'class' of interpersonal relations of communication was, in virtue of its systemic presence, a 'meta'-level to any subjective conception of what individuals believed they had communicated.

But he argued that an analogy can be made between each 'level' of information circuits and a formally constructed mathematical set, so that use of the mathematical notion of logical typing would *enable a psychotherapist to unmask errors of contrast of patterns of information at different levels of communication.*[4] Patterns of paradox in the communicative ordering of relations within the family then become visible.

Bateson's epistemological experimentation would not have gained prominence were it not for the evident practical importance of 'typing' or 'classification' in an interactive communicative setting. Psychotherapists recognized that in practice, logical types bear a strong analogy to rules of communication in a family, where individual subjective conceptions of a single member are bound to communication interdependencies of the 'family system' through mutual causal feedback. As a model, logical typing does enable a distinction to be drawn between the pattern of subjective conceptions and the pattern of interpersonal communicative relations. Once communicative order is seen to be a form of hierarchy, the analogy of logical types is useful to a discussion of the many examples of ordering, between the 'member' and 'the class,' between explicit and implicit coding, and between the type of coding used in specific contexts of communication. Bateson's concern with the paradoxes of interpersonal communication did, therefore, verge on the logic of 'predication' in Russell's abstract methods, namely, the relation of the subject to that which is being asserted.

Bateson himself admitted years later that logical typing was an analogy with very slippery edges: 'As I use "higher logical type" (HLT) the relation is commonly between propositions [of belief about relations-assertions] rather than between items, classes, names, etc. Proposition as members of classes of proposition - and there is a sticky, slippery edge. Can a class of propositions be itself a proposition? ... I guess I sinned in pushing HLT away from names and classes *without saying* that I was doing this ... ' (Letters, 5591/2-2a/1979).

He points out that the 'propositions' he was dealing with were not logical 'names' or 'classes,' as in Russell's scheme, but were assertions between relations and levels of relations in the 'hierarchy' of feedback circuits within the system. Nevertheless, in his analysis of double bind, Bateson argued that the paradoxes central to the phenomenon occur because participants as subjects are linked with premises and patterns of social interactions which they have learned through constant repitition, and which therefore seem to be 'objective' to them. This linkage between subject and 'object' is subject to rules, and the rules create fallacies of 'reality' and 'objectivity.' The logic in double bind, therefore, is that of warped contexts in which the subject believes circumstances to be 'objective' in the pattern of interrelationships. Where victims of the bind are unable to leave the field either physically or emotionally or perceptually, the traumata induced by double bind can be serious (Wilden and Wilson 1976: 278).[5]

Several psychotherapists noted that because there was no strict logic in the paradoxes Bateson discussed, the analogy with Russell's logic of types was not necessary, and was confusing. Double binds, they pointed out, arose more from false contrast in perspectives; and the inability to resolve choice or discern meaning of messages results from perspectival contrasts of present situation with prior patterns of learning. Since double binds deal only with psychological assertions between relations, the enfolding of objectivity in the fallacies of double bind is psychological rather than logical.

An interesting critique by Norbert Wiley in the Bateson archive tries to sort this issue out. The critique suggests that there are three general modes in the social sciences for expressing hierarchical order. The first mode is one in which particulars and their interactions are *generalized* to other levels of the hierarchy. The second mode is that of *totalization*. Here elements in the hierarchy are considered as running from diversity to totality, from details to pattern, and from part to whole. In this case, the 'higher level' is not a 'class' or 'genus' of which the lower level is a member, but is a *configuration*, or uniqueness, which characterizes concrete particulars taken all at once. There is, in addition, a third form of hierarchy, a reflexive hierarchy, which is at the heart of Bateson's contribution to an understanding of communicative ordering. A reflexive hierarchy is an interrelation between communicators and the same interrelation looked back at itself from an 'outside' vantage point. The notion of reflexivity always entails an ability of an intelligent being, or group, to get 'out' of itself in order to attend to itself. A reflexive process which succeeds in 'getting out' in order to attend to all those patterns of communication which in the long term have become full of misperceptions is a necessary aspect of continuing interpersonal relations within any bound system of communicators.

The critique argues that both Bateson and Russell jumble up the notion of 'levels' in their discussion of hierarchy and that Bateson, in particular, does not distinguish the different forms of hierarchical organization, or logical generalization from totalization of perceptual forms. If Bateson had made the distinction, he would have clearly recognized that reflexive hierarchies are psychological and existential; they pertain to formal logic hardly at all. Wiley goes on to say that fallacies in reflexive hierarchy are not 'errors' in the narrow logical sense and require little discussion of the truth value of statements among communicators. Instead they require an investigation of the various forms of communicative loops in relation to the perspectives of those in communication. The 'meta-standpoint' in a reflexive hierarchy is not so much a 'higher step' which resolves the errors of prior standpoints (a meta-context which redefines relations between class and members in a prior context) as a 'loop' which permits members of the loop to stand back and look at the whole of the loop (Wiley, in Letters, 1499-2/1980).

Reflexiveness involves all of the collection of communicators. If a reflexive loop involving all members is perceived, simultaneously, as being at the same level of communication as message loops within the collection – then the group thinks it is using its self-corrective capability or reflexivity at the organizational level, when it is actually not. Hence its inability to overcome its error.[6] The error results from collapsing communication loops, which results in collapsed patterns of reflexiveness. Collapsed reflexivity is characterized by a twist in 'vertical' levels, feedback from whole to part, so that communicators are somehow *prohibited or blocked* from seeing their relations from the perspective of a higher standpoint of the whole. And because they are prohibited from seeing their relations at the meta-level, they are unable to jump out of their existing pattern in order to involve themselves in a new pattern of order. Bateson's 'double bind' should be redrawn as a 'double, double bind,' says Wiley, for it is a reflexive vertical bind on top of a horizontal error in framing that seals in the bind, prohibiting anyone from stepping out and seeing all of the collection of communicators. Double bind makes it impossible for members ever to untwist knots of levels of communication in the system (Wiley in Letters, 1499-1j/1980).

This analysis won approval from Bateson. 'Your distinction between three sorts of "levels" seems to be important. I have teetered on the edge of that for a long time,' he wrote back (Letters, 1499-2b/1980).

APPENDIX 3

Bateson's Model of Co-evolution

Any diagram of interrelated feedback between the two systems of evolution and learning presented in *Mind* might have led Bateson's readers to the conclusion that he was proposing a formal design in nature, similar to a cybernetic system of control. He was, of course, categorically opposed to any view that a 'wired' network exists in natural order. Nevertheless, there is some explanatory merit in constructing, after the fact, a diagram of the abductions he made in that book. I have characterized Bateson's abductions - qualitative comparisons - first, from the perspective of coupling in total 'system,' and then of coupling of levels, within system.

PRELIMINARY DEFINITIONS OF THE ABDUCTIVE TAUTOLOGY

Survival Circuits

Neither the stochastic system 'mind' or 'nature' is entirely random. Nor are they separable, as feedback creates a resonance between them, each in the other. A process of selection operates on their random components. They also have built-in governors. In 'mentation' (see note B), the processes which ensure the survival of tautologies are predictable repetitions. In evolution, EPIGENESIS, the term first used by his friend Conrad Waddington to denote the development of the embryo after it has been fertilized, is one process which ensures conservation and internal coherence. Epigenesis resembles the development of a complex tautology to which nothing is added after the definitions and axioms of that tautology have been laid down. Thus the analogy of epigenesis/tautology can be considered as a relatively abstract level or circuit of ideas of the same order. Processes in these circuits operate differently in two different stochastic systems (note A).

Temporal Properties

Predictable processes are *convergent* processes. Convergent processes are contrasted with divergent processes, processes which in time can never be predicted. Thus the relation epigenesis/tautology can be compared with the relation somatic adjustment / learning; as convergent processes, they can be contrasted with their opposite, divergent processes.

Mentation (Note B)

Processes belong to a stochastic system which has two levels, the level of TAUTOLOGY or RIGOUR and the level of LEARNING. Tautology, a process of *conservation* in mentation, is of similar type to EPIGENESIS, the processes of conservation or *internal coherence* in evolution (Note C).

The processes of *change* in learning can be considered analagous to the processes of *adaptation* in evolution.

The process of REINFORCEMENT in *change* in learning can be considered in relation to SOMATIC ADJUSTMENT in *adaptation* in evolution.

Evolution

Processes here belong to a stochastic system which has two levels of feedback, the GENETIC and the SOMATIC. Both create flexibilities and must be matched to the flexibilities in the other.

Genetic determination, as an operation of feedback, is analogous to HABIT in mentation. Genocopies enable somatic mechanisms to maintain levels of flexibility in evolution in the same way that habit rescues thought from requirements of constant trial and error procedures. Genetic change operates on *populations;* it *calibrates the bias* or tolerance levels of the homeostat of the phenotype; it does not simply adjust ongoing feedback. The result is a loss of flexibility for the individual phenotype. For this reason, genetic change is delayed in time (note D).

Somatic adjustment is an adjustment of the *phenotype* in relation to criteria of *fitness*. Bateson defines fitness in terms of 'acquisition of matching flexibility' (*Steps* 1972: 502) to the immediate environment of an ecosystem. It is a 'learning' of sorts; analogously, learning is a 'matching flexibility' to the criteria of ordered experience. Somatic experience and learning are among the least abstract and more concrete processes of the two stochastic systems (note E).

EXAMPLES

Acclimation

Somatic change deals with immediate adjustments at the superficial, most concrete level. A person travelling from sea level to 12,000 feet experiences somatic change such as panting. This context is sudden and readily reversible. An extended visit to the mountains results in longer-term acclimation, which produces a context that is less readily reversible. This is compared with the less reversible nature of genetic change. Any extreme adjustment of somatic variables will create stressful conditions whose relief is then available through genetic change. *Acclimation* requires far more than superficial change in one activity; control in many cybernetic circuits has to undergo adjustment, such as respiratory changes, expanded rib cage, higher haemoglobin levels, and so on. This is more general adjustment at a deeper, more abstract level.

These two changes of context, each having to do with somatic adjustment, are analogous with change of contexts in learning. *Proto-learning* deals with narrow fact or action, while *deutero-learning* deals with contexts and classes of context, 'learning to learn' (*Mind* 1979: 156).

Genetic Change

Genetic change operating on populations *calibrates the bias* or tolerance levels of the homeostat of the phenotype; it does not simply adjust ongoing feedback. Any change achieved through the genotype results in a loss of flexibility for the individual phenotype. For this reason, genetic change is delayed in time. There is a distinction between the *type* of information controlled through genetic mechanisms and the *type* of information controlled in somatic adjustment. The characteristic type of information in all somatic change is *analogical* with degrees of control; resemblances are a result of information processes channelled in continuous waves. Genetic changes, by contrast, may be either quantitative or qualitative in their final expression. As Bateson has emphasized elsewhere, 'quantity never determines pattern' (note F).

EXPLANATORY NOTES

Note A

Epigenesis resembles the development of a complex tautology to which nothing is added after the definitions and the axioms of that tautology have been laid down. Evolution must always, Janus-like, face in two directions: inward towards the developmental regularities and physiology of the living creature and outward towards the vagaries and demands of the environment. Thus there is a relation between epigenesis and tautology, as abstract processes of the same order, even though the two are to be found in two different stochastic systems.

Note B

'Mentation' here simply designates processes of thought in a stochastic system which has concordance with information processes in another stochastic system called evolution. To envisage the whole, the following diagrams must be enlarged even further to be set in a reflexive context. For a fuller comment on the reflexive characteristics of evolution, see the final paragraphs below.

Note C

Tautology is an aggregate of linked propositions, in this case propositions about feedback. The survival of tautologies is dependent on predictable repetitions and induces RIGOUR in mental processes. Learning, on the other hand, is an adjustment of sorts to the criteria of ordered experience; learning gives matching flexibilities. Proto-learning deals with narrow fact or action, while deutero-learning deals with contexts and classes of context, 'learning to learn.' Efficient handling of context and classes of context becomes sunk into HABIT, as efficient classes of somatic adjustment become sunk into the geno-copying mechanism.

Note D

Selection will favour those new items which do not upset the old forms. There is a contrast to be made with respect to genetic selection in the evolutionary system, which is injunctive *at both individual and population levels*. There is no phenotypic characteristic unaffected by the genes. Mentation is injunctive *at the level of the individual alone*. The culture of populations does not select for individual character and behaviour in the same manner that genetic selection determines phenotypes. Mentation has cultural value preferences as a selector operating on trial and error activity. Evolution has natural selection as a reference control upon mutations. Natural selection works upon the gene pool of a population. It is essentially conservative of features of anatomy or physiology, or any other genetic characteristics.

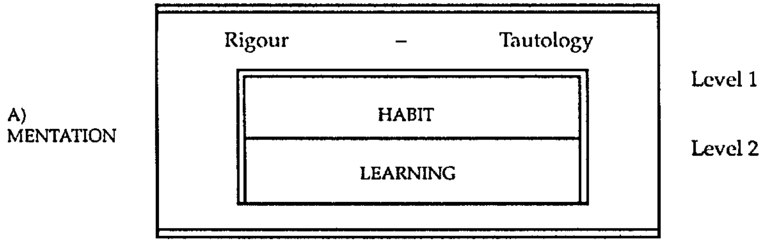
Note E

Somatic adjustment is characterized by degrees of adaptation. An extended visit to the mountains results in longer-term acclimation, which produces a context that is less readily reversible. Control in many cybernetic circuits has to undergo adjustment, such as respiratory changes, expanded rib cage, higher haemoglobin levels, and so on. This is more general adjustment at a deeper, more abstract level.

Note F

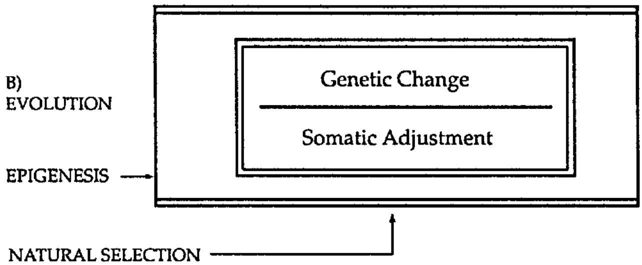
The hierarchical level of mentation exhibits both analogue and digital types of information organization. Ongoing trial and error, or ongoing experience of an individual in a local environment, is analogical; the classifying of repeated experience is digital, discontinuous, and concords with the presence of logical typing. The levels of somatic control are analogical but are marked by several degrees of control.

DIAGRAM 1: DOUBLE HIERARCHIES OF 'MENTATION'/EVOLUTION



LEVELS	ANALOGUE IN EVOLUTIONARY PROCESS
Level 1. Rigour-Tautology	Epigenesis
Level 2. Habit/Learning	Genetic/Somatic Change

Formal Comparison of Processes within Level 2

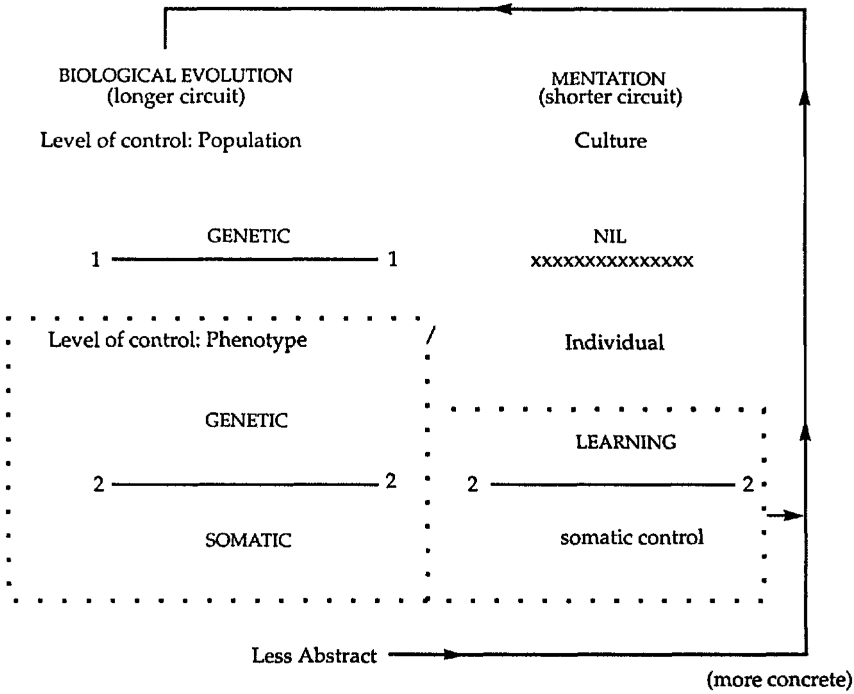


Considered as feedback systems, rather than static levels of a system, no feedback or calibration occurs separately from the other, and in all combinations of these there seems to be a necessary alternation between them. At a higher logical level, however, evolution operating upon populations does in fact achieve shifts in DNA. This calibration is subject to a larger and more abstract feedback system in which natural selection operates on mutation.

Contrast of Processes in Level 2 by Logical Type

GENETIC CHANGE		'MENTATION'
Type 1. Genocopies	(analogue)	Habit
Type 2. Adaptation/Acclimation	(analogue)	Learning and Reinforcement

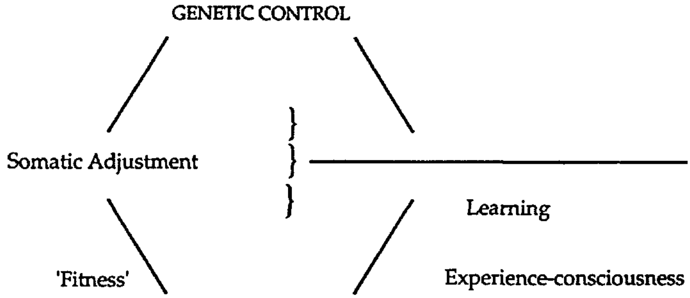
DIAGRAM 2: COUPLING AND MATCHING FLEXIBILITY



Mentation has no other level of control between individual learning and the level of population. This feeds potential for runaway in learned ideas. Culture cannot alter the homeostatic bias of individual learning in the manner that genetic alteration of bias alters the homeostat of the phenotype.

Both somatic control *and* LEARNING eventually 'peel off' into genetic control. Coupling involves different time series. In the short circuit, there are two levels to consider, the level of learning ('mind') and the level of soma ('body'). Somatic CONTROL, also appears in the longer circuit of evolution. In the shorter cicuit, mind/body relations are components of a single unit, the individual. In the longer circuit the somatic characteristics are still those of phenotypes (individuals), but phenotypes are constrained by populations of genotypes.

DIAGRAM 3: LEVELS OF CONTROL IN PHENOTYPE/INDIVIDUAL COUPLING



Every organism achieves changes of its own body in its lifetime. But the adjustment of organism (phenotype) to the environment is of a different type from natural selection. An organism must acquire certain somatic characteristics by use, disuse, hardship, and nurture, and *by habit or learning*. Acquired characteristics of this sort must never be passed directly on to the offspring.

Bateson offers an appraisal of this reciprocal adjustment in terms of his own predicament (he was 6 feet, 5 inches tall): 'If you are endowed with genes which predispose to tallness, you have to learn how to be tall and how to cope with this characteristic in a world where that characteristic need not be primarily a convenience – if there be such a thing as primarily adaptive characteristics' (Letters, 509-4b/1966).

In summary, the correct units of survival are interlocking patterns of interaction involving both individual organisms and populations in an evolutionary situation. The unit of survival is not a particular mutation of a subspecies in which a single change is followed by a single effect, as in the Darwinian (or Mendelian) versions. Survival in the biosphere constitutes processes of communication congruent with 'ideas,' so that the total network of mind and nature is

a system [of higher organization] in which there is always some of everything everywhere. [In holographic information] every part of the object is present throughout the negative so that any small part of the negative will give a picture – albeit blurred – of the whole object ... If we twang [a fishnet] at a given point waves of tension will spread in the net, be reflected back by the frame to the point of origin and out again. Twanging a different point will give a different pattern of resonance and any given pattern can be regenerated (or recalled?) by a twanging at one or more points at the edge or in the middle provided the time relations between these several twangings are preserved. ('Higher Organization,' CAF 138/1974/ A-3/A-4)

EVOLUTION AND REFLEXIVENESS

Throughout the discussion here, I have used the term 'mentation' as 'process of thinking,' a term that was not in Bateson's vocabulary. Bateson's 'mind' is a reflexive process attached to 'the double stochastic system of biological evolution' (i.e., genotype and somatotype) (*Mind* 1979: 182). The reflexive process of thought was presented as 'the zig-zag from classification to process.' But Bateson had some difficulties with this presentation of the *double system* – hence my use of the term 'mentation' rather than 'mind.' Nature may be a communicative order, but its processes of communication do not evolve in the same manner as that of individual consciousness – like dialectical zig-zags. It appears that he had not yet managed to resolve the problems of combining change in reflexive thinking with change of perception within a recursive ordering of natural events. These points are elaborated more fully in chapters 9 and 10.

APPENDIX 4

Scan, Interface, and Double Vision: A Model for Perceiving Ecological Wholes

Bateson's notion of 'scan' is an attempt to improve the model of the relation of process to structure spelled out in *Mind and Nature*. His model in *Mind* was influenced by the hierarchy of logical typing. There he proposed a dialectic between structure and process as a sort of zig-zag.[1] The published version of *Angels* mentions Bateson's dissatisfactions with this model in a brief footnote, but the significance of his change of thinking is all but lost.[2] He said that his model in *Mind* of dialectical zig-zag had emphasized the relation between structure and process primarily as a cognitive reordering of relations (i.e., reordering from the 'inside,' or 'the form side'). Now he required a model which would more clearly emphasize an ability to grasp percepts of 'the process side' in addition to 'the form side,' and their patterns of interconnection.

This process of scanning required as a minimum a triad of relations, instead of the two-step dialectic of class and its members he had put forward in *Mind*. The model of 'scanning' had to account for the way that the whole system - ecology, environment, mind - is able to re-enter an organism's perception, enabling observation in a recursive manner, without splitting organism from environment.

The steplike logic proposed in *Mind* attempted to capture process as a sort of broken spiral. This 'zigzag ladder of dialectic between form and process' contained a fatal flaw. It was oriented towards a dialectics of information which, like Russell's hierarchies of propositions, assumed a transitive ladder in its depiction of process. The spiral processes of Bateson's dialectic implied a pattern of discontinuous steps derived through contact of one level of a circuit with order at the 'next' level of the hierarchy.[3]

If the processes of reflexive thought were to accord with the characteristics of recursive coupling in natural systems, he required a model of reflexive communication that was *intransitive* in its processual orientation – and one which included patterns of loops within loops as a mark of its continuity. Bateson writes:

The whole long groping and argument ... gives us then a model, similar to the one sketched at the end of my *Mind and Nature* ... between 'form' (or structure) and 'process' (flux) ... There is one fundamental difference between that model and this which I now propose, in that I then saw the 'process' side of that model as composed of discontinuous steps. This was a serious error which arose because I approached the process side of the model from the 'form' side. I needed the process side to fill the gaps in the surely discontinuous formal component and this need was discontinuous. It was surely correct to see the form or structure side as discontinuous and hierarchical, but incorrect to project that discontinuity on to the process side. (*Angels* 1987: 166)

The paradigm of a scan at an interface is a smoke-curl from a cigarette:

A smoke ring is, literally and etymologically, introverted. It is endlessly turning upon itself, a torus, a doughnut spinning on the axis of the circular cylinder which is the doughnut. And this turning upon its own in-turned axis is what gives to the smoke ring separable existence. It is, after all, made up of nothing but air marked with a little smoke. It is of the same substance with its environment. But it has duration and location and a certain degree of separation by virtue of its own in-turned motion. In a sense, the smoke ring stands as a very primitive, oversimplified paradigm for all recursive systems which contain the beginning of self-reference or shall we say self-hood. (GB, 1977c; *Sacred* 1991: 223)

The method of scanning attempted to initiate an approach to the vexed question of change in recursive systems, which neither the logic of self-reproducing systems nor the mathematics of fractal geometries seemed to resolve. How is it possible to gain new perspectives in a system which closes back on itself? How can new patterns 'jump out' of a system – as in *moiré* – if much of the recursive patterns repeat self-similar forms?

INTERFACE

In the brief reference to Bateson's discussion of 'creative subjectivity' in chapter 9, I noted that Bateson thought one can become aware of processes in which repetitions of transforms of differences ('distinctions'/'indications') cross boundaries between unconscious self-reference and connections with other recursive systems, perceptual and cognitive, cultural, and natural. Through the examination of these transforms, we come to understand better the processes of linking, relating, and connection among the transforms. Where transforms of differences and distinctions cross boundaries between unconscious self-reference and connect with other recursions is the region of 'creative subjectivity.' Only here, at the boundary, in the coupling between self with other systems of selves, does one become aware of *transforms* of differences, so that explanation becomes possible. Bateson therefore sets himself the task of creating a model of 'scanning the interface' which would help understanding of these phenomena of coupling and conjoining between self-referencing systems.

Bateson develops the notion of a boundary or interface in *Angels*. He proposes that difference must interface twice into the process of perception. In the first case, the interface is in the form of perceiving a pattern of continuities; and in the second interface, differences that make a difference are recognized in order to enable classification to take place. Thus,

> the movement of image relative to end organs on the retina has the function of scanning, a function of turning a difference which was in a sense static in the image, into an event, a change. And if you in one way or another prevent the micromystagmus, the eye ceases to be able to see ... In some men the afferent impulse – for that is what we are talking about, may be news of an event outside of O[bserver] or it may be news of a difference between one part and another of the environment of O. And to make it more difficult of course, it is absolutely essential that O know the difference (that word again but now in a different sense) between those impulses which come in triggered by an external event and those impulses which come in triggered by that synthetic event created by the end organ itself. In other words, if I move my head and get that extra information by parallax, I have to be able to sometime ('I' whatever that is) to distinguish between these two ways of seeing. (*Angels* UE no. 2)

The knowledge of depth obtained in parallax, the increment of information, results in information of a different order. The transform is of an unconscious scan into a conscious event, and consequent transform of recognition of change in events. At this point, the scan coincides with other patterns of change, description of events in forms imagined 'from the inside.' The process then completes the recursion: the whole process of scanning (recognition of double differences) then imposes pattern on the 'outside.' This point is best represented in Notebook 56, Fall 1974: 'These two aspects – the digesting of incoming information into the creation of pattern and the imposition of pattern upon the "outside" are together crucial. It is at the crossing of these that creativity abides.' Boundaries of any interface are scanned as we meet them and are themselves changed as we alter our relations to them.

Bateson's method of scanning the interface is a reinterpretation of his prior method of 'double description.' The method of 'double description' had been Bateson's way of generating new information in patterns of human interaction that occur in the many levels of nonlinear systems in which two or more senses are combined. Double description appeared in several forms. When Bateson had examined the contexts of action in family therapy, he had noted that the reaction of individuals to the reaction of other individuals is organized in a sort of choreography of interactions in time. The choreography and its variations could be observed, and Bateson noted that each partner developed his or her own perspective of the 'dance.' Bateson termed this the 'punctuation' of the pattern of their communicative interactions. He also noted that if an observer combines the punctuations of the partners, then the product of punctuations can lead to a perspective of the whole system.[4] But only the analogy – not the method – could be employed in uncovering the choreography of humanity's interactions with nature.

DOUBLE VISION

One term Bateson uses in *Angels* for his new method of scanning is 'double vision.' The phrase 'double vision' is culled from William Blake. Bateson made many references to the poetry of William Blake throughout his writings as an example of how imagination becomes part of our faculties of perception. Blake had insisted on the importance of the 'eye' of imagination entering our processes of perception. Instead of simply perceiving 'with the eye,' we perceive 'through the eye,' Blake stated. This is a subtle but profound shift away from standard scientific interpretation of perception.

Bateson took Blake's point to mean that poets raised submerged features of the unconscious as an aid to our conscious understanding. The artistic imagination fitted particular parts of the content of submerged consciousness. Blake, he noted, had even written about the need to correct conscious interpretation through a synthesis of the polarities of consciousness and the imaginary (Notebook 39/1967; draft of *Steps* 1972: 128–52).[5]

The notion of 'double vision' is found in Blake's famous quatrain in his letter to Thomas Butts (22 November 1802):

For double the vision my eyes do see,
And a double vision is always with me:
With my inward eye 'tis an old man grey;
With my outward a thistle across my way.

For a long time, standard interpretations of the quatrain insisted that Blake was urging a move back from the objective order of science to the mystic or mythical. These interpreters allege that Blake supported the older superstitions; and he is putting the case for a reversion to the old mode of consciousness – formed by presences haunting it. Northrop Frye, the great Blakean scholar, was among the first to suggest that Blake's quatrain requires an entirely different interpretation.

According to Frye, Blake speaks about a third mode of consciousness, an enlarged mode in which neither objectivist reductionism nor superstition has its place. It is, says Frye, 'one in which the vision of gods comes back in the form of a sense of identity with nature, where nature is not merely to be studied and lived in but loved and cherished, where place becomes home' (Frye 1991: 84). Frye then goes on to speak of Blake's 'double vision' as a vision of a spiritual and physical world simultaneously present. Frye, the theologian, supports the interpretation of a 'double vision' which evokes the double presence of humanity and spiritual potentiality. Blake's third mode of consciousness is one in which 'our life in the resurrection, then, is already here, and waiting to be recognized.'

Our life in the resurrection is an attractive framework for thinking about the relation between humanity and nature and appears in various guises in much writing about ecology and spirituality. Here Frye and

Bateson part company. Bateson's conceptualization of a third mode of consciousness is aesthetic. Bateson brings 'old man grey' and 'the world of the thistle' into relationship with one another, but as the interface of metaphor and unconscious perception of redundancies. These are the means through which a 'double vision' is able to uncover the immanent field of aesthetics, embodying the rhythms of life and death. Scanning actively enables recursively derived understanding of patterns of recursive interactions. By this means, 'the thistle' in the world of appearances becomes matched with the 'old man grey' of epistemology. A new form of totemism, perhaps.

While Bateson's story really has no end, the interpretation from Bateson himself ends at this chronological point. Those who wish to pursue his recursive vision have to rely on what others have drawn from his stream of ideas about ideas. Almost at once, Bateson's own recursive vision becomes confused with the interpretations of others. For example, Maturana and Varela produced their own recursive vision in which they categorically reject the interleaving of recursive patterning in biology with cybernetics and information theory. Their versions of recursion, together with that of Spencer-Brown, were almost immediately confused with Bateson's. The first book to make this mistake appeared in the year following his death in 1980 (Wilder and Weakland 1981). The confusion is compounded in Keeney's discussion of aesthetics and cybernetic epistemology (Keeney 1983). More recently, Douglas Flemons continues their trend by taking the Spencer-Brown notations for a logic of recursive forms and linking these to Taoist conceptions of *wu wei* – emptiness, immanence, and the 'not-acting' self. Flemons argues throughout that Bateson's notions of mind fit such a potpourri of Taoism, family therapy, and the overtly Buddhist ideas of Varela (Flemons 1991).

Notes

INTRODUCTION

1 In social science the term 'recursion' has become familiar through the recent writings of Anthony Giddens. Social activities, he writes, 'are continually recreated by [social actors] via the very means whereby they express themselves as actors.' In and through these activities, social agents reproduce the conditions that make these activities possible. In Giddens's view, recursion is an important component of 'structuration,' structure itself being the rules and resources recursively implicated in social reproduction (Giddens 1984: xxxi–xxxiii, 3). Giddens's analysis, as with that of Jurgen Habermas and so much of modern social science, rests on the 'conceptualization of human knowledgeability [cognition] and its involvement with action.' This form of social agency Giddens regards as very different from the sort of 'knowledgeability' displayed in nature. The whole of Bateson's writing, by contrast, is directed towards overcoming the explicit dualism of human cognition as an expression of action which, in turn, is contrasted to the 'non-active,' 'non-intelligent,' 'passive' forms of intelligence attributed to nature. He would have found Giddens's and Habermas's notions of recursion a mirror of an unreformed theory of consciousness originating in the Enlightenment.

2 Gleick spends little time on the *qualitative* aspects of recursive form, the domain in which Bateson's ideas are prominent, and devotes most of his discussion to the discovery of *quantitative* elements of recursion.

3 The strength of Berman's book is that it shows Bateson's holism is based on a systemic, rather than ego-centred, theory of consciousness aligned to the natural world (Berman 1984: 190). Berman's analysis of Bateson is often good, sometimes scintillating, yet towards the end, he criticizes

Bateson from the standpoint of his (Berman's) own 'liberatory' stance on eco-politics. He writes a whole chapter criticizing Bateson's 'hierarchical' thinking, and linking it to a 'politics of consciousness' which Bateson never had. Berman relied on a key informant, Paul Ryan (Berman 1984: 345n. 26), who attempted unsuccessfully to persuade Bateson to alter his discussion of the interrelationship between cybernetics and holism and accept Ryan's own position.

4 Wilder and Weakland's volume is a collection of seminal essays on Bateson's ideas. Wilden provides a thorough exploration of Bateson's propositions carried forward into the field of communications and semiotic inquiry. Brad Keeney captures the thinking of Bateson's final years and from them distils a wealth of notions about recursive systems. Keeney emphasizes the importance of perception in grasping pattern in recursive systems and how this attaches to Bateson's aesthetic, 'the pattern which connects.' However, Keeney's book is concerned with family therapy and not ecological systems.

5 Bateson argues that any framework of recursion which separates human activity from nature is fallacious. Thus any idea of recursion which represents natural order only from the perspective of 'human agency' and 'social reproduction' is anthropomorphic. The larger question is how humans may derive rules about the recursiveness of natural order so that a recursive epistemology includes this knowledge of recursion in natural forms.

6 Following in the footsteps of his Christian upbringing, Gore believes that 'the image of God can be seen in every corner of creation' and 'by gathering in the mind's eye all of creation, one can perceive the image of the Creator vividly' (Gore 1992: 265).

7 A discussion of the difference between 'light green' reform and the 'deep green' challenge to the very paradigms of material affluence in modern industrial or post-industrial society is contained in *Green Political Thought* (Dobson 1990: 6ff).

8 Equally any investigator who concludes that increased global temperature – global warming – can be measured by some sort of meteorological thermometer, as if the living atmosphere was primarily an energy system, is also mistaken. The biosphere is more like a macrocosmic thermostat (see Appendix 1).

9 It is important to note that 'embodiment' in Bateson's writing does not refer to a physical or an organic body. In social science, especially among phenomenologists, the metaphor of embodiment tethers human thought to language and language to its connections with bodily gesture. The

metaphor of organic (bodily) embodiment is seen as 'the true medium of expression' which connects us with each other and with the world (Gill 1991: 154). Bateson rejects this form of 'embodiment' together with all organic physical metaphors to which it gives rise.

10 Thus he wrote in 1957, reflecting on the question of creativity in science: 'I [investigate] a large complex, interactive gestalt which has its own sense of artistic merit, which can be investigated by complex theoretical models [of interactive homeostatic circuits]' (Letters, 240–10b/1957).

11 Rodney Donaldson, personal communication.

12 Old scientific solutions to the Riddle of the Sphinx were clear enough. The power to bind was perceived to lie in physical energy derived from movement of atoms and molecules; and its 'embodiment ' lay in patterns of understanding about energy transformation. Our new answers to the Riddle of the Sphinx should be 'in step with how we conduct our civilization, and *this in turn be in step with the actual workings of the living system*' (*Angels* 1987: 177–8, emphasis added). See chapter 3 for further discussion.

CHAPTER 1 The Youngest Bateson

1 Mendel's publications were sent to Bateson by a colleague, the Dutch botanist Hugo de Vries. Others involved in the rediscovery of Mendel were the Austrian Erich von Tschermak, and the German Carl Correns. Once he had received Mendel's paper, Bateson immediately understood its significance and gave an address upon it on 8 April 1900 within a few hours of reading the German version (Lipset 1980: 35–7).

2 Though W.B. was the first person to suggest the term 'genetics' for these 'Mendelian factors,' he did not foresee that the subject matter of genetics would become a laboratory science. He thought of genetics more as natural history. William Coleman discusses the history behind W.B.'s interpretation of the term 'genetics' in 'Bateson and Chromosomes: Conservative Thought in Science' (Coleman 1971).

3 Some recent developments in molecular biology reject natural selection as the driving force behind evolutionary change in favour of evolutionary drift. The 'neutral theory' of evolution argues that evolution proceeds primarily as a system supporting conservation of existing characteristics, through ensuring neutral change of molecular characteristics. Equally, new interpretation of fossil records supports evolutionary fits and starts, long periods of stasis punctuated by fairly rapid change, instead of the continuous gradual change which Darwin proposed. For a neo-Darwinian defence, see Stebbins and Ayala 1985.

4 David Lipset records the following personal communication from Gregory Bateson: 'In fact, I fled from my mother ... after [W.B. died in 1926]. She took on the worst of his mannerisms with the rigidity of a convert. [My mother] had the whole thing rigged in which I was to become the precise re-incarnation of the old man' (Lipset in Brockman, ed., 1977: 46–7).

5 At the same time, Bateson also noted that in his younger days he never doubted the soundness of his father's positions because to do so would have brought about emotional rupture.

6 The fission and fusion models were developed especially by E.E. Evans-Pritchard in his study of the Nuer of the (then) Anglo-Egyptian Sudan, and Meyer Fortes in his study of the Tallensi of Nigeria. The two anthropologists combined to produce a classic text on the political systems of small-scale societies in Africa (Fortes and Evans-Pritchard 1940). For the origin of Gregory Bateson's discussion of segmentation, see 'Meristic Phenomena' and 'Segmentation, Organic and Mechanical' in William Bateson's *Problems of Genetics* (1979: 31–82).

7 Gregory Bateson also refers to Chladni figures: 'The matter of ... resonance patterns [of the Chladni figure type] has become of great interest as a result of recent suggestions of Karl Pribram that memory is, at least in part, achieved by something like hologram formation in the brain. A "mental hologram" is, if I understand it aright, a complex four-dimensional pattern of resonance in a three-dimensional neural network' (*Angels* 1987: 47). Here Bateson places biological description alongside cultural description so that matching of the 'double description' would produce a sort of 'third dimension' in understanding process and pattern in large complex systems.

8 'A Re-examination of Bateson's Rule' discusses the relation between redundancy in physical forms and redundancy in information theory, confirming the authenticity of his father's vision.

9 Another useful discussion of the interrelationship of the ideas of William Bateson and Gregory Bateson can be found in Berman's *The Re-enchantment of the World*. Berman makes the following comment: 'Above all, it was William Bateson's attitude toward reason itself which shaped so much of Gregory's scientific and emotional consciousness' (Berman 1984: 196). W. Bateson accepted 'intuitive insight' and recognized conceptual wholeness in art. These were, he believed, clear limits to any understanding obtainable by rational calculation, and evidence of a deeper level of reality which lay beyond the truth of any scientific explanation.

10 In particular, Gregory was well aware that 'the history of science is only

superficially guided by scientific research and disciplined thinking. Behind this superficial facade there is always a heaving mass of inchoate mysticism which the scientific figures themselves never put into words. One thinks of the big wooden box locked in Isaac Newton's rooms in Trinity College [Cambridge]. In this box he [Newton] kept alchemist manuscripts, deistic tracts and other occult material' (Letters, 321–13a/1968).

11 This adventure with film and perception was pursued further during the war years, when Bateson undertook an exhaustive analysis of the Nazi propaganda film *Hitlerjunge Quex*. His analysis concentrates on how Nazi propaganda in the film builds upon generalizations made from systematic contrasts. One set of contrasts in the film, he noted, was artistic and spun out of the plot; the other was emotional. Each was a set of implicit contrasts, implicating each other. 'An Analysis of the Film *Hitlerjunge Quex* (1933)' was written in 1943 (GB, 1943b). It was revised for publication by Bateson and appears as a chapter in Margaret Mead and Rhoda Métraux's *The Study of Culture at a Distance* (Mead and Métraux 1953: 302–14).

12 Worse, their functional interlinkage, a figment of the anthropologist's scientific imagination, is said to constitute 'the structure' of society.

13 All relationship between any observer and a system to be described requires a mapping of 'the typological relations between messages,' as Bateson put it. False categorization results from the observers' relationships themselves containing propositions about truth and validity. In this sense, the confusion between 'classes' and instances is tied to the conditions of communicative interaction between the observer and other scientists; their establishment of classification rules is as much a means to report to themselves in precise technical language as to record what an observer 'factually' observes.

14 Even in his original publication, his writing on circular and reticulate phenomena is prescient: 'since the phenomena which we are studying are themselves inter-dependent it is certain that our descriptions must contain inter-dependent statements; and since this is so the descriptions must forever be regarded as "not proven" unless we can devise some method of transcending the limits of the circles.' The research goal became a matter of awakening science to the 'limits of the circles,' not finding methods that will bring about short-cuts to these limitations (*Naven*, 2d ed., 1958: 117).

15 Bateson's contribution to the book was largely to tie together a series of propositions which would give intellectual credence to the new style of therapy. His contributions are both assertive and epigrammatic and drew

very little upon the descriptive material of anthropology for support. But then Ruesch drew little upon psychiatric case histories (Misc. Mss., box 6; 1987: 275, items 56–7).

16 The book would have dealt with the issues of entropy, vicious circles, purpose, error, metacommunication, the limits to knowledge (Maxwell's Demon), value theory considered as relation between phenomena, signs, signals, codification, the difference and relation between mind and body, and the implication of time (Notebook 4/1948).

17 In 1961 Bateson edited a slim volume entitled *Perceval's Narrative: A Patient's Account of His Psychosis*, 1830–32, which describes the symptomatic situation and 'cure' of a schizophrenic, the son of a former British prime minister.

18 'Worse, it distorted those ideas and spread many misunderstandings about the double bind and basic communication theory as we were developing it' (Letters, Jay Haley to Carlos Sluzki and D.C. Ransom, 1319–10a/1976).

19 Haley's 'Development of a Theory: A History of a Research Project' was written originally in 1961, when the research project (1952–62) was ending. Bateson discouraged him from publishing it but later was glad to see it in print as part of the Sluzki and Ransom retrospective *Double Bind* (1976: 59–103). Bateson commented to Haley on receiving the manuscript that he thought his article was 'a history,' not 'the history.' A copy which Haley sent to Bateson before publication prompted this reply from Bateson: 'For me it brings back all the bitterness and agony of being unable to get my point of view across to you. I guess you thought that every move I made was a "power" play. I assumed, of course, that a year or two of working in our project would be sufficient to convince you that "power" is a cultural myth based upon an anti-cybernetic position, ideas of lineal causation and so on. I did not estimate correctly the enormous power (in another sense) of that myth' (Letters, 593–104a/1970).

20 Watzlawick replied, admitting in his letter that 'it has only recently dawned on me how you conceive of the connection between evolution and communication. This is truly fascinating stuff ... ' (Letters, Watzlawick to Bateson, 1463–20a/1966).

21 Haley comments: 'The issue of power and control was always a problem within the project. It seemed to me that how much power one person would allow another to have over him was a central issue in human life. It was also a particular issue in our special fields of investigation – hypnosis, therapy and processes within families, particularly families of the mad. There was little or no research on power and control at the time, and in fact there seemed to be an avoidance of the subject. The moral

issue whether one should or should not struggle for power seemed to introject itself into the study of the phenomenon. I was trying at the time to shift from an observation of the individual to the observation of a system, and to view a power struggle as the product of the needs of a system rather than the needs of a person. I still prefer that view and am trying to clarify it. I think it is misleading to say that an individual has an inner need to control other people, just as I think it is naive to postulate an instinct of aggression' (Sluzki and Ransom 1976: 78).

22 The following comment from Lynn Hoffman underlines the significance of Bateson's premonitions: 'After Haley began to study coalition behaviour in families with schizophrenics, he changed his position [and suggested that a family member may find himself in the predicament of being punished for choosing sides. This idea] ... made the irrational behaviour of individuals the consequence of [power in] the social structures they inhabited, not simply a consequence of confused or contradictory messages. This shift brought family therapy to a new place. Family theory could no longer be dismissed as some kind of linguistic metapsychology but could be fairly placed with other contemporary behavioural research' (Hoffman 1981: 107). Additional evidence of Haley's attitude is in Lipset (1980: 222–6).

23 Another danger, he believed, was the increase of radioactivity affecting the Van Allen belt, that is the radiation belt partly surrounding the earth at heights of several thousand kilometres, containing high-energy charged particles. This has not proved to be the case; increased radiation was modified by international agreements on underground testing of atomic weapons. Thinning of the ozone layer through chemical use of CFC's, especially by the military-industrial complex, has replaced this global concern of vastly increasing the levels of radioactivity above the earth.

24 Questions put after his talk suggest that he had not won his audience to his point of view. It was evident many students in the audience branded him as a political conservative. The reaction is similar to that accorded to other environmentalists at the time. The nascent green movement was viewed by the left as a hyphenated mixture of radical-conservative. Its radicalism stemmed from outright rejection of economic growth as the prevailing *raison d'être* for government and Western scientific enterprise. The left wing found this stance to be totally unacceptable for the left wished to promote both economic growth and Western science.

25 The role of Barry Commoner in Bateson's conference is explored in *Our Own Metaphor* (M.C. Bateson 1972). For Commoner's views at this time, see his *Science and Survival* (Commoner 1966).

26 For some time, Bateson had been taken up with the possibilities of the mathematics of group theory as an abstract domain in which to think about the topology of a variety of communicative forms in biological and social science (see chapter 8). So, of course, was Piaget, whose little treatise on 'structure' saw fruitful applications of group theory in a wide range of disciplines, including anthropology, linguistics, psychology, and biology (Piaget 1970). 'The particular models I've been using,' said Bateson, ' ... have been mainly group theoretical, homeostatic and [A.] Bavelas indirection approaches [directed graphs], limited-communication, group dynamics type of things. And evolutionary ... And I've toyed around with one or two mathematicians on the general question of [whether there is a mathematics to describe] a phase-space which would be organized not in Cartesian terms, in quantities, but would be organized in group theoretical terms [as transformations in a limited space region]' (Letters, 240–10b/1957). Bateson is evidently referring to the mathematics of an 'attractor,' which later is described as a space of stability in non-linear chaos theory.

27 'Collaboration between Ecologists and Government,' memorandum, 22 Dec. 1969. This unpublished memorandum was written in preparation for testimony on behalf of the University of Hawaii Committee on Ecology and Man, presented in March 1970 before a committee of the State Senate of Hawaii in favour of Bill S.B. 1132 (Letters, 426–8a; *Steps* 1972: 488).

28 His argument about 'trust' was one that he had initially developed just after the Second World War when he sat on committees of scientists that included Robert Oppenheimer, administrative head of the Manhattan Project, and Alger Hiss, subsequently tried for espionage, both of whom sought to understand the effects of nuclear weaponry on military defence strategies and international politics (Notebook 7/1948–50; GB, 1946d: 10–11, 1946e: 26–8).

29 There are some parallels between Bateson and the GAIA hypothesis (see Thompson 1987), but Bateson certainly did not perceive the planet or the biosphere as the sort of super-organism which James Lovelock describes in his first book on GAIA. In his more recent work, Lovelock calls on readers to consult Bateson to deal with the experience of the metaphor of 'GAIA' (Lovelock 1990: 216ff).

CHAPTER 2 A Theory of Consciousness

1 Classic statements of this sort are analysed in *The Social Construction of Reality* (Berger and Luckmann 1967: 18).

2 They argue that while psychologists might talk of 'individuation,' every

psychic deviation from a culture's norms must in some way be related to those norms. No individual was ever entirely separated from his social network. Equally, the values of a social network partly determine the network of perception. For all human beings and all cultures have some understanding of 'good' and 'bad.' A human being 'must act in terms of what he knows – good or evil – and, when he acts, he will meet with frustration and pain if things are not as he "knows" them to be. Therefore he must, in a certain sense, wish them to be as he "knows" they are' (*Communication 1951: 176*).

3 Their arguments are derived from cybernetic theory. Cybernetics defined itself as the study of circular causal mechanisms, but 'mutual causal' has the same type of meaning. Unlike linear or one-way causal mechanisms, mutual causal mechanisms exhibit a sequence in which the output from A modifies B, whose response becomes part of the subsequent input received by A. The way B responds to A is an aspect of A's self-monitoring; hence B's response informs A about itself and its setting. Bateson wrote of circular causation: 'Throughout the whole subject of genetics and evolution, indeed the whole subject of communications theory, the secret is to ask a) what are the total possibilities of what might happen b) what items of this larger set fail to occur c) what is the reasoning for the non-happening of that which does not happen? Never ask why what happens does happen. To ask this will only land you in totally unacceptable metaphors involving energetic causation' (Letters, 465–2c/1962). This letter to C.H. Waddington, however, was not posted.

4 Bateson pursues his metaphor of addiction and 'war' in other contexts. Perhaps the only condition under which the world will not go to hell in the present nuclear confrontation, Bateson wrote, is that we, both Russians and Anglo Saxons, be willing to let it go and rebuild relations based on this joint trust (Notebook 14B/1951).

5 This, of course, is true of dialectical materialism as well as positivism in science. Bateson concentrates on scientific positivism, although he comments from time to time on Marxist thinking. He suggests the latter is more rigorous than positivism because it is so consistent in its materialist propositions.

6 The Marxist notions, borrowed from Hegel, of thesis/antithesis/synthesis (proposition / contradiction / reversal of contradiction to include the initial proposition) are conflictual and exclusionary because they are framed within the context of objectivity and/or power.

7 In an earlier tradition of communication studies, this 'power' was called 'gatekeeping.'

8 This point is drawn from comments by Albert Scheflen, who goes on to

point out that most systems theory is written in some mixture of the two epistemologies (Newtonian interaction and cybernetics). Family therapy is an example. And double-bind theory, too, is a mixture of these epistemologies. It is a hash of communicational field concepts and a view of the interactional exchange of messages (Scheflen 1978: 127–49).

9 Some sociologists even insist that reflexiveness is a field of activity based on objective relations of power. The case which comes immediately to mind is that of Pierre Bourdieu (Bourdieu and Wacquant 1992). Bourdieu's definition of a 'field' is entirely that of a field of social power.

10 The context of this comment is as follows: 'As I saw it, he [Haley] believed in the validity of the metaphor of "power" in human relations. I believed then – and today believe even more strongly – that the *myth* of power always corrupts because it proposes always a false (though conventional) epistemology. I believe that all such metaphors derived from pleroma [physical energy] and applied to creatura [living systems] are antiheuristic. They are groping in a wrong direction, and the direction is not less wrong or less socially pathogenic because the associated mythology is in fact self-validating among those who believe in it and act upon it.'

11 Jay Haley, who worked so closely with Bateson, argued that it was true that the observer of social and political contexts in which power is perceived as objective reality soon evokes this 'reality.' But despite the sort of false perceptions that Bateson pointed out, conflicts *in the system as a whole* can still be perceived as a conflict of 'needs.' Hence, by inference, some notion of a 'drive for power' is valid. 'When the [organizing] hierarchy is not clearly established, the creatures within it will struggle with one another. An observer watching the action and thinking in terms of the individual as a unit can postulate a drive for power within the person because he is not viewing the [systemic] situation. I have found it most productive to postulate "needs" in the [systemic] contexts individuals participate in, and I was groping in that direction at the time of the project [on schizophrenia]' (Haley, in Sluzki and Ransom 1976: 78).

12 There is sometimes a confusion in Bateson's argument between many-valued logic and many-level logic (Wilden 1972: 498). Bateson's use of the term 'power' in a systemic sense comes close to a notion of 'multiple empowering,' which can be taken in both senses, namely, levels and values. For example, the following quotation could imply both: 'Consider a court of law. There is one sort of "power" for the judge, another sort for the jury, other sorts for the attorneys on each side, a special sort for the defendant, and another sort for the policeman at the door. It is precisely the

differentiation of sorts of power that is basic to all *systems* (political, ecological, etc., etc.), and this fact necessarily bankrupts the analogy between power in physics and "power" in politics' (GB, 1974l: 27).

13 It also resulted in Bateson's large claim that 'scarcely a single principle worthy of a place in the list of fundamentals' had been produced in the behavioural sciences besides cybernetics (*Steps* 1972: xix).

14 The reference to physicists is as follows: 'Physicists construct a materialist prison out of what they have observed, believing all the while that the external data yielded from experimentation is valid and "real."' Yet 'between one experiment and the next [even] our physicists sneak around the corner and consult mediums' (Letter to Nick Humphrey, a reviewer of *Mind and Nature*, GB, 1980a).

15 The modern German philosopher Hans-Georg Gadamer also discusses the links between ritual and play, and the good and the beautiful, in order to show that there is no meaning to 'play' other than creativity focused upon the idea of play. Play, as Gadamer points out, is an elementary condition of human life (Gadamer 1986). Yet Bateson's aesthetics owes little to the German tradition of idealism. There is in Bateson's writing a clear distinction between idealism and holism. This is why Bateson drew upon the English poet William Blake, rather than Kant, Hegel, Fichte, or Nietzsche.

16 In role theory, for example, individuals are portrayed as actors; social change creates a situation in which individuals are required to learn to read another sort of 'script.' The 'script' of the play is, according to role theory, a morality play, for as actors assume new roles they recreate social norms, customs, and morals, all of which undergo change.

17 Equally, an idea, like any mental process, cannot be described as a locatable 'thing.' As I will explain in the next chapter, an idea owes its existence to a 'binding' in time. Indeed, only in a metaphorical sense may a 'great idea' or a 'new idea' be said to 'stand out' – that is, be a definite locatable figure – against the rest of the background information.

18 The major difference between AA's interpretation of a 'higher Power' and theological interpretation is that AA regards neither 'self' nor 'system' as beings or souls in an other-worldly relationship – as commonly represented in theological interpretation. All the circularities, oscillations, adjustments, and change occur within a communicational order that is immanent, of the here and now.

19 Briefly, his position is that all mapping rules are looplike – and looplike comparisons, by confusing levels of interpretation, create situations in which it is almost impossible for us to avoid paradox. In a self-referring

system, no mapping can be made other than the self-referring mapping of relations between the observer and the observed system (of which the observer is a part). Only in time are the paradoxes which arise from errors of self-reference in the mapping of relations overcome.

20 Some postmodernists use the technique of 'deconstruction' to unsettle the theories with which we have surrounded ourselves. Modern deconstructionism is mostly concerned with statements or text, especially the text of Western philosophy, and with techniques which enable metaphysicians to modify existing terrains of thought by producing new configurations from the 'inside' of the text. Several of the key postmodernists, Derrida in particular, conflate the 'text' context into a wider realm of 'being' as a starting point for a critique of authorship and textuality in Western society. Lawson's account of Derrida is indicative: 'The glimpse beyond is made possible through the reflexive turning of the text to itself, for in this movement the present meaning is shaken and is shaken in a way that cannot be simply thrown off. [Derrida says:] "Once the circle turns, once the volume rolls itself up, once the book is repeated, its identification with itself gathers an imperceptible difference which permits efficaciously, rigorously, that is, discretely, to exit from the closure [of knowledge]." Thus the move of reflexivity allows the text to indicate in the shift of meaning that there is something beyond what is merely said' (Lawson 1985: 113). According to Derrida: 'Repeated, the same line is no longer exactly the same, the ring no longer has exactly the same centre, *the origin has played.*'

Bateson's notions of mapping are recursive, but his understanding of reflexiveness reaches far beyond the social context of closure of textual knowledge and the individualist assumptions inherent in the author-text-reflexive search relation.

CHAPTER 3 The Map Is Not the Territory: Time, Change, and Survival

1 'I had learned a great deal from [Radcliffe-Brown] and had formed an affection and an admiration for him when I was in Sydney for a term in 1928. But between 1928 and 1935, there was most of my thinking that went into *Naven*, so I had moved forward a long way. R-B had not moved correspondingly and was, I think, a little frightened of the progress made by others (as I grow older, I begin to recognize the feeling)' (Letters, 1367-b1/1974).

2 'Our standard method of communicating [in living systems] will be "a R

b" (a in the model has such-and-such a relationship with b in the model) and A R1 B (A in the territory has so and so relationship with B in the territory) and R[elationship in the model] is identical with R1 [the Relationship in the territory]. The relation between a = b is the same as the relation between A = B. Never shall we suggest that a = A or that b = B. To do so is in fact the central sin in all analogic thinking: it is to say that the roads in the territory are made of printer's ink' (Notebook 12B / Jan. 1950).

3 The changed understanding of form began in the latter quarter of the nineteenth century, before Einstein. One of the major nineteenth-century reformulations lay in James Clerk Maxwell's studies of electromagnetism. Bateson was fond of citing this example. Maxwell showed that the characteristic forms of 'attraction' and 'repulsion' occurring in electromagnetic fields could be studied as transformation of patterns without any reference to material bodies (Williams 1980).

4 'For this purpose, the mind involved in the materialist theory dissolves into a function of organism. The psychological field then exhibits what an event is in itself. Our bodily event is an unusually complex type of organism and consequently includes cognition. Further, space and time, in their most concrete signification, become the locus of events. An organism is the realisation of a definite shape of value ... an event is [both] a matter of fact which by reason of its limitation is a value for itself; but by reason of its very nature it also requires the whole universe in order to be itself' (Whitehead 1967: 194).

5 Thus Bourdieu writes: 'To think in terms of field is to *think relationally.* The relational (rather than more narrowly "structuralist") mode of thinking is as [Ernst] Cassirer demonstrated in [*Substance and Function*] the hallmark of modern science ... I could twist Hegel's famous formula and say that *the real is the relational*: what exists in the social world are relations – not interactions between agents or intersubjective ties between individuals, but objective relations which exist "independently of individual consciousness and will" as Marx said' (1992: 96–7). Bateson would agree that to think in terms of a field is to think relationally, but the notion that in this field 'objective relations' exist independently of 'intersubjective ties between individuals' arises from a false distinction in the first place between 'individual consciousness' and 'objective relations.'

6 Bateson replied to the historian of anthropology George Stocking that conversations with 'Whitehead in 1947 [on Whitehead's tour of the United States] did not specifically shape my thinking at that time' (Letters, 1367-2a/1974). Yet, as already noted, Whitehead's 'fallacy of mis-

placed concreteness,' the mistaking by an observer of part of a problem as a whole or universal, is discussed extensively in the first edition of *Naven* (1936), and Bateson uses this example of fallacy repeatedly from then on. His debt to Waddington for 'disentangling' the notion of misplaced concreteness and planting 'the seeds of Whitehead's philosophy in my mind' is noted in *Naven* (2d ed., 1958: 263).

7 As Bateson was constantly pointing out, the whole history of evolution, the idea of evolution in biological science, is in many ways an historical expression of changing perceptions of stability and change by evolutionists themselves. Changing perceptions define that which is specified as 'evolution.' In the study of evolution, as elsewhere, the relation between time and observed patterns of change is elusive. All observers of the natural order live in time and bring their own experience of time to the understanding of what they are observing. As a result there can be no 'objectively true' statements about simultaneity or temporal succession. Instead much of the truth of scientific statements of the relation between time and change rests upon an agreement that the means by which the observer identified a pattern was accurate.

8 Whitehead, of course, had little understanding of cybernetic feedback in information systems, since cybernetics did not appear until twenty years after *Science and the Modern World*.

9 The capacity of living systems to adjust to change by reorganizing their response to variance and to 'dampen oscillation' through internal reorganization was one of the crucial features of cybernetic explanation. Bateson brought it quickly into his study of family therapy. 'The question of changing the patient is evidently one of the points which are imperfectly formulated in therapeutic orthodoxy ... I suspect that there is a central difficulty in formulating the matter of change, which is the same difficulty as that which we have in anthropology in deciding whether a culture ever changes' (CAF 166-D1/1948–9).

10 Though 'rationality,' by implication, could not rest on the two-valued certainty of 'truth' or 'falsehood' explicit in Aristotelian logic, for 'either-or' formulations are far too simplistic for the multidimensional order with which all mapping processes must cope (Korzybski 1949: 61–3).

11 'There is an if-then of events – which is temporal ... Now since Greek days, and perhaps earlier, there's been another set of if-then's, which I'll call logical ... [logical] "then" is not a temporal value. It is a timeless "then." And what we used to ask about computers in the [19]40's was, can computers simulate logic? It was precisely the wrong question. The right question was, can logic simulate cause and effect. The answer is

that it can not. Unless you let time into logic ... all good logicians, you see, want logic ... to be a totally empty world [of pure content] with no juice [natural history] in it ... the moment you get context, then what you say at Time 1 is a context of Time 2, which is the context of Time 3, and so it goes. Math has to have process in it' ('Dialogue between Werner Erhard and Gregory Bateson,' audiotape transcript, 4 Sept. 1976, p. 2).

12 Yet, despite Korzybski's elegant presentation of difference as the ground for mapping relations, Bateson went back to the original theorem quoted by Korzybski, the Weber-Fechner Law, for his own elaboration of difference in structure and process. According to Bateson, it was Weber who discovered (in 1834) that perception was related to ratios of intensity in the 'stimulus' and showed for the first time 'that the ability to perceive difference between two weights is based on the ratios between them and not upon the subtractive difference ... Now that discovery that the first and most fundamental step of mental life – the receipt of news of a difference from the outside – depends upon difference, and that the differences are in fact ratios, is basic for epistemology, the science of how it is we can know anything. We can only know by virtue of a difference. This means that our entire mental life is one degree more abstract than the physical world around us' (*Sacred* 1991: 309).

13 In pure science, the author of the most forceful alternative to the 'received view' was Thomas Kuhn. The logic of scientific discovery, his argument ran, had little to do with the direct application of axiomatic rules. Discovery proceeded unevenly in fits and starts, usually punctuated by historical episodes in which an older scientific 'paradigm' is replaced in whole or in part by an incompatible new one. These developmental episodes could be considered equivalents to 'scientific revolutions.' Nevertheless, philosophers of science objected that the term 'paradigm,' as Kuhn used it, was so general that it could not be easily applied. Some critics claimed it was so misleading that it was 'a positive hindrance to the understanding of some central aspects of science' (Suppe 1977: 135–51).

14 The correspondence between him and Arthur Koestler, another general systems theorist, was testy, to say the least.

15 Jantsch writes of a new paradigm of 'self-realization' through 'self-transcendence' in which 'a transcultural sense of mankind will develop.' This is a typical theme in *Evolution and Consciousness: Human Systems in Transition* (Jantsch and Waddington 1975: 7). In it appear essays by C.H. Waddington, Ilya Prigogine, who did so much to carry these ideas into pure science, Magoroh Maruyama, a cyberneticist, and an ecologist, C.S. Holling.

16 Bateson even shunned the usual correlations which linguists drew between symbols and 'meaning.' Semantic probing of symbols amounted to a trivial exercise in mapping data onto data, he said (for further discussion see chapter 6):

> Q[uestioner]: Would you like to reflect on the capacity to symbolize.
> G. Bateson: I never use that word. I don't like using it because the word tends to cut things up when people talk of symbols as if they were parts of a dictionary and you could have a dictionary of flowers, like Orphelia, a rue means this and a rose means something else. Dictionaries of symbolism always seem to me to be cheap representations of what really happens. I don't like dictionaries of words. I think they mostly tell lies. Words are not really like that ... [Do not think in terms of items] but always think in terms of the relationship between them ... The correct answer to 'how many fingers do you have?' is not five. The correct answer is that what I have is four relationships between fingers ... (GB, 1980b: 19; *Sacred* 1991: 302)

17 Among those used to dividing the world into the two opposed categories of idealism and materialism, the classification of Bateson as an 'idealist' does, of course, suit their views. A typical example is the anthropologist Jonathan Friedman, who calls Bateson a 'Hegelian Ecologist' (Friedman 1979: 262ff).

18 In addition, Korzybski's interpretations were rooted in the mathematics of probability (Korzybski 1949: 640), which fell foul of Bateson's objections to any science which couched its explanations in quantitative descriptions of phenomena.

19 Nor did he believe that information patterns conformed to Jungian versions of coincidence. Bateson's dispute with Koestler involved the notion of coincidence expounded both in the Jungian version of synchronicity and in Lamarckism. Koestler also was a champion of Paul Kammerer, a Viennese experimental biologist who committed suicide in 1926. Kammerer was fascinated by coincidences throughout his life and, like Jung, kept a log book of them. Kammerer argued that 'the recurrence of identical or dissimilar data in contiguous areas of space and time is an empirical fact which has to be accepted and which cannot be explained by coincidence.' Kammerer's experimental work in biology, on midwife toads, suggested that Lamarckism has some basis in evolution. After the First World War, Kammerer's experimentation was denounced by Bateson's father as fraudulent; this led in turn to events which eventually resulted in Kammerer taking his own life. Koestler wrote a whole book on the incident; for details, see Koestler 1978: 261ff.

20 Only some early information theorists, like Colin Cherry, recognized that a communicative situation is itself *always* implicated in the transmission of messages (Cherry 1966: 220–57). As we shall see in chapters 5 and 6, most cyberneticists defined 'news' simply as a potential of signals in a channel to inform. 'Information' was 'clear instruction,' as opposed to indistinguishable signals or 'noise.' Their concerns were analogous to those of telephone engineers: if there is to be communication via a telephone link, then the primary consideration must be the design of the link to transmit identifiable voice sounds from one place to another.

21 Ideas exist as contrasts and comparisons, and the appropriate way to begin to think of patterns of ideas, and the meta-patterns which connect, is primarily as a dance of interacting parts only secondarily pegged down by various sorts of physical limits: ' ... in my mental world or universe I acknowledge no things and obviously, of cóurse, there are no things in thought. The neurons may be channels for something, but they are not themselves things within the domain of thought, unless you think about them, which is another thing again' (GB, 1980f; *Sacred* 1991: 237).

22 Eugene Odum, it should be noted, is himself oriented strongly towards a systems viewpoint. His 'general system' is, however, that of 'life storage,' which has energy as its focal point of reference. In fairness, his text features many aspects of ecosystems which have little to do with energy transformations: aesthetic values, organizational hierarchy, holism, homeostasis, diffuse networks of processes operating in different time scales, contrasting ecological types, resilience, redundancy, thresholds, coexistence, co-evolution, ecological climax, and succession.

CHAPTER 4 Metaphors for Living Forms

1 'The mental landscape in which Gregory moved is, to most of us, a foreign one, as foreign as the ways of thought we might have to explore in the study of culture with different premises from our own, or perhaps the study of another species. I have consciously to shift gears when I want to work in Gregory's frame of reference' (*Angels* 1987: 184).

2 The inclusions and exclusions in his list changed from time to time, but these were among the core writers he registered as his 'intellectual forebears.'

3 This comment is in a series of exchanges with Connie Hansen. Hansen wrote on 15 April 1974: 'I have come to the conclusion that the main reason your ideas and you are not spreading faster is because of the way you write them. I find your writing unnecessarily complicated, vague and

over wordy. It takes the patience of Job to get what you are trying to say ... And I find that the average reader does not have the time or the patience of Job. They complain it takes three to four readings to get the essence of one article and they believe that what you have to say could be said more simply with less work for the reader' (Letters, Hansen to G.B., 610–1b/1974).

4 Writing at an earlier date, he said: 'It is exceedingly difficult to get people to correct their epistemology, but some sort of narrative of how [my] epistemology grew leading directly into the new positions may be useful.' It is quite clear that Bateson's prologues as to how his ideas came about were meant as a solution to his audiences' lack of comprehension (Letters, 52–23b/1970).

5 During 1947–8, as his marriage to Margaret Mead was dissolving, Bateson suffered from bouts of depression. Mead persuaded him to go to a Jungian analyst and common friend, Elizabeth Hellersberg (*Daughter's* 1984: 49).

6 His biographer, Lipset, notes that at the age of fifty 'for a second time he was in panic for his professional life' (Lipset 1980: 205). The panic period refers to the hiatus in funding in 1954 from the Josiah Macy Foundation to Bateson's communications project.

7 The most evident case of this is anthropology. One of the few British anthropologists to remain friends with Bateson, Edmund Leach, said of *Naven*, his first publication, 'it is virtually unreadable but contains enough original ideas to fill a library.' The significance of the ideas in *Naven* caught fire in British anthropology in the 1960s, and a reprint sold well (Leach 1980). Yet, by the time anthropology had caught up with Bateson, he was seemingly out of the discipline and writing about systems issues which few anthropologists considered, and even fewer would identify as relevant to their own discipline.

8 There is a problem in Bateson's use of the term 'tautology.' If we follow Wittgenstein's *Tractatus*, a tautology refers to a truth of logic. In the technical sense in which Wittgenstein uses it, a tautology is a proposition of which the contradictory is self-contradictory (Russell 1977: 308). Yet the glossary of terms in *Angels* (1987: 212), which defines Bateson's use of tautology, reads: 'An aggregate of linked propositions in which the validity of the *links* between them cannot be doubted. The truth of the proposition is not claimed, e.g. euclidean geometry.' Bateson shifts the strict definition of tautology in logic to premises and relations in an interactive communicative setting. In Bateson's use of the term, tautologies are propositions of belief more than principles of a logical set.

9 This is one reason Bateson felt quite comfortable in using Jung's term 'creatura' in a manner entirely different from the way in which Jung had used it (M.C. Bateson, 'Daddy, Can a Scientist Be Wise?' in Brockman 1977: 59).

10 Most of the section on logical typing in 'Toward a Theory of Schizophrenia' was cut by the editors of *Behavioural Science* (vol. 1, no. 4, 1956).

11 Hopscotch is the first step away from the notion that the physical world is the 'real' world. We have instead to investigate the interaction of ideas: to take whatever ideas we can and throw them into the hopscotch, and then experiment 'with whatever ideas we'd like to throw onto that frame ... music ... or dance ... or whatever we can think of as presenting experiences that would be relevant to the whole thing' (CAF 258-A1/ 1974). Hopscotch is a metaphor of the embodiment of mind and the functional unity of intellect, body, and feeling. The same images, drawn from Blake, occur in his 'Radical Software' speech referred to below.

12 The Blakean metaphor of *Innocence and Experience,* the comparison of freedom and determinism in youth and old age, takes up a whole chapter in *Angels* (1987: 167–82). Amusingly, Bateson compares the formal idea with a limerick about the freedom of 'bus lines' compared to the determinisms of 'tram lines': 'They [determinisms] are tram lines which we follow because "this is how we do things," or "it is done."'

13 The archive has been put together with meticulous care by Rodney Donaldson, who is also editor of *A Sacred Unity: Further Steps to an Ecology of Mind* (GB, 1991). Donaldson is a former graduate student of Gregory Bateson as well as his dedicated archivist.

14 Toulmin also complains that the writing in *Mind and Nature* is often shrill and scolding in tone. However, this volume was initially meant to be two separate books: one discussing questions of evolution ('The Evolutionary Idea'); the other discussing the false epistemology behind how science is presently taught in universities and schools. Toulmin seems to have picked up a lack of conjunction in the published volume.

15 Marcus, an anthropologist, attempts to examine the whole of Bateson's work by taking his major anthropological text, *Naven,* as a foundation for all his subsequent writing. Thus Bateson becomes, in Marcus's eyes, an anthropological functionalist who had a highly developed hermeneutic sensibility. 'Bateson allowed himself to place too much importance on the mere heuristic juggling of metaphors and analogies as solutions to fundamentally hermeneutic problems' (Marcus 1985: 75). This woefully misunderstands how Bateson related style to ideas. Among other mistakes in Marcus's reading of Bateson is the fact that Bateson explicitly rejects her-

meneutics as an epistemological position because of the strong premises of rationality in hermeneutics, as well as the importance it attaches to individual consciousness as a means for producing rational solutions.

16 Bateson half mused whether a collection of these routines would be a 'strange but(?) fascinating book – one thinks of the "notebooks" of Samuel Butler – or Leonardo' ('Dialogue between Gregory Bateson and Werner Erhard,' audiotape transcript, 3 Sept. 1976, p. 3).

17 For example, part of the audience walked out in 1975 at a talk given in London hosted by R.D. Laing. My own impression from the transcript of this talk is that Bateson 'lost it'; but my interviews with members of that audience suggest there may have been a split between those who felt he was saying what they expected him to say and those who were confused.

18 The relationship between creative repetition and 'steps' has been exquisitely put by Northrop Frye in the following manner: 'To practice the piano is to set oneself free to play it. The theme of practice-repetition, is, of course, involved in the metaphor of [a ladder], with its image of step-by-step progression. The spiral form in which the ladder so often appears adds the image of cyclical movement to that of upward advance. The cycle in itself may symbolize either a constant frustration of energy, the "same dull round," in Blake's phrase, or its opposite, the self-contained energy at the apex of the spiral, where a symbol of further advance is no longer appropriate' (Frye 1990: 305). Practice-repitition is, of course, associated with cumulative memory.

19 There was a lengthy passage of time in Bateson's own life before his acceptance of Carl Jung. Part of the reason was that Bateson had profound objections to the Jungian theory of types – for the Jungian archetypes had always been presented to him as being constructs of individual personalities. His lengthy friendship with a noted Jungian analyst, Joseph Wheelwright, modified Bateson's initial opposition. Wheelwright managed to convince Bateson that the Jungian notions were merely a way of explanation and not, as Bateson thought, substantive forms. Jung's type formulations were, in Wheelwright's view, 'part of his [Jung's] lifelong attempt to understand what went wrong between him and Freud' (Wheelwright 1982: 54, 55).

20 The reference to Shiva is not a direct one but an elliptical reference to J. Robert Oppenheimer's evocation of that deity. Oppenheimer was the physicist in charge of the Manhattan Project. On the explosion of Trinity, the very first nuclear bomb, set off in the New Mexico desert on 16 July 1945, Oppenheimer was stunned by the sheer magnitude of the blast. He is reported to have remarked that a passage from Hindu scripture came to

his mind as he saw the mushroom cloud of Trinity rise: 'I am become death, shatterer of worlds.' The blast had evoked a metaphor of a nuclear godhead: Shiva, god-the-destroyer.

21 Bateson pointed out that Jung himself changed the definitions of his own terms over time. In fact, by the time he had come to write *Answer to Job*, his distinctions of *creatura* and *pleroma* had ended up in a mess, Bateson argued. Jung was so concerned with the processes of individuation that his whole discussion of the boundaries between individuation and collective archetype eventually got out of hand. 'Jung is in a mess. I've adapted the word pleroma from Jung's *Seven Sermons* ... If you've read the *Answer To Job* you will find that the archetypes have all gotten into the pleroma which means that obviously the pleroma means something totally different to Jung from what it means in myths ... because understanding of the myth depends on being able to wobble ideas around' (GB, 1978b: 43–9).

CHAPTER 5 Cybernetics – Janus of Modernity

1 One misconstruction, found in Ingold's *Evolution and Social Life*, is as follows: 'The implication of [Bateson's] view is that consciousness, far from being a movement from which thoughts are recursively detached, is but a logical working-out of thoughts that have already installed themselves in the thinker's mind, and is in that sense analogous to the epigenetic revelation of structure as opposed to the evolutionary creation of novelty ... For that very reason, Bateson's understanding of creativity is thoroughly mechanistic ... ' (Ingold 1986: 195).

2 The formal working statement of the American Geophysical Union's Chapman Conference on the GAIA hypothesis, held in San Diego in March 1988, put it this way: 'A question of fundamental intellectual importance to the geosciences is whether the earth's climate is regulated. The Gaia Hypothesis, introduced by Jim Lovelock from England and Lynn Margulis from the United States [in 1972], surmises that interaction between the biota and the physical and chemical environment is of large enough intensity to serve in an active feedback capacity for biogeoclimatologic control' (Joseph 1990: 74).

3 The difference between Wiener's stochastic (random process) approach and von Neumann's determinist approach through logical automata was apparent to Bateson from the start. Bateson mentions in his letters to Warren McCulloch the difficulties he had with von Neumann's game theory. The automaton in von Neumann's game theory seems 'busy maxi-

mating his access to utility, whereas in case of a return to steady state [via feedback] there must always be a devaluation of "too much of a good thing." By postulate this [devaluation] is ruled out in the games [theory of von Neumann] ... ' (Letters, 931–2/1946). Von Neumann once wrote to another game theorist, 'I shudder at the thought that highly efficient purposive organizational elements like protein, should originate in a random process' (quoted in Heims 1980: 154).

4 Such an explanation is quite different from that proposed in behaviourism. According to the behaviourists, what the cat does is maintain in its head a preference ordering of desirable temperatures, which it then uses to calculate a spot of maximal utility through considering the products of the energy output of the fire against heat conduction in the surrounding atmosphere (Steinbrunner 1974: 53). Some cat! Some decision!

5 Ashby's presentation of feedback considerably modified Wiener's position and was more 'environmental' in its orientation. Wiener had represented feedback as a physical property of the system's circuitry, that is, as an *internal system* of receptor, reference control, and effector. Wiener identified feedback with the actual circuit design in the network of signals in a mechanism; this tended to close a system with feedback from its environment. For Ashby, the stability of a system with feedback is not dependent upon the integrity of a tracking response along an internal circuit; both stability or instability were properties of the system *as a whole*. Thus, calling a system 'stable' must include the interaction of organism and environment in a more embracing manner than Wiener had suggested. In a stable system, 'environmental variables' mutually match or become correlated with those variables changed by an organism as part of its adaptation to its environment.

6 'In broad terms this means that "progress" i.e. change in selected direction is always incredibly difficult and only achieved by general expenditure of energy. Whereas "degeneration" – change in random and multiple directions – is comparatively easy – as Buddha, Hitler, Christ and others have pointed out. It's an old complaint of all reformers that ever tried to push the donkey of human affairs up the entropic hill' (Letters, 1390–1c/1945). He had begun by asking himself about the nature of the correlation between human learning and entropy. This only began to make sense once the cybernetic definition of negative entropy removed any positivistic relation between the two and negentropy was understood to be time-dependent constraints anticipating deviation.

7 There are, however, other problems arising from this definition. 'Negentropy' refers to statistical probabilities of increasing knowledge, so that a

correlation between learning and entropy should be restricted to a statistical set or class of circumstances. However, standard definitions refer to learning as an 'individual possession of knowledge,' acquired by study (*Concise Oxford Dictionary*). Subsequent chapters will show that Bateson spends a great deal of time formulating the conditions of variance in learning between a statistical class and its members. He used Bertrand Russell's theory of logical types as a means for ensuring this distinction until the inflexibilities of Russell's logical typing finally overwhelmed him (see Appendix 2).

8 One of the reasons for Bateson's rapport with Ashby's homeostat was that his model was entirely non-Darwinian. The conclusions that Ashby drew from his model were in direct contrast to Darwin's notions of uniform and continuous motion in evolution through natural selection. According to Ashby's interpretation of evolutionary mechanisms, a rather random and haphazard structure will have certain positions that are nearly in a stable state and others that are far from equilibrium. The stable positions, or patterns, will, by their very nature, last for a long time and thereby provide a basis for learning, while the non-equilibrium positions will last only temporarily. Wiener later hailed this contribution by Ashby as 'one of the great philosophical contributions of our day' (Wiener 1973: 54 [originally published, 1950]).

9 According to Ashby, the usual form of adjustment to perturbation is for organisms to *amplify* their own capacity for organization (as opposed to dampening down oscillation) in order to meet the conditions of change in their coupling with the environment. Both memory and learning increase the possibilities of amplification by increasing the variety of responses.

10 Ashby's machine had four little magnets coupled to each other in such a way that they always came to rest in a central position no matter how they were perturbed. Interpreted simply as a model of rules for constraints in adaptation, Ashby's little device demonstrated the design of feedback in loosely coupled systems. However, when others began to interpret it as a 'lifelike' machine, mistaking model for reality, the homeostat received severe criticism. In *Great Ideas in ... Cybernetics*, Singh comments that 'the mere production of a machine that carries out an operation similar to that performed by an animal is no warrant for assuming that both animal and machine work in the same way, any more than treating birds and airplanes as identical mechanisms simply because both manage to "fly"' (Singh 1966: 22).

11 The model was constructed by Bateson's friend Anatol Holt, who was working on the mathematics of Petri nets, simulated networks of occur-

rences or temporal events ordered by queuing procedures. Holt used a UNIVAC computer, then one of the most powerful electronic computers available. The model incorporated many of Ashby's definitions but was connected up in a hierarchical series, instead of the oscillating circle of Ashby's homeostat (Letters, 672–1a/1956).

12 Ashby argued that systems with feedback are 'error controlled.' A change in a thermostat, for example, is error controlled. Feedback is a purely *functional, that is, temporal relation* of systemic interaction. A thermostat is affected in time by the functional relation of the difference between the actual and the set temperatures (Ashby 1960: 55ff). Each adjustment is a functional deviation of the system's actual state from a reference state. This functional relation is also characteristic of any organism *plus* the phase-space of its environment, as they undergo mutual matching. Error control defined a whole region of stability in which 'adaptive behaviour' of a living organism matches the 'behaviour of the stable system.'

13 Ashby said that transmission from one source to another in a communication channel is equivalent to the communication of variety. The notion of variety expresses a summation of differences in an object, and in this sense variety is synonymous with multiformity and diversity. A way of imagining information as variety can be expressed in the act of looking at a diamond. A well-cut diamond is a dance of patterns of light coming from the many facets refracting difference in light striking the diamond's head. Information can be considered variety in the same sort of way, a sort of dance of patterns of difference, and this is 'the most fundamental concept in cybernetics.' The 'difference' in variety occurs in two ways: either two items transmitted in sequence are recognizably different, through their contrast; or difference in contrast occurs in the passage of time. Variety is recognizable between a prior transmission and a subsequent one. In this case, topological variety in a channel expresses how events have changed with time (Ashby 1961: 9).

14 As an extension of the necessity for 'time binding,' Wiener concluded that cybernetics would be able to peruse the design of any institutions in society in order to reveal how patterns of learning coped with periodic instabilities in society and plan more flexible conditions. He believed cybernetics would develop a very wide notion of adaptation by matching design criteria in social and biological systems to sources of flexibility or inflexibilities. Through generalization about the form of faulty design, cybernetics would manage to 'steer' society into better models of organization. Bateson objected: if cybernetics was intent on establishing principles of self-organization, it must, as a matter of priority, distinguish the

physical aspects of communication, signals in channels, from the non-material aspects of communication – perception, learning, ideas and thinking about sensation.

15 Bateson, in a letter to Wiener and A. Rosenblueth, lists nine fundamental points that he would wish to cover if the seminars on cybernetics were ever to be published (Letters, 1496–3/1947). Most of the other five points have already been discussed in this chapter.

16 Of course, feed-'back' is not really 'backwards,' except in the sense of returning to a point of origin. It is only because orientation to a boxlike model requires a spatial representation of arrows 'going the other way' that the term 'feedback' has gained currency. Another meaning would be 'reciprocal' – which is the way Bateson interpreted the term. Or, in terms of an orientation to time, the 'back' is 'forward' in a time series. The forward time series has the effect, through its circular causal attributes, of conserving a setting or a pattern. Some scholars have stated that there is no 'feedback' in cybernetics, only different kinds of feedforward – such as conservationist feedforward and 'runaway oscillation.' Clearly the ordinary household thermostat is not a machine for running time backwards!

17 As Heims points out in his compelling biography of John von Neumann and Norbert Wiener, von Neumann became a key consultant in the 1950 decision to proceed with building the hydrogen bomb. Von Neumann sided with Edward Teller and with Lewis Strauss, the chairman of the Atomic Energy Commission, against J. Robert Oppenheimer, the chief scientific director of the Manhattan Project. When the pro-bomb faction won out, von Neumann became increasingly active in important committees advising the government on weapons policies and became a consistent advocate for accelerating the arms race. On arms race issues, Wiener saw the escalation in the arms race as a military version of alcoholic addiction – 'another little drink won't hurt us.' To him, the theme of 'another little drink' was as unconvincing in its military context as it was in that of alcoholic addiction. More specifically, Wiener believed that von Neumann's 'games theory' could not deal with several levels at once – tactics, strategy, and general considerations – since each level of consideration must occupy different time spans. Generally, Weiner argued, policy recommendations based on attention to one level alone will contradict the others taken all together, so that a game theoretic search for the best policy under all levels of sophistication is a futile one and must lead to nothing but paradox and confusion. Wiener assumed – quite correctly as it turned out – that in the long run the USSR shared with the United States a healthy hope for life on earth and that the Russians had no desire to

celebrate a nominal victory with a universal funeral pyre on both sides (Heims 1980: 308).

The links here to Bateson's own position are evident. The theme of the military's addiction to escalation of the arms race finds an eloquent restatement in Bateson's later writing: the holistic response of trusting one another was the only way to break the pattern of escalation in the armaments race.

18 For example, the GAIA hypothesis does not seem to resolve the issue of tight versus loose coupling. The GAIA hypothesis depicts a coupled process in which the evolution of life and the evolution of rocks, oceans, and atmosphere are so tightly joined together that they are really one process. But in other respects, Lovelock has argued that the homeostatic mechanism of GAIA is so resilient that even an influx of megatons of bromofluorocarbons and chloroflourocarbons (CFC's) will, in the long term, be assimilated by GAIA: 'The very concept of pollution is anthropocentric and it may even be irrelevant in the Gaian context' (Lovelock quoted in Joseph 1990: 206).

CHAPTER 6 Communication and Its Embodiment

1 As will be explained in chapter 7, Bateson envisaged genetic coupling also as involving a 'readiness to receive': '[In order to evoke] a notion of readiness in a frog's egg when pricked by a spermatozoon ... the information must be distributed all over. It cannot be in the future right side or in the future left side ... there must be some sort of spiral twist or stress, very widespread and including most of the surface and possibly the deeper protoplasm of the egg ... If, in order to receive a digital answer to a question – if that digital answer is to determine right or left asymmetry – then the *question* must already contain the asymmetry ... the readiness to be told must be immanent in the egg if the spermatozoon is to provide an answer ... ' (Bk. Mss., box 5; 1987: 204.24).

2 He goes on: 'All this was discussed in *Our Own Metaphor*, the report by my daughter on the conference which I organized in 1968. At that conference, several participants [of the environmental movement of the day] wanted to rush into *action*. But I restrained them. I still feel that as scientists our first job is to get the idea straight (though as politicians and citizens we may act)' (Draft Memorandum for Mind/Body Conference, CAF 100/1976).

3 Random: 'A sequence of events is said to be random if there is no way of predicting the next event of a given kind from the event or events that

have preceded and if the system obeys the regularities of probability ... ' *Stochastic*: 'If a sequence of events combines a random component with a selective process so that only certain outcomes are allowed to endure, that sequence is said to be stochastic' (*Mind* 1978: 230).

4 There appeared to be some difference between short-term memory and long-term memory, McCulloch said. Short-term memory is a result of a relatively uncomplicated reverberation in a circuit. The reverberation in short-term memory was looplike because unless there was a circuit around which the signal could travel, there could be no recall but just a signal that would imply one event in one moment of time. Theoretically a set of such signals patterned after some event could circuit such a loop indefinitely. In fact, short-term reverberating loops are constrained by time. As long as the loops continue to reverberate, our brains are able to 'trap' any 'fact' that can be defined in an unambiguous manner. However, when we go to sleep, or get a bump on the head, or simply switch our attention to something else, the circuit ceases to reverberate. At this moment in time, any unambiguous sensation would be lost *unless* some enduring alteration is made by switching from short-term to long-term memory. How such a switch occurs remains undefined in McCulloch's work, but he notes that for such a process to take place, the short-term reverberation would have to be represented for a sufficient length of time in order to become the source of an invariant idea in long-term memory (McCulloch 1965: 150).

5 An interesting example of the difference between his early experimental mapping of cybernetic ideas and attainment of interpretative fluency is to be found in two back-to-back articles on Bali in the anthropological section of *Steps*. The first, 'Bali: The Value System of a Steady State,' written in 1949, uses a mechanistic concept of cybernetic 'relay' in order to express reversible and irreversible aspects of social change in an island society. The article is original in that it introduces a cultural concept of 'steady state' twenty-five years before the Club of Rome publications in the 1970s. In the second, written in 1967, 'Style, Grace and Information in Primitive Art,' the mechanistic circuit structure has become a background for a much more complex set of ideas about the systemic nature of integration of meaning, art, consciousness, and cross-cultural recognition of pattern (*Steps* 1972: 107–27, 128–52).

6 Bateson had learned from his anthropological fieldwork that no 'mapping' of a 'territory' should ever rely upon an inductive description of actual links of a proposition. If this were so, the ethnographer would 'kill the territory': 'If, in Korzybski's phrase, we confuse the "map" with the "ter-

ritory" then indeed the cartographer has killed the territory for us: he has destroyed our imagination and bound us into his little symbols on paper so that we shall never gain see the landscape ... If, on the other hand, the rules of codification are kept clear and the diagram is seen for what it is ... then no harm is done' (*Communication* 1951: 245).

7 The list is contained in 'Communication: A Natural History of an Interview' (GB, 1971b).

8 Like other cyberneticians, McCulloch considered a signal in a message as an impulse, but he always recognized that a neural message was not a 'thing' but an abstraction, a 'percept.' Said Bateson: 'Warren McCulloch pointed out ... the impacting cause [in communication] is no longer a thing but a percept, a transform of certain selected characteristics of the impacting entity. There are no things in the domain of communication. No man, perhaps, can claim to have fully assimilated this generalization' (Letters, 1024–38/1965).

9 'If it were possible never to confuse a given type of event (Ei) in one set of internal or external circumstances (ci) with similar events (Eii) in other sets of circumstances (Cii etc) all would be well. But this is impossible, short of sacrificing the whole of Gestalt codification. The price which man pays for the economy which Gestalt codification permits is his proneness to ambivalence ... ' (*Communication* 1951: 192).

10 'It seems that the interface between nerve and environment is characterized by a difference in *kind* i.e. in logical typing, between what is on one side of the interface and what is on the other. What is quantitative on the input side becomes qualitative and discontinuous on the perception side. Neurons obey an "all or nothing" rule and, to make them report continuous variation in a *quantity*, it is necessary to employ a statistical device – either the statistics of a population of neurons, or the frequency of response of the single neuron' (*Angels* 1987: 123).

11 Others disagreed. A noted anthropologist, Ray Birdwhistell, with whom Bateson worked, doubted whether cybernetics was ever useful to him. He wrote to Bateson: 'I don't believe ... I can think of a single example that you and I did not know about from our knowledge of pattern and organization which has been *enriched* by cybernetics and systems theory. Frankly, I don't think either of these have done anything except to provide a poetry comprehensible to folks we might otherwise not have been able to talk to – and who have provided us with precious little in return. Remember, I talked to you in the early forties – I don't think a substitute language is enrichment. There are ideas in *Naven* which were famisht [*sic*] by linear (however apparently clarified by cybernetic language) cybernetic simplification' (Letters, 173–65b/1970).

12 The cybernetic proposition drawn from McCulloch which Bateson reformulated was: 'in any cybernetic servo-system, the impulse ... transmitted from the built-in sense organ to the energy source is a message we may verbalize either as a report regarding the value of the variable at a given moment or as a command to the energy source' ('Four Lectures,' CAF 126-D24/1955). Transcribed as a mechanical device, the report and command aspects of a message adequately describe how a thermostat operates. Unless reformulated as 'news' and 'change,' the concepts of report and command considered in McCulloch's terms have limited significance for human communication.

13 Later, Bateson's team was to show that if all family members were included in their research observation, the therapeutic interview yielded patterns never revealed in individual interviews. Systemic communication among family members often disconfirmed therapeutic assessment made on the basis of one-on-one interviews, for patterns of signalling in family communication were more determinative about mood, feeling, and behaviour of individuals within the family. Being systemic, these communication patterns were more abstract.

14 Since mid-century a large segment of the social sciences and humanities has become imbued with semiotics. The most notable of the proponents of semiotics were Roland Barthes and Claude Lévi-Strauss. They, along with other theorists, aligned coding to the syntax of human language. Bateson's theory of communication was to move in the other direction, away from the syntactical dimensions of coding, so that the many-levelled conjunction of coding could be embodied in patterns of social interaction. Concurrently, Bateson diminishes the boundaries between human symbolization and the natural world, which semiotics so avidly asserts.

15 As Weakland put it: 'Somewhere ... the double bind came in: I don't quite know how ... I know how it got published, but I don't recall how it arose. It got published ... when we began to move from levels of communication and communication in general to more of a focus on schizophrenia ... ' (Wilder and Weakland 1981: 53).

16 Bateson derived redundancy from information theory and cybernetics to denote 'informationally decidable relations' of scanner and system. In his view, redundancy includes perception, so that the latter is an active element in the construction of patterns of knowing (epistemology): 'If, from perception of some X, it is possible to make better than random guesses about some Y, there is a "redundancy" between X and Y, or "X is a coded message about Y," or "Y is a transform of X," or "X is a transform of Y"' (GB, 1975g: 133). This is by no means the normal use of the term 'redundancy' in information theory, where it is defined as an attribute of a

physically located source. Colin Cherry defines redundancy as 'a property given to a *source* by virtue of an excess of rules (syntax) whereby it becomes increasingly less likely that mistakes in *reception* [from that source] will be avoided' (Cherry 1966: 308). Bateson's redundancy is of news of a pattern coded in non-locatable contrasts, sometimes coded in quite different forms.

17 An earlier definition of metaphor is as follows: metaphor 'is a model using analogies with a vengeance, but is only vicious in so far as I fail to make clear to myself and my audience that I am using models' (Notebook 15/1951).

18 The original title of *About Bateson* was to have been 'Metaphor and Metaphysics: An Introduction to Gregory Bateson' (Letters, 955–16/1974).

CHAPTER 7 Mind and Nature

1 And, he added, the great biologist D'Arcy Thompson thought so too (Thompson 1961).

2 This letter was addressed to C.E. Ashley, an unusual correspondent because Ashley had been convicted of murder and was incarcerated in a California prison.

3 The signals animals use are multi-level and can therefore become signs 'which can be trusted, distrusted, falsified, denied, amplified, corrected and so forth' – a point which he made in his justifiably celebrated article 'A Theory of Play and Fantasy' (from a draft recorded in Notebook 16/ca. 1953). Bateson argues that once signals are converted into signs which can be either trusted or falsified, reflexiveness occurs; and animal communication is, in this respect, of the same type as human communication.

4 The reference here is to 'play': 'Action is a context, that context *being perceived in a particular way by the organism concerned*. The problem is to define that particular way ... of perceiving the context (and the action in the context) ... An action (or action sequence) may be both "play" and "not-play" simultaneously, perception being of one genus at one level and of another genus at another' ('A game ... play ... humour,' Notebook 14/1951).

5 Bateson contrasts 'analogic' to 'digital' as follows: 'the digital correspond[s] to what I have called coded communication [in language] while the analogic corresponds to the ostensive.' 'Ostensive' (from the Latin *ostendere* = to show) refers to an act of communication in which the object is *pointed at* and is used as its own referent: 'there is a greater truth to pointing than in words but it is clear that by pointing only you cannot

persuade.' Other forms of coding to which he refers are: 'iconic,' in which a representation of the referent is used to propose itself (combat is mentioned by showing a fang); 'transinformation,' an indirect method of coding in which 'the referent is represented only by instructions for coping with it – all the adaptive information in the genome is coded by this means'; and a special case of 'ostensive' in which meaning is assigned to action ('when the mother goes to market and leaves baby in playpen this "communicates"') ('Four Lectures,' CAF 126-A15-A20-B2/1955).

6 The central dogma of molecular biology proposed that general rules for information transfer from one polymer with a defined genetic alphabet to another were sequential. Once this sequential information has passed from the genome into protein, genetic information cannot get out of its protein translation again and feed back into DNA (Crick 1970: 153).

7 There is a wing in biology, mostly evolutionary biologists, who do not believe that all properties, behaviour, and performances of a living organism can be explained by being broken into molecular structures driven by bits of information. They concern themselves with behaviour, community organization, and other myriad relationships by which organisms in their relations with one another change their environment (Jacob 1982: 6ff). But this wing, the integrationists, usually limit their discussions to the living cell and its immediate environment. Nowhere does their investigation touch the sort of concerns which Bateson raised – interactive 'messaging' across boundaries of nature and culture, the relation of cultural ideas to the degradation of natural forms.

8 The value of Waddington's key notion of 'epigenetic landscape,' linking gene with environment through 'chreods' or time-trajectories, Bateson said, 'lies in the degree to which it enables Wad. to keep clear his logical typing. That is: the landscape model served the same function in Wad's thinking which the "logical types" model served in mine' (Bk. Mss., box 6; 1987: 207). Nevertheless, he did not accept Waddington's explanations of epigenetic landscape as an alternative. Even after their reconciliation, Bateson continued to object to Waddington's scheme: 'I did not like Waddington's epigenetic landscape and argued with him on the subject as long ago as 1934 when the landscape had the shape of a railway shunting yard.' Waddington's 'chreods' treated biological matter in a time series and followed closely the argument Whitehead had put forward about 'concrescence.' In Bateson's view, a biological system 'is not a list of organs or indeed any aggregate of material matter – it is pattern – an idea and in so far as it is an idea, the step from morphogenesis to behaviour and learning is a relatively short one' (Letters, 127–5a/1980).

9 In the nineteenth century, following Weismann's anti-Lamarckian argument that somatic change induced by experience could never be inherited, a biologist named Baldwin had suggested that while somatic change could never be inherited, from time to time, on a purely random basis, mutations occur which would duplicate the somatic effect. Baldwin also suggested that since these somatic effects were adaptive in the life of the parent generation, the mutation duplicating these effects would be adaptive in the next generation. There was, in addition, a process of change in the contrary direction, a process which Bateson termed an 'anti-Baldwin effect.' In this change, that which was formerly controlled by the genome is handed over to the soma (Letters, 483–4/1967). In his letter to Konrad Lorenz, Bateson proposes rules that would specify the conditions under which Baldwin effects and anti-Baldwin effects might occur.

10 In his letter to Waddington, he had suggested that the presence of two levels or types, genetic and somatic, by no means proposed dualism, for both circuits of information belonged to a common 'entropy economics' or 'economics of flexibility.' There were different levels of 'information economics' in the two servo-pathways. The first type of feedback seemed to be similar to feedback circuits in the soma; the second type appeared to involve 'direct genotypic communication via the chromosomes to the cells of the modified organ.' Basic to 'entropy economics' was the notion that any subsection of a population of any given species, though genetically heterogeneous, is always limited by the special states of its servomechanisms through which it deals with whatever is uncomfortable in genotype or environment (Letters, 465–2c, 2d/ca. 1962 [letter not sent]).

11 'By culture, then, I mean the hierarchic aggregate of details, regularities and rules which is characteristic of the ongoing stream of life' ('Culture and the Family,' CAF 74/1969).

12 The term 'convergence' as a 'synonym of redundancy at a different space or time grain [in] the integration of the unit' was borrowed from Warren Brodey (Letters, 207–19b/1971). Brodey also helped Bateson draw appropriate distinctions between his cybernetic notion of survival-circuits in evolution and recursiveness in ecological systems. This point is explained in the next chapter.

13 For an interesting discussion of the incorporation of the industrial state of mind into Darwin's vision of evolution, see Rifkin 1984: 26–61.

14 The modern definition of organism as information program underlines this fact, he said, for 'the program' contains only *coded* representations of organs and their phenotypic relationships. Exceptions to this generaliza-

tion, Bateson notes, are the cases where mechanisms of heredity depend on cytoplasmic plasmid and the like (Notebook 34 / ca. 1965).

15 The term 'co-evolution' has a more technical usage in biology than Bateson uses here – that of mutuality or symbiosis between species. 'Discussion of coevolution has for the most part been restricted to some rather specific cases, such as pollination, adaptations, adjustment to competition, specific mutualisms, predator-prey arms races, and herbivory.' But 'even so restricted, coevolution may comprise most of evolution' (van Valen in Nitecki 1983: 1,2). Note van Valen makes this assessment from the perspective that 'the common currency of evolution is free energy.'

16 The temporal record did not support the Darwinian hypothesis of gradual and continuous adaptations throughout evolutionary time. Rather, fossil remains revealed long periods of stasis in the morphology of living forms, punctuated by brief periods of rapid change. Eldredge and Gould said that an inadequate picture had been guiding the thoughts of those studying the evolutionary record for the last hundred years and this inadequate picture had been tenaciously held. Natural scientists believed it to be 'objective' but had not recognized the guiding sway of the Darwinian ideas. All propositions of Darwinian natural selection rested upon mapping geographical space. These had to be replaced by maps which incorporated time as an additional dimension. Eldredge groped towards a multi-level tabulation of 'time frames,' showing how the relation between a time-frame in macro-evolution no longer accorded with a time-frame in micro-evolution (Eldredge and Gould 1985: 150,151).

17 This move towards a new type of theoretical biology was spearheaded in Britain by Bateson's long-term friend Conrad Waddington. Waddington edited a four-volume set of papers expressing some extremely important perspectives on this position about patterns of life and laws of form (*Towards a Theoretical Biology*, 4 vols, 1968–72).

18 'It is the ecology which survives and slowly evolves ... But if the process of adaptation were the whole story, there could be no systematic pathology. Trouble arises because the logic of "adaptation" is a different [temporal] "logic" from that of the survival and evolution of an ecological system. In Warren Brodey's phrase, the "time grain" of the adaptation is different from that of the ecology. "Survival" means that certain descriptive statements about some living system continue to be true through some period of time; and, conversely, "evolution" refers to changes in the truth of certain descriptive statements about some living system. The trick is to define which statements about which systems remain true or

undergo change. The paradoxes (and the pathologies) of systemic process arise precisely because the constancy and survival of some larger system is maintained by changes in the constituent subsystems' (*Steps* 1972: 338–9).

CHAPTER 8 Recursion

1 The phrase is attributed to Aldo Leopold. 'Leopold was one of the first to formulate an egalitarian ecosystem ethic: "A thing is right when it tends to preserve the integrity, stability, and beauty of the biotic community. It is wrong when it tends otherwise." Leopold's ideas are truly subversive and constitute a landmark in the development of the biocentric position' (Devall and Sessions 1985: 86).

2 The well-known English idealist philosopher R.G. Collingwood states that the activity of mind belongs wholly to the human realm. While nature might resemble history in certain ways, reflexive thinking is unique to human affairs. Collingwood notes that there are similarities between change, adaptation, evolution, and 'timefulness' in nature, and historical circumstance; but historical knowledge is quite special, distinctive of cultural performance and the development of human civilization. It should be pointed out that Collingwood's whole thesis in *The Idea of History* is put forward as a counter-claim to Whitehead, who 'seems to have abolished the difference between natural process and historical process and to have resolved nature into history' (Collingwood 1961: 211).

3 Collingwood's themes are iterated by Jurgen Habermas. Habermas, a modern German communication theorist, views modern logic and rationality as emerging from a series of confusions between nature and culture inherent in the mythical thought predominant in a pre-rational age, whereas Bateson believed that modern rationality is itself confused by its own myth – the necessity to separate human thought from nature. The distinction between the positions is instructive. Habermas argues: ' ... the confusion of nature and culture by no means signifies only a conceptual blending of the objective and social worlds, but also a – by our lights – deficient differentiation between *language and world*; that is, between speech as the medium of communication and that about which understanding can be reached in linguistic communication. In the totalizing mode of mythical worldviews, it is apparently difficult to draw with sufficient precision the familiar (to us) semiotic distinctions between the sign-substratum of linguistic expression, its semantic content, and the referent to which a speaker can refer with its help. The magical relation between

names and designated objects, the concretistic relation between the meaning of expressions and the states-of-affairs represented give evidence of systematic confusion between *internal connections of meaning and external connections of objects* ... In this sense the logical relation between ground and consequence is internal, the causal relation between cause and effect is external (symbolic *versus* physical causation)' (Habermas 1981: 49).

4 When an animal embryo grows and develops, there is an increase in entropy of the thermodynamic system, consisting of embryo and the environment from which it takes its food, and to which it releases heat and excretory products. But from the point of view of form, there has been *morphogenesis* – a genesis of form in which there is considerable increase in order and complexity over a relatively short period of time. 'The second law of thermodynamics serves to emphasise this dependence of living organisms on external sources of energy, but it does nothing to explain their specific forms' (Sheldrake 1981: 63,114).

5 He wrote: 'The ultimate pattern *never* determines its antecedents. There are no final causes.' Thus 'entelechy,' he maintained, was a mistaken principle of order. 'It has been argued above that the testing of innovation against older pattern probably occurs during epigenesis, and, if this is so, then the relations which lead to homologies among adult or dead phenotypes, *should* certainly be thought of as inherent in the processes of growth and change rather than existing in the typology of the phenotype after those processes had occurred' (Notebook 35/1965).

6 In the elementary cybernetic mechanisms, such as a heat engine, the function of a difference is the difference between two temperatures, so that in these simple mechanical systems difference is equivalent to some form of negative entropy, and the effect of an 'error' signal is to trigger a build-up order in a thermodynamic system.

7 In a note to Tony Wilden on the draft of a paper which Wilden had submitted to Bateson for comments, he wrote: ' ... the code *is* the relationship between sender and receiver. But it is questionable whether "sender" and "receiver" should be reified at all. The terms are only useful as a temporary heuristic, stepping stones for talking to old style epistemologists' (Letters, 1497–246/70).

8 Thus, in an earlier formulation he notes that there was some evidence that 'the organisms which we study act as if their communicational worlds contain such and such hierarchic steps at such points [of their inter-communication]. These are organizing fictions upon which these organisms depend for mutual understanding. It is the necessity for mu-

tual understanding that forces social organisms into agreement about the fictions' (Letters, 693-2/1964). The argument that 'agreement about the fictions' orders communication in a natural system arose 'as if' information is processed in time series, and hierarchic steps appears flimsy at best.

9 Peirce's original argument had been that neither deduction nor induction was an adequate means of creating or explaining the formation of a hypothesis. Hypotheses were the outcome of a third and radically different process. A hypothesis was tentatively adopted because it 'saves some particular appearance.' 'Appearance' is not so much a direct 'look' at events; rather, it refers to those apparent consistencies that can be drawn from events 'so far as can be seen' (Russell 1977: 277ff).

10 The version of 'abduction' Bateson said he followed was 'named by Peirce and described with some care by Warren McCulloch' (Bk. Mss., box 5; 1987: 204.34). One of McCulloch's pupils, Stafford Beer, has described McCulloch's method of abduction as 'homomorphic modelling': 'The process of homomorphic modelling is at least a heuristic method for inferring the existence and structure of systems of which the complexity defeats isomorphic modelling' (Beer 1966: 125).

11 Wittgenstein found there are always formal 'resemblances' among the issues in the disparate language games. One way Wittgenstein suggests resemblances are formed is 'by describing one as variation of another – by describing them and *emphasizing* their differences and analogies' (Wittgenstein 1956: II, para. 14).

12 As to the notion of a game, a game with its rules was not a private affair. However, agreement among individuals is not all that is necessary in order for rule-governed activity to become part of a game. Agreement does not arise so much from agreement in opinions, but in 'form of life' (Wittgenstein 1958: para. 241). 'How do we compare games? By describing them – by describing one as variation of another – by describing them and *emphasizing* their differences and analogies ... But what about *this* proposition: "In draughts all the pieces have the same powers, but not in chess"? Whom am I telling this? Someone who already knows both games, or someone who does not yet know them. Here it looks as if the first one stands in no need of our information and the second one can do nothing with it. But suppose I were to say: "See! In draughts all the pieces have the same powers ... " or better still, "See! In these games all the pieces have the same powers, in those not." But what does such a proposition do? It introduces a new *concept*, a new ground of classification. I teach you to answer the question: "Name games of the first sort" etc.

But in a similar way it would be possible to set questions like: "Invent a game with a rook"' (Wittgenstein 1956: para. II–14).

13 As he would later announce: 'So today I am a *monist*. I deny all explanatory principles which will conflict with the possibility of or necessity for deductive thought. In the meanwhile, the educational systems of the west – and especially the USA – have reverted to the pre-deductive level ... Because, you see, once you admit that there is dualism at the top level of the deductive tree, then ever after *all* propositions are both true and false. There is no *criterion of incredibility*' (Letters, 579–4b/1980).

14 'Operations' in the theory of groups generate mathematical groups by arbitrary definition and also denote transforms of the operations. The 'members' of the mathematical group are themselves only coded names for items so related: '... for purposes of this discussion on homologies, the best example of a purely relational language is provided by group theory ... the infinite group of whole numbers is generated from the definitions of operations which can be performed on its members. The group so generated will show multiplicative symmetry about one of its members ... it will show in addition symmetry about another member i.e. treat 1 corresponding to the number 0 ... both the relata and the overall pattern of the group are generated by definition of these operations whereby they are interrelated. Thus 1(0), 2 = 2(0), 3 would denote that the same operation which transforms 1 into 2 will also transform 2 into 3 ... The group is totally defined by relations between its members – and the members are only coded names for any items so related. The "operations" which are the relationships are acts of coding and transform' (Notebook 35 / ca. 1965).

15 This is a surprising conclusion, in that the great psychologist Jean Piaget made group theory the very centre of his own discussion of structuralism (Piaget 1970). Bateson's adherence to abduction as method and to logical typing as structure seems to have prevented his consideration of the conventions of structuralism which were so dominant a part of intellectual discussion in this period. There seems to have been no predisposition on Bateson's part to split descriptions of surface transforms from underlying or deep structural transforms – as many authors from Marxists to linguists did in this period – and make the latter the 'deeper' reality. The contributions of group theory to structuralist thinking in a wide range of subjects is summarized by Piaget in his book.

16 This type of demonstration of loopiness is accepted today as one the first examples of chaos theory. Distorted loopiness combined with repetition of pattern in many dimensions kept mathematicians glued to their ana-

logue computers for several years after Bateson's death – especially the mathematicians at his own campus, the University of Santa Cruz. The Hawaii seminar was conducted in conjunction with Warren Brodey and Avery Johnson, and notes in the archives refer to their joint deliberations. Bateson, Johnson, and Brodey were all ahead of their time for James Gleick's summary of the subject, *Chaos Theory*, only appeared in 1987.

17 A brief paragraph in the published version of *Mind* records only that 'it appears that the idea of "logical typing" when transplanted from the abstract realms inhabited by mathematicological philosophers to the hurly-burly of organisms, takes on a very different appearance. Instead of a hierarchy of classes, we face a hierarchy of *orders of recursiveness*' (*Mind* 1979: 201).

18 He also wrote: 'Wittgenstein seems to have thought that none of the limitations of *Principia* could hold in a communication world which includes ostensive communication. After all, in the world of *Tractatus*, no child could ever learn a language. Personally I think that Wittgenstein was wrong in totally discarding the limitations [of *Principia*]. The natural history world, after all, is a hybrid and we are necessarily caught within the limitations of rigorous tautology to the extent that we as human beings accept the logical model [while in the natural history of communication most of the message material and especially the communication about relationship is non-digital and it is quite unclear whether the limits of digital logic must necessarily apply]' (Letters, 544–2b/1969).

19 A geometric figure sometimes used to explain this mapping is the Koch curve. The Koch curve is an example of a function mapping onto itself, or undergoing 're-entry' into its own 'form.' If the function F is considered to be a 'program instruction' in which the instruction is to loop the function F onto itself, then the example is familiar to computer users as a DO LOOP entering its own ground, and creating a 'hang-up' in the computer program being used.

20 However, Varela has recently changed his own view on the question and refers now to a concept of 'embodied action': 'By using the term *embodied* we mean to highlight two points: first, that cognition depends upon the kinds of experience that come from having a body with various sensorimotor capacities, and second, that these individual sensorimotor capacities are themselves embedded in a more encompassing biological, psychological and cultural context. By using the term *action* we mean to emphasize once again that sensory and motor processes, perception and action, are fundamentally inseparable in lived cognition. Indeed, the two are not merely contingently linked in individuals; they have also evolved

together' (Varela, Thompson, and Rosch 1991: 173). This statement is much closer to Bateson's insistence that information, drawn from both embodied patterns of interaction and their evolution, is an integral part of recursive phenomena.

21 According to Maturana and Varela, autopoietic systems may be said to *produce* their own environment. Their processes of evolution consist entirely of correspondence and coordination between a living system and any other living system in its 'environment' and are brought about solely as a result of the system's own activity. Recursive 'feedback' or looping in their perspective is defined as an aspect of the system's *internal condition of autonomy*. In their interactions with other systems, autonomous systems are oriented towards their own requirements for self-produced organization. Compensation to peturbations are related, in turn, to the system's resilience or flexibility, both of which are qualities of their autonomous characteristics. There is no governor or comparator within an autonomous system to which an assignment of correspondence between the autonomy of the living system and the conditions of successful ordering can be referred. Autopoeitic systems do not 'adapt' – they only drift (Maturana and Varela 1980).

22 The contrast of metaphor and redundancy necessitates a 'double description,' he argued, one for each pattern or level. The overlap, or contrast, he conceived as a logical product of each abstraction. The double description gave a sense of 'reality' to the abstractions made at each of the two levels (Notebook 51/1973).

23 G. Spencer-Brown's *Laws of Form* will be examined further in the next chapter. It was first published in Great Britain in 1969. The Bantam publication became available in 1972. In March 1973 Spencer-Brown attended a conference at Esalen, the 'OM' Conference, at which he gave a formal presentation of his thesis of how 're-entry' of time constructs a logic for oscillating systems. Bateson was somewhat disappointed that Spencer-Brown's 'laws' referred only to digital systems.

24 As this exchange in an interview about self-reference and consciousness indicates:

> [John] Welwood: I'm wondering if consciousness can become a scientific investigation in the sense that you can never step out of it to look at it.
>
> G.B.: There are things you can do though. To begin with you can make various sorts of mathematical recursive systems and consider which of these might represent consciousness in some way ... (GB, 1978b)

CHAPTER 9 The Pattern Which Connects

1 Another way of putting the same position occurs in *Angels Fear*. The title was a warning that impatient enthusiasms cover deep epistemological panic ... fools rush in where angels fear to tread (*Angels* 1987: 14).

2 'You see in a sense any of what they call "progress," any move, any change, is in the end going to have its price. Its price is essentially a diminution of the number of available alternatives after you've chosen that one. If you are, let us say, recording something in memory or responding to something, you have a finite number of possible changes that can occur ... Your responses or your adaptive possibilities are not infinite ... and I'm always facing the problem of greater complexity in the environment than I can deal with, either in response or in record or in whatever it is, record and response not being fundamentally different ... What we do is, all the time, a using up of alternatives and that using up of alternatives is very closely related, obviously, to doing the common-sense thing at that level and incurring it later. You [begin to] see the ecological end of the world sort of problem' (GB in Berger 1978: 223).

3 As pointed out in chapter 8, Habermas's approach to these issues were all based on a central premise of rational discourse. While Habermas recognizes how imperatives of technological control undermine consensus and community organization, his approach to environmentalism leads him to support a managerial strategy, based on the autonomy of rationality, while Bateson rejects this solution.

4 The German Greens' manifesto stated that 'encroachment on natural habitats and the extermination of animal and plant species is destroying the balance of nature and along with it the basis of our own life. It is necessary to maintain or restore a biologically intact environment in order to ensure human survival of future generations' ('German Green Party Manifesto' [1983], quoted in Dobson 1990: 67, 137). By 1983 they had obtained 5.6 per cent of the national vote, which increased to 8.3 per cent in January 1987. More surprising was the sudden prominence of eco-glasnost movements at the end of the 1980s. These new social movements burst forth in the most unlikely of places, Eastern Europe. Leaders of eco-glasnost, such as those of Charta 77 in Czechoslovakia, provided the new president, Vaclav Havel, and new ministers of the reformed communist state.

5 He wrote: ' ... flexibility is to specialization as entropy is to negentropy. Flexibility may be defined as *uncommitted potential for change*. Again, follow-

ing Ross Ashby, we note that the *distribution* of flexibility among the many variables of a system is a matter of great importance' (Letters, 427–11 / ca. 1970).

6 As in this quote: 'I believe that this massive aggregation of threats to man and his ecological systems arises out of errors in our habits of thought at deep and partly unconscious levels. As therapists we clearly have a duty. First, to achieve clarity in ourselves; and then to look for every sign of clarity in others and to implement them and reinforce them in whatever is sane in them' (*Steps* 1972: 487). Note, however, that Bateson actually suggested this as a plan of action while he was chief scientist of the Biological Relations Division of the Oceanic Institute in Hawaii. ' ... I would strongly advise [legislators] sit tight and refuse to make any move until there is an adequate population of influential people outside the legislature who begin to see the new philosophy' (Letters, 426–36a/ 1970).

7 The conference was sponsored by the Wenner-Gren Foundation in 1969 and had the title 'A Symposium on the Moral and Aesthetic Structure of Human Adaptation.' The title gives little evidence as to the conference's proposed concerns with a systems approach to ecological thinking, and, indeed, the difference between Bateson's approach to the issues and those of the participants was so wide that the conference fell apart. 'I think I asked too much of my participants,' Bateson wrote to a critic of the conference, for, he reflected, it was not as good as the one which had produced *Our Own Metaphor* a year earlier. Most of the participants held the view that planning and action were filtered through language and conceived in response to immediate goals (Letters, 733–2/1969).

8 In his initial memorandum, he alternated between the possibility of an 'aesthetic determinism' and the possibility of an 'aesthetic approach.' The two terms were loosely drawn, and the major thrust of his concern seemed to be the way in which aesthetics might provide a 'short-cut' to the evaluation of plans for ecological action. A short-cut would arise because the processes of evaluation of ecosystem relations would not try to compute all relations between relevant variables but instead would use various sorts of guesses.

9 Bateson argues that it is much more difficult to talk about 'healthy' perceptions than it is to talk about their pathology, as when perception is disturbed and the systemic attributes go wrong (*Sacred* 1991: 265). The notion that aesthetic perception might itself be linked to cultural pathology never seems to have occurred to other ecologists, like Arne Naess, favouring aesthetic contemplation of nature. Naess emphasizes *personal* vi-

sions of nature and encourages the attainment of ecological wisdom through personal interrelations with nature (Naess 1989).

10 The science of perception has, in recent years, itself undergone a change of interpretation which would accord more with Bateson's views. Recent work by neurologists identify four parallel systems concerned with different attributes of vision – one for motion, one for colour, and two for form. Unlike traditional interpretations of perception, modern neuroscience argues that perception is an active process. The segregation and active re-integration of functions of the four parallel systems can be demonstrated, for segregation is reflected in some of the pathologies afflicting the visual cortex. Among these are 'blindsight' patients who 'see' but do not 'understand.' People with this condition are totally blind, yet if they are forced to guess in experimental conditions in the laboratory, they can correctly discriminate among a wide variety of visual stimuli. Their ability to undertake sensory discrimination comes from preprocessing areas inside the brain, indicating that there is an active mental component to seeing (Zeki 1992: 74–6).

11 The frog is reported as being insensitive to minute increments of heat, so that if placed in a pan of water and the water is heated to boiling point incrementally, the frog will remain insensate and die. By analogy, other ecologists have argued that limitations in our own processes of perception make us *ontologically unable* to consider long-term or evolutionary adaptation to environment. One such argument is that the internal constitution of our mental structure evolved some time ago, in a very different environment from today when our survival depended on the very short-term perceptions of change. The human mind evolved to register short-term changes from moment to moment, day to day, season to season. The ontology of human perception did not permit us to distinguish the long-term environmental 'backdrop' against which those short-term changes took place. Hence we have an inability to perceive long-term environmental change and to make appropriate adaptations to it (Ornstein and Ehrlich1989: 19ff).

12 Among the many illusions of perception that Adelbert Ames used to demonstrate were those of the rules of parallax and the rules of inversion. Bateson, having been caught in these perceptual illusions, records: 'By action, failure, and the attempt to correct action [guided by intellectual knowledge] and by repeated effort so that the direction in which I was trying to correct myself was validated by experience, I gradually began to learn rules for the creation of my image ... I cannot say that I corrected the image [because] the creation of such images is not done by

that part of my mind which we call "I"' ('Four Lectures,' CAF 126-B12/1955).

13 Zeki notes that when experimenters in neuroscience divided sensing from understanding, the neurologists had no knowledge that their position supported a dualism deeply embedded in Western philosophy (Zeki 1992: 69).

14 According to gestalt theorists, human perception builds images from discrete elements, resolving the strain of a deformed situation with 'good configuration.' But gestalt theorists proposed that the building of 'good configuration' was a mechanical act. In contrast, Bateson believed that all perception is an active process of transforming external sensing of the world.

15 The term *moiré* is 'associated with ancient silk fabric ... [and] suggests "flecked" or "watered" marking of some sort on old silk fabric,' according to a dictionary of textile manufacture. The term has also been used 'to describe textiles in which a rippled or watered effect is produced by pressing certain ribbed fabrics in such a way as to flatten parts of the ribs and leave the rest in relief. The flattened and unflattened parts reflect the light differently ... ' Bateson refers to *moiré* as 'the same word as mohair, a soft fabric double woven in some way.'

16 The hologrammic image, or image of overlay, is linked to his *three-term* 'logic' of parts and wholes. As explained in the previous chapter, contrast (a) is a two-dimensional contrast of relations between part and whole (comparable to level and meta-level); followed by another comparison, in a third (second-order) dimension, which contrasts (b) part and whole to the environment of the whole, with 'environment' emerging through comparison of perceived holistic phenomena: a double woven vision.

17 In any unified recursive system which embodies reflexiveness, descriptive features marking references to knower and to known, self-reference to other, become habituated and largely unconscious. Yet it was still possible to have 'creative subjectivity.' Bateson proposes that there is always some sort of theoretical 'space' through which it becomes possible to discern and compare the processes of recursive transformations. A discussion of his model of scanning the interface is presented in Appendix 4.

18 Here he is suggesting that 'bits' of information on which aesthetics is 'built' are a selection of pattern from redundancies. Thus, he remarks in his lecture 'Eternal Verities,' '"is built on" is a peculiar phrase and does not mean logic. It is much more closely related to how a symphony has been built on an opening theme ... We are almost totally unconscious of the whole aesthetic structure which is very abstract and probably the

most important type of network which organizes our mental life' (Tape of talk, 'Eternal Verities,' 14 March 1980, an edited version of which appears in the *Yale Law Review* [GB, 1981e]).

19 The letter was written on 24 October 1978 and appears in a chapter in *Angels* which is devoted to other issues than those of perception.

20 Brad Keeney is one who goes too far in this direction. So do several contributors to *Rigor and Imagination* (Wilder and Weakland 1981).

21 That the mathematics of the *Laws of Form* ignored the existential/epistemological conditions of marking a distinction is revealed in this section of the transcript of the 'Om Conference':

> Spencer-Brown: There is no outside or inside when you have drawn the first distinction. You have just drawn a distinction ... then we mark one side ... But remember in the mathematics there is no outside ... There are just two sides ... We call it the marked state because it is convenient to call it by something ... simply for something to call it. ('Om Conference,' 19–20 March 1973, p. 37, Misc. Mss., box 1)

In Bateson's terms, these conditions are never arbitrary but always emerge from prior patterns or communicative relations. Failure to distinguish the boundary between 'inside' and 'outside,' or otherwise to undertake arbitrary repeated shifts of context of the boundary markers 'inside' and 'outside,' will dissolve that boundary and lead to schizophrenic interactions. His classic literary example is that of Mr. Corry, the 'tremulous, whispy little old lady' who appears in the children's fable of 'Mary Poppins' (*Sacred* 1991: 131).

22 'Gregory Bateson: What goes on between animals is evidently characterized by, among other things, the absence of 'not' – the absence of a simple negative. While they can forbid each other – say 'don't' – they can in general not deny a message which they themselves have emitted. They cannot negate ... the messages which they emit tend to go in the form of intentional groups, or something which is part of action, and part stands as name for the whole in some sense ... It's sort of in the hope that I am here, that your *Laws of Form* might be the sense on which to map this sort of sound. We have a two-legged language which is very unsuitable for mapping what goes on between animals. Indeed it is very unsuitable for mapping what goes on between people.

Spencer-Brown: *Laws of Form* comes effectively from the licencing of the *not* operator in logic. What is of interest in Gregory Bateson's account of the animals is that they don't so much as communicate as commune with us and with each other ... As soon as we have a *not* we have a kind of world that no animal without a *not* ever sees. And since, in *Laws of Form* the laws of form can be described as coming from granting a licence to *not*, it is therefore the universe of the *not* speaking animal that this particular form is about' ('Om Conference,' 19–20 March 1973, pp. 86, 92, Misc. Mss., box 1).

23 On the whole, Spencer-Brown's logic of re-entrant form gives far too much emphasis to the 'copy function' in the iteration of the logical operator. Perhaps this is why his ideas caught on in the fields of cognitive science and artificial intelligence. The copy function gives prominence to both 'forward chaining' and 'backward chaining' logical operations. Here I follow Keeney, who is very succinct on Spencer-Brown's views. He states that in recursive systems of the Spencer-Brown type, description is secondary to the act of having obeyed a command, an injunction, or a prescription. Thus a description always follows an act of demarcation by a describer: 'To understand any realm of phenomena we should [first] begin by knowing how it is constructed.' He quotes Spencer-Brown's *Laws of Form*: 'Our understanding of such a universe comes not from discovering its present appearance, but in remembering what we originally did to bring it about' (quoted in Keeney 1983: 20). Through the logic of re-entrant form, recovery of the whole is resolved through the backward iterations of logical operators. The task seems to become one of recovery of the order of recursive sequences, by marking orders of recursion invoked in any description. Through marking the 'orders of recursion,' this method enables the laying of a trail back to initial premises. The trail shows how the distinctions became marked, and the initial distinction would then become available for inspection. By this means, keeping track of the recursive order of drawing of distinction upon distinction points once more to the whole world.

Bateson, to the contrary, argued that any rule or injunction, even a copy rule, will inevitably end up in a tangle of its own paradoxical assertions. Hence the necessity for 'old fashioned logic.'

24 In an earlier version: 'Abraxas is approximately Shiva, the ultimate Creator-Destroyer, the most terrible and the most beautiful of all gods that man contains within his microcosmic self and that in turn is contained in the macrocosm. Within Abraxas, the more familiar figures (Helios, the Sun and Devil, darkness) are subsumed' (Letters, 201-9d/1973; GB, 1974e).

CHAPTER 10 Visions of Unity

1 Mander, for example, quotes the following from 'A Basic Call to Consciousness: The Hau De No Sau Nee [Iroquois] Address to the Western World,' delivered at a 1977 UN Conference on Indigenous Peoples: 'The

traditional Native people hold the key to the reversal of the processes [of ecological destruction] in Western Civilization, which hold the promise of unimaginable future suffering and destruction. Spiritualism is the highest form of political consciousness. And we, the Native people of the Western Hemisphere, are among the world's surviving proprietors of that consciousness ... Our culture is among the most ancient continuously existing cultures in the world. We are spiritual guardians of this place. We are here to impart that message' (Mander 1991: 193).

2 The quotes are taken from statements made by the Dalai lama in a TV program aired by the Public Broadcast System, 'Spirit and Nature,' in 1991.

3 As we shall see below, Bateson disputed any vector approach to cosmology, that is, a transitive path emanating from self to cosmological system. The vector approach to cosmology is put forward by Will Jones in a lengthy article in *Current Anthropology*. The article was an outcome of Will Jones's participation in Bateson's 1969 Wenner-Gren conference. In his reply to Jones, Bateson categorically rejects Jones's interpretations: 'I believe that your model and your definition of "world view" is simply wrong and that the "vector" metaphor is inappropriate and misleading' (Letters, 733–5a/1970). Naess's discussion of 'self-realization!' suggests such a vector approach to the relation between individual and system.

4 The published interview accompanying his appearance at the Dartington Hall seminar appeared only six months before his death. Part of it is reprinted in *Sacred* (1991: 300–5).

5 Many anthropologists, including myself, have come across this situation when investigating notions of sacredness and belief systems of other cultures. There is a form of knowledge which cannot be told, because the act of telling about it transforms that which cannot be told into the realm of description. Hence Bateson's concern, expressed later in this chapter, with the secrecy or hiddenness of information about the sacred.

6 A crude rendition of the Trinity of Saint Augustine would suggest a transcendent Father, who is the knower; embodied flesh, which is the Son – the known; and the Spirit, the bliss of knowing, as the relationship between them.

7 As with all Bateson's terminology, he is careful to avoid using the term 'sacred' in the usual meaning of 'sacred place.' That would give the notion of 'sacredness' a location, which was entirely against his prior notions of 'located mind.' Instead, he talks of a 'scale of meanings' from sacredness 'on the extreme pure end' to sacredness 'applied to the most impure, the most horrible.' There was a notion of 'magical power' attached to both

ends of the scale. Bateson then deals with sacredness by trying to search out fallacies of thinking within the range of this scale, and how they violated the integration which the term 'sacred' proposed (GB, 1975a; *Sacred* 1991: 268ff).

8 He noted that the first step of the 'recipe' in modern scientific thinking was to establish the rules of sceptical thinking. From this followed the construction of 'self-evident' propositions about doubt and falsification.

9 'The Oxford English Dictionary says of preconception [that it is] "an opinion entertained prior to actual knowledge." But I am using the word in a somewhat narrower sense to mean an opinion *necessary* to subsequent "knowledge" and *shaping* subsequent knowledge for better or for worse; better, a premise of subsequent beliefs. Of "actual knowledge" I know nothing. As Blake would say, "It is a fallacy and its existence an imposture"' (*Angels* UE no. 9).

10 The same could be said to be true in the transmission of biological messages. Biological message transmission in the nucleotide takes place when the DNA initiates it. When these processes of transmission to protein formation occur, the DNA assumes a spiral form. There is a circular loop in the DNA which appears when the nucleotide is at rest and not engaged in 'messaging.' Thus there are two states: non-communication, when the circular or looplike characteristic of the DNA form appears; and 'messaging,' when the DNA form takes the shape of a double helix. Bateson talks of a state of 'readiness'; that is, non-communication in the loops of the recursive system is an alternate state of 'structure/process' ready to receive active messaging.

11 In the realm of the sacred, 'the material of dream and poetry has to be more or less secret from the prose part of mind. It's this secrecy, this obscuration, that the Protestant thinks is wrong, and a psychoanalyst, I suppose, wouldn't approve of it either. But that secrecy, you see, is a protecting of parts of the whole process or mechanism to see that the parts don't neutralize each other' (GB, 1975a; *Sacred* 1991: 267).

12 On 'mandala-like': 'I was always suspicious of mandala from the Hakken Kreuz upwards and including the Book of Kells. I think at a very long stretch mandalas carry a mystical reference (but very mystical) to the recurrent truth that the biosphere is organized in recursive trains of causation. But these recursive trains are never, never circles. The components of either inner or outer rings never in nature constitute Gallois groups and the Romantics always want to represent nature with Gallois groups as for example in astrology, I Ching, and what not ... if you want to understand mind you should look at nature and by nature I mean especially

the products of biological evolution (very few animal parts rotate more than 360 degrees in a lifetime)' (Letters, 462–6a/1979).

13 In other contexts, Bateson defined 'self' as 'a polymorphic abstraction of rather high order,' by which he meant that self was not so much a located body as a nexus of propositions in a network of propositions, which accounts for the fact that the self is so difficult to come to know (Notebook 35/1965).

14 The Bateson correspondence also gives examples of what he believes to be fallacious assumptions of oneness and identity in Buddhist thinking. While Buddhism retained a notion of difference between self and system, it seemed to Bateson that, as a whole, Buddhist thinking lacked attention to process. Buddhist teaching, even more than Christian teaching, built up its philosophy by attention to continuities, he said. While Bateson found this congenial, he could not agree with notions of identity spun out from Buddhist expression of temporal continuity. In particular, 'I just cannot swallow reincarnation,' he said. It was not an adequate representation of the rhythms of repetition in the cosmos (Letters, 1216–22/1975). The concept of 'oneness' contained in the notion of *karma* and bodily reincarnation seemed preposterous. At the same time, Bateson had sympathy with those Buddhist notions which explored propositions about recurrent truths of self and system; for example, *samsara*. *Samsara* is a Buddhist notion of the ego-centred world of anxiety and confusion to which 'nirvana' is contrasted. It denotes some form of process through which ego first presents barriers to joyful living in the world; but subsequently ego-centred barriers are overcome (Hayward 1987: 51, 66). Bateson records that *samsara* was closely related to the process of self-deception: ' ... the matter of *samsara* and the body-mind dualism and the weaving of the intellect with emotion ... must all be examined together, because any epistemological error in one part of this tangle will change the appearance of all other parts' (Notebook 65/1976). Bateson developed this view while teaching at the Naropa Institute in Colorado.

15 As another author to that volume suggests, Bateson's way out of the seductions of individualism is to accept some aspects of experience as a single subject, an 'I,' but then to reject 'I' as a sign standing for singularity of organization (Schlossberg 1977: 147).

16 This discussion arose within the context of his dismissal from the Board of Regents at the University of California, and the exact reference was to the arms race and threat of atomic war. The quotation reads: 'I am talking ... about tearing that larger fabric within which death of the individual person or nation is continually necessary. As long as you are tor-

mented by ideas of personal and individual death, it will be difficult to see straight. To kill the Russians and the whole biosphere will be preferable to risking your own skin' (Letters, 1177-9a/1979).

17 This would mean the mapping of mental process down to 'the natural history of the organism, perhaps neurophysiology or even deeper than that, meeting with the foundations of mathematics on what for the moment we are calling the outside ... [remembering] the outside only has [those] particular characteristics which it shows, because the eye of the organism itself has certain epistemological characteristics. And notice, of course, that the eye has only its epistemological characteristics because it is made of atoms and entities which exist in numbers and patterns and so forth' (*Angels* UE no. 2).

18 Or as Bateson himself puts it: 'Is religion about the relation between the old and the new? Is that where the sacred is hidden?' (*Angels* UE no. 2).

19 'You know, it struck me when I was working on this part of the manuscript that what you had done was to whack out a huge hunk of draft for your editor, putting everything that's now in chapter 13 ['The Unmocked God'] and in chapter 15 ['The Structure in the Fabric'] together, so that it came out as a sort of model of the whole book, groping and all' (M.C. Bateson in *Angels* 1987: 145).

20 Indeed, this is a fair précis of what Bateson actually wrote (*Angels* 1987: 165, 166).

21 An extremely useful discussion is to be found in Bochner 1981: 74.

22 Bateson illustrated his thinking with a double snake diagram in the original manuscript.

23 But even thinking through metaphor in recursive systems leads to error in thinking metaphorically. As with all recursive patterns, 'it is a matter of how to keep those different levels, rings, or whatever, *not* separate, because they can never be separate, and *not* confused, because if they get confused, then you begin to take the metaphoric as absolute, as the schizophrenic does' (GB, 1975a; *Sacred* 1991: 269).

APPENDIX 1 Two Models of Ecology Compared: Odum and Bateson

1 And Bateson pointed to relations of communication evident in morphogenesis which indicate the existence of 'entropy economics.'

2 The early work on cybernetics proposed a statistical measure relating information to entropy, the statistical relation being the reverse of a positive correlation of energetic work, namely, negentropy. Bateson took the reverse of the reverse, and for reasons discussed in chapter 5, called 'ne-

gentropy' entropy economics. In entropy economics, any ecological system which exhibits a continuous range of values between upper and lower limits of tolerance has no fixed values, and values are free to shift from one position to another within a 'budget' of pathways, which are, in turn, organized in levels.

3 There are some minor discrepancies between my presentation of the diagram, drawn from the John Todd letter, and the diagram which appears in the published version of *Angels Fear* (1987: 104). Bateson includes in the Todd letter the designation (t1) to indicate time sequences. Also he includes a visible feedback loop between thermostat and house marked 'Furnace etc.' This is not presented in the diagram published in *Angels Fear*, though it is discussed in a preceding passage of the book (1987: 40–9). Further, for sake of clarity, the feedback loop between thermostat and furnace in the model below is only partly indicated.

4 A feature of Bateson's model is that he does not represent his 'thermostat' simply as a 'structure,' 'object,' or 'process.' In addition, he considers his model of 'thermostat' in terms of the classification 'thermostat.' By this means, he is able to compare the ordinary house thermostat with other forms of 'thermostat type structures and processes' in ecosystems. The means by which he accomplishes this is to consider the proposition of 'reverse links' in the levels of interaction within the model 'thermostat.' Moving from a model of structure and process to a consideration of *the type of structure and processes considered* – from model to a discussion 'about the model' – is a usual style of analysis in Bateson's work. It emerges from his insistence that no model or structure should be 'objectified,' treated as a 'thing' external to, or cut off from the observer's own definition of structure. Speaking 'about' was crucial in any definition at all.

5 The zig of Bateson's model is depicted as a downward arrow running right to left. The zig indicates a bias or a setting changing events within a subsystem. But consider another possibility: a loop back in reverse direction by which settings in the smaller system change events in the larger. Under these conditions, news of a *state* of bias travelling upward (to the system which normally sets the bias) changes events there.

APPENDIX 2 Models of Recursive Hierarchy: Logical Types and Double Bind

1 '[In about 1950] I come along and say approximately, "Well if *Principia be true*, then what are the consequences for human natural history of building our lives on premises which are contrary to *Principia*?" The result is

double bind theory in the much wider sense than the mere history of schizophrenic families' (Letters, 559–20a/1969).

2 In one letter, he asked Holt: 'Am I right in supposing that you are on the way to constructing for causal systems a body of theorems analagous to the calculus of propositions? i.e. to perform for causal systems which contain time what the calculus of propositions does for logical systems which are timeless?' (Letters, 672–17/1968). Holt did not accomplish this, but both Spencer-Brown and Varela did attain this goal. For further discussion on this point, see chapter 9.

3 The major point in his discussion of levels, he said, is that all 'progress' has its price and any change is going to lessen the numbers of available alternatives (GB, 1978g[i]: 218, 223).

4 More correctly, logical typing is used as a means through which relations of *contrast* in different circuits of information can be compared. The contrast is made by people in communication who affirm or deny propositions about the relationship. While all communication reveals disjunctures in 'levels' of communication, the question is to what extent the disjunctures of reflexiveness are isomorphic with disjunctures in sets of events, items, classes, and names.

5 Wilden and Wilson note: 'It may seem that we are faced with an insoluble dilemma. On the one hand, as it appears, we have the traditional logic, dependent on the axiom of identity (non-contradiction) – logic that we know from experience will work *inside* any system we isolate in space and time. On the other, it seems, we find a logic of levels, differences and paradox which contradicts or negates the first ... [but] only from *within* the closed-system perspective can any opposition between the two logics be assumed.' They go on to point out that an ecosystemic logic subsumes and includes the traditional analytic perspective as a supplementary logical system of lower logical types because an ecosystemic logic is multidimensional and includes levels in which either/or disjunctions are subordinated to both–and connections (Wilden and Wilson 1976: 273–4).

6 'Now comes Bateson. His genius was to realize a fallacy in the third type of hierarchy, that of reflexivity, was a lot like those in the other two Russell domains of generalization and totalization ... [but] it is not actually a fallacy in the usual sense, even though it is covered by the Russell rule. It is something emotional, existential and deeply human, and not just an "error" in the narrow sense of fallacy. The group thinks it is using its self-corrective capability of reflexivity when it is actually not, it is doing something like Sartre's "bad faith" in which free choice is surrendered to determinism, thereby giving up its own freedom. The vertical double

bind is a form of bad faith, in which the group loses its freedom to change and thereby self-correcting possibilities, by adopting the sounds of freedom, but not the reality' (Wiley, in Letters, 1499–1/1980).

APPENDIX 4 Scan, Interface, and Double Vision: A Model for Perceiving Ecological Wholes

1 In *Mind* he states that his method 'compare[s] the *processes* of thought with the double stochastic *system* of biological evolution' and 'show[s] that thought is also characterized by such a *double system* i.e. of similar form to genetic and somatic domains' (*Mind* 1979: 182; emphasis added).
2 His unpublished manuscript places a little more emphasis on this change, but one would still not suppose from the unpublished account that the change is fundamental, which means that either Bateson did not regard the change as fundamental, as I believe it to be (and which his own admission of error suggests), or that he was unable to complete his thoughts on the matter.
3 The spiral matched the formal pattern of the double helix in DNA. In human families, the spiral was an analogy of the interactions of a dance among members of a family: individual members of a family constituted one half-step of the existential dance, while the systemic processes of interaction embodying the organization of communication among the family as a unit was the other. Tony Wilden seems to have given Bateson the germ of this idea in the draft of one of his papers that he forwarded to Bateson: 'Imagine the message-in-a-circuit in an ecosystem which is maintaining homeostasis,' he wrote to Bateson, 'as a spiral in which information – the transformation of difference – flows in two directions. This is much like the form of a double helix in DNA. Project the form of the double helix onto a geometric plane. In one direction there is a transform of a circle (in the spirals) – which is a suitable metaphor of synchrony (structure) in this form. The same projection onto a geometric plane also yields a zig-zag ladder between the spirals of the double helix. This zig-zag ladder between the spirals is a suitable metaphor of diachrony (process) in the geometric transform' (Wilden, 'Epistemology and the Biosocial Crisis: The Difference That Makes a Difference,' draft paper, in Letters, 1497–29/1970).
4 Punctuation of the dance by person A combined with a punctuation pattern of B, each of which is reciprocal to each other and mutually reinforces each other, creates a combination of punctuations; through these combinatory punctuations, the observer glimpses the whole relationship

(Keeney 1983: 37–8). Double description enables people to arrive at some understanding of the propositions or rules governing contexts of interrelationships in which they find themselves. Structure in the zig-zag is presented as a classification of rules formed in habitual, repetitive action. Process, on the other hand, is the dynamic pattern of interrelations which embody categorization of patterned habits. These become broken or discontinued through the formation of new interrelations at each transformation of structure.

5 Especially in Blake's text 'The Marriage of Heaven and Hell.' According to Bateson, Blake went much further and asserted that the only 'reality' is that of the Poetic Imagination. In fact, Blake believed his creative imagination was open to direct 'perception.' 'He believed the creations of the imagination to be real, while the bread he bought from the baker was merely symbolic ... Blake would focus his ear and let his auditory voices dictate his poems, or he would focus his vision upon the paper in front of him and draw or paint it according to the outlines he saw. Blake knew the difference between the everyday world and the creative imagination, but reversed their relative importance. Yet he was no schizophrenic; his imaginings were a matter of self-discipline, a focusing of otherwise submerged or unconscious processes in order to aid conscious interpretation' ('The Communicational Approach to Physiology and Human Behaviour,' CAF 52-A1/1959).

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3. UNPUBLISHED SOURCES

The Gregory Bateson archive in the special collections section of the McHenry Library of the University of California, Santa Cruz, is arranged as follows:

COR (Correspondence and Subject Files, 1939–80; boxes 1–39): see 3a below

Bk. Mss. (Book Manuscripts, ca. late 1950–80; boxes 1–9): proofs, notes, correspondence (see 3b below)

Misc. Mss. (Miscellaneous Manuscripts; boxes 1–6): manuscripts, transcripts, booklets, marginalia, select articles about G.B. to 1980

Angels Fear, unedited Mss.: see 3c below

PAF (Published Articles File, 1925–85): copies of those articles cited in the bibliography of *A Sacred Unity* (Bateson 1991: 314–36)

CAF (Complete Articles File, 1925–80; boxes 1–16): manuscripts, notes, reference materials, correspondence, and, in the case of published articles, reprints and photocopies. These are ordered individually by number and paginated (i.e., CAF no.-page no./year)

Notebooks (Notebooks and Loose Notes, 1943–77; boxes 1–6)

Tapes (boxes 1–7) and films

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3b. *Bk. Mss. (Book Manuscripts, ca. late 1950–80, boxes 1–9)*

Boxes 1–3: *Steps to an Ecology of Mind;* box 4: *Where Angels Fear to Tread;* boxes 5–9: *Mind and Nature*. The following have been cited from the Bk. Mss.:
Box 5; 1987: 204.13: 'Forward' [*sic;* to the Ms. 'The Evolutionary Idea']. 5 pp.
Box 5; 1987: 204.24: 'A Way of Seeing.' [Ms. beginning 'D: what do you look at?']. December 1973. 55 pp.
Box 5; 1987: 204.33: 'The Criteria of Mental Process.' December 1973–January 1974. 39 pp.
Box 5; 1987: 205.1: 'Ideas as Units of Evolution.' February 1974. 3 pp.
Box 5; 1987: 205.26: 'Glossary Bits.' May 1974. 14 pp.
Box 5; 1987: 205.27: 'Chapter V: Co-Evolution' [of 'The Evolutionary Idea']. 17 pp.
Box 5; 1987: 206.6: 'Logical Types' [loose manuscripts]. 8 July 1976.
Box 6; 1987: 208.42: 'Abduction; [unlabelled folder-scraps out]. 25 pp.
Box 6; 1987: 209.22: 'Mind in Nature' [benefit for Lindisfarne]. 17 November 1977.

3c. Angels Fear, *Unedited Mss.*

The following portions of the unedited version of *Angels Fear* have been cited:
UE no. 2: 'Eternal Verities' [tape transcript of a talk given to the Jungian Institute of San Francisco, 14 March 1980].
UE no. 7: 'Double Vision' [Remsen Bird Lecture]. 25 October 1978.
UE no. 9: 'The Defences of Faith' [a chapter re-edited for the published version].
UE nos. 13–15: 'The Unmocked God' [a chapter split into several portions in the published version].

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