FORESIGHT

The Art and Science of Anticipating the Future

Dennis Loveridge

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Preface

There has to be a reason and a purpose for a book. One of Peter Checkland's students claimed that any book should make two earlier books redundant, while a one-time colleague, Trevor Williams, always tested a book's quality subjectively by asking whether it would win a place on his 'six inch' bookshelf of invaluable books. As this book will not follow conventions I cannot be sure whether it will meet either of the above criteria. The lack of convention will come from the informal, story-telling style used by Donald Michael in many of his papers and followed (unwittingly I suspect) by Susan Greenfield in *Tomorrow's People*, which she claimed should have been a novel. Rather than 'a book' this will really be a series of short books (chapters); interrelated if the reader wishes, but stand-alone, in current vernacular, for those whose interests lie in chosen chapters. The choice of presentation is deliberate so that those who dismiss say, the underlying notions of foresight as 'gobbledegook', may at least content themselves with some practical ideas relating to its execution in either business or the public sphere. Throughout there will be much emphasis on *interrelatedness* and *interconnectedness*, two *systems properties* that my long time colleague, Philip Holroyd, and I have discussed endlessly (Note 1). The success or otherwise of the scheme 'will be history', as the saying goes, once the text is complete. I would not have set myself this unfamiliar task had I not believed that *systems thinking*, which will be constantly in my mind, has been separated from futures studies for far too long. To attempt to bring the two together is both the reason for and purpose of the book, while strengthening the case for foresightful futures studies is another purpose of the book.

If the book concerns systems thinking and futures studies you may well ask why is its title 'Foresight'? Unashamedly, because *foresight* and systems thinking are tightly interrelated; it is also a widely used term and because the community of institutional practitioners have chosen, dangerously and unwittingly I believe, to slide towards the more complicated activity of scenario planning, which is inherently based on systems thinking. Now is not the time to take that argument further, but I should differentiate between *f*oresight as an individual or small group activity that depends on *appreciation, anticipation and learning* and Foresight as a procedural activity currently much in vogue in national planning. Tiresome though the differentiation is, it has become unavoidable. So *f*oresight is the genesis of the two subtitles (‘*care or provision for the future*’ or ‘*the muzzle sight of a gun*’) and is needed now more than ever if nations are to avoid sleepwalking into future situations they would rather avoid. The relationship to freedom and democracy are clear. Both have to be struggled for continuously against those people and situations that would restrict them, possibilities that are only too obvious, and in some surprising places, in 2008.

Appreciation, anticipation and learning form a feedback loop that enables *f*oresight to play a fundamental part in human development in every sphere. As the art of looking forward (the meaning intended throughout the remainder of the book), *f*oresight is an essential ingredient in the development of the relationships between humanity and the world in which we live. However, this distinctive human activity takes place on a planet that depends effectively on a complex form of dynamic ‘homeostasis’ or *homeorrhesis* (Note 2) (more will be said about this later) for the survival of its population of living organisms of all kinds. Homeorrhesis is devoid of *f*oresight so that there is an immediate discord between humanity’s attempts to shape its own future within a system that is largely blind to those attempts and can severely punish the presumption that ‘we [humans] are in control’. For this reason, amongst others, my expectations of *f*oresight are tempered by knowing that it is neither forecasting nor prediction nor is it a science, but is a marriage of intuition, substantive knowledge projected into the future and sensitivity to developing trends, issues and events in a symbiogenetic way. Often these traits give plenty of opportunities for disparaging comparisons with vitalism or prophecy or give rise to references to futurology, a notion thoroughly rejected in hard headed circles in business, government, science and secular society. In scientific circles, this view, while understandable, is a cause for some amusement since ideas dignified by the word theory are often little more than speculation or conjecture (both of which are discussed later) or better described as scenarios as is evidenced, dare I suggest, in cosmology despite its extensive scientific validation. Happily, these speculations, conjectures and scenarios can change science and its counterparts elsewhere for example, in business, the social milieu, politics and notions of sustainability. None of this is possible without embarking on the arduous step of understanding, through appreciation, anticipation and learning, the intermingling of themes from the **S**ocial, **T**echnological, **E**conomic, **E**cological, **P**olitical and **V**alue/norm events (the STEEPV set that will often be referred to), issues and trends that inform and make *f*oresight possible. It is drawing together all of the above threads in an integrative way that gives rise to the many themes and the inter-working of practice and theory explored in this book. Inevitably, the emphasis on interconnectedness, relationships and integration are ‘glued’ together by the notions of systems thinking that ultimately underlie all that is said in the following chapters.

I have spent most of my working life in industry and industrial research. Much of that time involved activities that did not conform to conventions, no

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I wish to thank many people who, through discussions over decades have helped to shape the thoughts embodied in this book: many of them are mentioned in the Preface. The Open University's Open Business School generously agreed to my request to reproduce parts of the course material on scenario planning that I prepared for them in 1992. My colleagues Maria Nedeva, Michael Keenan and Kerstin Cuhls also generously agreed to my using, in Chapter 3, parts of the annexes to our 2001 review of national foresight programmes. My appreciation goes to Michael Keenan for many hours of discussion on the awkward subject of prioritisation, a matter we never resolved. My thanks also go to Michael Keenan, Ian Miles and Rafael Popper who shared in the considerable trials and tribulations as we conducted our first international foresight programme: we learned a great deal that has provided some of the insights in the text. To Michael Keenan and Ozcan Saritas – many thanks for hours of creative argument about systemic foresight: here the interpretation of the notion of systemic foresight is entirely mine 'warts and all.' Discussions with Cristiano Cagnin and Paul Upham helped to place Corporate Social Responsibility, the Global Reporting Initiative, the precautionary principle and the Natural Step in the context of foresight and systems thinking: again I accept complete responsibility for the presentation here including any misunderstandings. On more mundane matters, the population data used to construct the graphs in Chapter 8 are drawn from the 'World Population Prospects Population Database the 2006 Revision' by the United Nations Population Division, 2007. The data used in constructing the illustrations of the demographic transition are drawn from the 1998 World Development Indicators on CD-ROM.

Introduction

… if it be not nipped in the bud, it will
burst into a conflagration which will
deluge the world

Sir Boyle Roche (1743–1807)

What is systemic thinking? What is foresight? After all, we know there are boundaries to our lives and thoughts, and both are essential parts of the wholeness explicit to systemic thinking. Similarly, we all anticipate the future in small and large ways so that anticipation or foresight is hardly an unusual activity. So what is all the fuss about? Sir Boyle Roche clearly knew the answer lay in the freedom of creative thought and anticipation, combined with the need to control their consequences, intended and otherwise, at whatever scale is involved.

History has a strong influence in any endeavour and that of foresightful activity is no exception. Indeed, I would contend that hindsight and foresight work in harness through the notions of wholeness. 'But why study history at all? Why concern ourselves with anything beyond the range of our own time and place?' were cogent questions Toynbee asked in the Foreword to his monumental, systems-based study of world history conducted between 1924 and 1972 (Toynbee 1972:10). Rhetorically, Toynbee's response was that 'Within the last 500 years, the whole face of the globe, together with its air envelope, has been knit together physically by the amazing advance of technology, but Mankind has not yet been united politically, and we are still strangers to each other in our local ways of life, which we have inherited from the times before the recent "annihilation of distance".' While I would demur from Toynbee's first contention, the evidence for the second is greater now than ever. Toynbee concluded that '… Man does not live in just the immediate present' but in a '… mental time-stream, remembering the past and looking forward – with hope or with fear – to an oncoming future.' In the global context of history, acts of anticipation, some of global influence others much more local, have been recorded throughout human history. The continual reference to and appearance of jesters, prophets and seers makes clear the ever-present interest of rulers and others in knowing what the future has in store for them. The penalties paid by the purveyors of anticipations were generally painful and often fatal even when they turned out to be right, as Nicolai Kondratieff found in 1923 when he developed his long cycle theory of capitalism (Kondratieff 1935:105) that did not give Stalin the answer he wanted! Beyond a small set of current certainties, knowing what the future holds, as purveyed by sages, can only be opinion even when supported by complicated modelling – mathematical or otherwise. Selective listening is an enduring and endearing human trait that leads to the Biblical dictum, '*A prophet is not without honour, save in his own country, and in his own house*' (Matthew 57). Everyone concerned with foresight does well to remember that saying. Similarly, that the ancients were sceptics is illustrated by the philosopher Horace: '*What shall be to-morrow, think not of asking. Each day that Fortune gives you, be it what it may, set down for gain*' (Odes, I, ix:13). Denigration of acts of anticipation, of foresight, have a long history. It is only the strength of human curiosity to know the future, to engage with the mystery and paradox of wanting to know the unknowable, that has stayed the powerful hand of denigration and often ridicule. The history of human foresight and its influence is complicated and deep. All that will be attempted in a few short paragraphs is to set the activity in the context of the last 2500 years.

Anticipation, or foresight, is fiercely argued over wherever it occurs or whenever it is claimed or referred to; it is after all a political activity, related to agenda setting, that is why it is either 'care or provision for the future' or 'the muzzle sight of a gun'. Clauswitzian though this comment may seem (Clauswitz 1832), there is little doubt about the wholeness of the combination of force and politics to the extent of Mark Twain's contention that 'soap and education are not as sudden as a massacre, but they are more deadly in the long run' in bringing about change in ways of behaviour. The first may be more permanent, but too often massacre is the preferred situation. In 2008, at a time when the idea of the preventive or pre-emptive war has undergone one of its historical recrudescences (Note 1) these dual properties of systemic thought and foresight can hardly be more evident even though their use may have left much to be desired.

Foresight was alive and well in the ancient world. The BOGSAT committee (bunch of guys sat around a table) was as well used then as it is now. Various ways were used to reach a consensus about what to do as a result of their anticipations. These may well have been rather more brutal and physically direct than those of modern times, which have their deeply combined psychological and physical aspects of economic and social exclusion. To ancient (and modern) societies their 'worlds' were simultaneously simple and baffling. Simple, because physical survival was always the dominating theme of life (it still is in 2008), but baffling because survival was often difficult, if not elusive, in the face of threats and dangers that were and remain ever present. In such worlds, simple blunt responses to situations often worked immediately within tightly drawn boundaries, but were soon found (and still are) to have many unanticipated outcomes, a feature that remains prominent. However, there was no pretence that human beings were anything other than part of a much larger natural world in which only human foresight (or anticipation), and understanding accumulated from it, would ensure survival from day to day. The world remains the same today. So has the world really changed and become more complicated? Or has population growth and human persistence in the pursuit of knowledge created complexity? Whether this complexity will improve the human being, as is now proposed by an ardent posse of transhumanist advocates – and opposed with equal passion by others – remains a huge uncertainty that I cannot escape. For the Earth as a living system, the returning notion that a separate human world can be created is based on the hubris that humanity continues to believe in its dominant position in the world, as set out in Genesis (1:26–31), that we are 'in charge' of the Earth and can fashion it (or even worse improve its design or even redesign it as humankind has been attempting to do for millennia) to our desires, while avoiding the unanticipated or unwanted outcomes: this is a disastrous lack of systemic thinking, of foresight and of learning.

While foresight is an inherent human activity, conducted both consciously and unconsciously, it appears to be both simple and complex, one of its many paradoxes. Some years ago, I was asked what would be the characteristics of a manager in the future; I had no hesitation in placing the ability to manage paradoxes at the top of the list. I believe this to be true now and for some distance into the future since the more we think we know, rather than understand, the more hobbled and inappropriate humanity's actions seem to become. In the rich parts of the world an hedonistic economic system promotes a culture of possession of artefacts. These have an ever-shorter life cycle, but not lifetime, creating mountains of junk while the majority of the Earth's people live in unpleasant circumstances and often in poverty and starvation, while supermarkets force good food to be thrown away. The threat of disease and natural disaster is ever present for all people, with the possibility that the relationship to survival may be inversely related to wealth, though transhumanists, who believe in a post-human future providing immortality, would disagree. Demographics alone point to the emergence of immensely difficult situations while our understanding of growth phenomena lead inevitably to ask 'What will bring population growth to an end?' and 'At what level may that occur?' Foresight, as the progenitor of forecasting and futures studies, has said a little about that so far. Will it be disease? Or a major natural disaster, such as the eruption of a giant caldera or the impact of an asteroid of kilometre dimensions? Or the crowding effects referred to in World modelling (Meadows 1972 & 1992)? Or will it be *homeorrhesis* (ibid.) as anticipated by Lovelock's notion of *Gaia*, in which mankind might finds itself in a world too inhospitable for survival? All are possible and at least some may occur simultaneously.

There are shining examples of systemic thinking and *f*oresight in the ancient world. Anaximander's first cosmological view (Anaximander *c.* 600 BC) broke the ancient belief that the Earth was held in place by some kind of physical support. More important were the writings of the fifth century Pythagoreans science, on inventions and on the applications for technology in artefacts large and small, all derived from far hazier notions of social needs, or more often wants, which themselves were often born of the subtle (and sometimes not so subtle) influences of advertising, the media and naked political ambition. It was the age of the 'can do' mentality which rarely questioned the advisability of what was done to assuage public demand (Loveridge 1983:498). For these reasons, it might reasonably be said that industry was in the vanguard of using foresight and the partial use of systemic thinking. In industry, the use of such hazy terms for activities that had been everyday practice in business development, from time immemorial, was averred as was reference to the haphazard and opportunistic character of its activities. Foresight or not, the bottom line had to be, and still is, one of a positive cash position, otherwise the tomorrow of foresight becomes irrelevant. Now this emphasis is shifting, albeit hazily, to include social responsibility as additions to the bottom line stretch further into the notions of wholeness. There is clearly a relationship between planning and foresight that needs an historical reference.

From the time of Marx and the notions, however distorted, of the social control of the means of production, the idea of planning, especially 'national' planning, has had ideological overtones. Paradoxically, planning is ubiquitous though its implementations may be very different from company to company and nation to nation. For some time in the 1960s planning was seen as a Cartesian process made up of impartial frameworks and certainty of outcome; the reality of aggregations of overt and covert ambitions of myriads of people, with their own agendas, was not entertained. Aided by growing computer power, the belief in Cartesian approaches seemed sufficient to build operating models, of great complication and detail, of businesses and governments. In the culture of the 1950s and 1960s, for managers to admit uncertainty in making and taking decisions was to be branded 'incompetent' or 'unprofessional', a sentiment that has not died completely even today when the uncertainties facing decision makers and takers are much more evident. Events in the early 1970s brought the collapse of this era of pseudo-certainty and it has never returned. Often the key event is said to have been the oil crisis that followed the Yom Kippur war in the autumn of 1973, an event anticipated by several years by some oil company executives, but this was not the only event to topple the era of pseudo-certainty. The international merger boom of the late 1960s shattered long-held notions of loyalty; international terrorism strode onto the scene never to depart; single-issue groups reared their heads for the first time; student campus riots and their parallel in the wider community occurred in many countries; all these events helped in their own ways to destroy the ambience of stability and certainty so that, aided by the advent of post-modernist thought, planning went askew and became disreputable. New methods were sought and emerged during the mid-1970s in what became known as 'scenario planning' (Wack 1985a:73 and 1985b:139). At the same time computer modelling was turning to wider issues and yielded outcomes such as the Meadows World 3 (Note 4) and the early weather forecasting models that have matured into the current versions of Global Circulation Models (GCMs) (Note 5). The surface of these events can only be scratched here, so great has been the shift away from the certainties of the Cartesian era of modelling and management whether in business or governments. However, underlying all these shifts has been the perception of many trends and events that have and still are reshaping the world; that perception is the characteristic of systemic thinking and of foresight. It is the role of the agile mind to perceive and anticipate future events sometimes correctly, as it turns out, and sometimes to be wrong catastrophically! (Note 6) It must be made clear that foresight is not planning of the scenario or any other genus: foresight is anticipation and nothing more, but should be informed through systemic thinking; that will be its meaning throughout this book. The current tendency to mutate the label foresight unwittingly into something that sounds uncommonly like scenario planning, but without recognising the depth of that process and the effort it requires, is downright dangerous.

Now at the dawn of the twenty-first century, formal Foresight has become frenetic and global as its ideas are adopted in ever more continents and countries. However, the related bureaucracy tends to direct its focus to established sets of concerns, including biotechnology, information technology and, more recently, nanotechnology and cognitive science. Whether these distinctly Western concerns are of universal importance must be questioned as must the possibility of developing countries by-passing the industrial era altogether, a possibility I, amongst others, first recognised 30 years ago. Foresight of the non-bureaucratic kind is ever present, and thankfully so, as the source of ideas and influences later taken up in formal Foresight programmes, but often ridiculed currently (the behavioural aspects of Foresight are conveniently not discussed by its proponents). The concerns of real foresight (Loveridge 2001:783) look beyond the obvious toward the new kinds of society that may emerge over the coming century from the dynamic situations that may describe the 'problems of living' not just for humankind but for the continuance of the Earth as a living system. I have been involved, in a minor way, in promoting the current frenetic Foresight activity. In industry, my home for most of my working life, foresight is ever present. It is the Japanese who, from 1971 onwards, through their five-yearly 'technology forecasts', stoked the fire that has led to the current blaze of Foresight. However, the way the methodological fuel has evolved has left me uneasy. Its application is fragmented and punctuated to a degree that often has led to pedestrian outcomes that, if continued, may lead to extinction of the blaze. It is for this reason that a relationship between systemic thinking and Foresight is set out in a later chapter. For me this is a return to my roots. It remains to be seen whether systemic thinking can help to cope with the complexity of situations that *f*oresight is now both creating and identifying, but it now seems obvious that the fragmented, punctuated and non-systemic bureaucratic processes of Foresight cannot serve their intended purpose for much longer, while wrestling simultaneously with the shifting balance of influence of modernist and post-modernist thought.

Foresight is not new, only newly rediscovered after one of its periodic sojourns in the intellectual and political wilderness. In this brief contextual introduction, some of the topics that will be discussed in ensuing chapters are hinted at while others are not. Inevitably, where ideas here draw upon work by other authors there will be signposts to the originals. The task ahead is daunting, but it will not be shirked. It is time now to turn to what matters from here onwards.

Part I

Systems and foresight

less than the replacement rate. The consequences, in terms of the necessary future wealth-generating capability of the rising generations through the 1980s and onwards – dependency ratios, an ageing population, immigration and emigration, and other matters – were clear enough by the early 1980s to be indicated to the company and later to enable me to teach about them to an undergraduate course from 1992 onwards. There are many other examples where the centrepiece of institutional Foresight studies fail because, even in 2008, they are conducted on the basis of classic reductionism; the systemic interrelations are rarely made.

In the Introduction I referred to institutional Foresight's slow and unobtrusive mutation toward what is believed to be scenario planning. The shift has been real enough and in the UK Government's Foresight group this emphasis is referred to directly. The words 'visions', 'alternatives' and the post-modern word 'narrative' have come onto the scene to the extent that the Foresight process is now referred to in much the same way as the planning process used to be. The extent to which this similarity has advanced can be gleaned from Miles and Keenan (2002: 15) in their 'Practical Guide to Regional Foresight in the United Kingdom' where they claim that:

> The term 'Foresight' [is understood] "to describe a range of approaches to improving decision making … Foresight involves bringing together key agents of change and sources of knowledge, in order to develop *strategic visions* and *anticipatory intelligence*. Of equal importance, Foresight is often explicitly intended to establish *networks* of knowledgeable agents". (Note 2)

However, this shift has not embraced the full context and content of scenario planning, leaving the Foresight process with both feet in mid-air, an expression used by Donald Michael in his reflections on thinking about the future (Michael 1985: 94). Foresight, real or institutional, enables visions of the future. While life is the present, anticipations of the future are an inevitable part of that present. The purpose of visions of the future is to attempt to identify, as far as one sensibly can, different kinds of futures in which life may take place. For example, in 2001 the argument in the UK about joining the single European currency and involvement in Europe's further political integration ignored the 1974 report by Lord Kennet, a UK parliamentarian, that openly acknowledged that political union was Europe's ultimate aim (Kennet 1976). If people in the UK did not know that, it was because the question was not asked. In 1956, Jan Monet and his associates' vision was of an integrated Europe free from war. There are other visions for the future of Europe, some of them distinctly unpleasant.

Visions of the future are there because they are inevitable; without them the polity can neither develop nor policy be created. However, one property a vision must have was neatly summed up by Al Haig, the one-time US Secretary of State, that '… vision without discipline is daydream' (Haig 1984). Foresight is an essential precursor to creating vision and is needed to prevent daydreaming; in that way foresight enables policy to be shaped.

In its current context, the Foresight process is said to be systematic, within the often undefined boundaries of study. Within this frame, the reductionist overtones of systematic inquiry cannot be evaded. However, this creates an oxymoron as neither a systematic nor a reductionist way of caring or providing for the future is possible for something that does not yet exist. By contrast it *is* possible to anticipate possible future events that, when taken together, describe a set of perceptually bounded, imagined future situations; this is a systemic, not a systematic, way of proceeding because it is opinion centred, deals in uncertainty and alternatives, and relies on what Vickers means by comprehension (Vickers 1963), which will be discussed shortly.

What can be concluded about foresight at this point? First, that the real variant identifies a series of either random or pseudo-random and specific future events, anticipated by individuals or groups often within well-defined boundaries, that are widely ignored or denied when first recognised. The interrelationships between these specific future events and the present are not always sought or displayed, though in the best circumstances they are. Although the notions of a paradigm and a paradigm shift (Kuhn 1962) are usually reserved for scientific theory, real foresight is closely allied to these events. Characteristically, the events described by real foresight, at their time of identification, are of low probability of occurrence, but of high information content describing highly unusual matters or patterns of them. Second, the institutional variant is mostly concerned with rediscovery of past real outpourings and aggregation of them into collections of ideas, often in an *ad hoc* way, that are perceived to be related to a problem, however broadly that may be described. Characteristically, these collections of ideas are of high probability of occurrence and low information content, because much more is known about the ideas involved.

Systems thinking and its influence

What then of systems and systems thinking? Systems thinking can touch every form of human and natural activity; it is this propensity that has, in the past, led to extravagant claims for its capabilities with the attendant risk of disrepute, typified by the highly critical papers by Phillips (1969: 3) and Lilienfeld (1978: 191) in which general systems theory is dissected closely (Phillips' and Lilienfeld's criticisms will be explored at greater length in Chapter 2). Other than simple lexicographic descriptions it should be obvious that formal definitions of 'system' robs the term of its depth and complexity. Flood (1999) attempted to clarify the position relating to systems thinking as follows:

> 'Systemic thinking is then not something that can be explained easily and understood comprehensively … Very quickly we will lose touch with the

> notion of wholeness in a trivialised account of its so-called properties. Many textbooks … make this mistake … explain the world in terms of systems and subsystems, what a system is and how it behaves. An account in these terms … strips it [systemic thinking] of all essential meaning. Systemic thinking begins with an intuitive grasp of existence'
>
> (Flood 1999: 82)

Flood's comment indicates the well-known systemic tenet that phenomena can never be wholly known for the very reason that we are part of them, a notion that stems from gestalt psychology and Smuts' original writing on holism (Smuts 1926) and, more remotely, from a sociological adaptation (or corruption) of the uncertainty principle (Heisenberg 1927). Flood's point is well made, giving more cause to avoid formal definitions of ideas that are shaped by the plasticity of the human mind.

Von Bertalanffy (1929) set out the beginnings of systems and systems thinking especially to challenge reductionist thought that dominated science at the time and in many ways still does. For von Bertalanffy reduction was not a viable way to study living biological phenomena that needed to be set in the context of other phenomena with which they interacted, with increasing complication, and from which they gained their life support. What may loosely be called the systems movement sprang from von Bertalanffy's original work and led to the formation of the Society for General Systems Research in the 1940s. Many times since attempts have been made to define systems thinking, particularly during the early post-World War II development of operational research (e.g. Churchman 1968); mostly, as Flood maintains, these efforts have been counter productive.

Checkland sets out a chronology of the rise of systems thinking (Checkland 1981: 59), which I will not repeat here, in a way that also indicates problem areas that systems thinking faced at the time and mostly still does. In his review, Checkland claimed that Aristotle argued that the sum is greater than the parts in any set of interconnected elements, but it remains unclear when the modern notion of thinking about situations as a whole, systemic thinking, began to be used. Jan Smuts (1926) may be the person who marked out holism in its modern idiom. Dictionary descriptions indicate that systems are collections of items that are interconnected or interrelated. Checkland (1981) goes further to claim the nature of these collections, with their interconnections, to be a model, hierarchical in structure, with emergent properties and with communication and control aspects. With the passage of time, the focus of attention in systems research fragmented into many themes that are summarised in Figure 1.1 and not simply into hard and soft systems.

Throughout the different streams of systems activity, interdependencies are prominent features; these become ever-more so as the differences between the traditional notions of hard and soft systems blur. Process control theory and its applications are the most easily recognised, though nowadays the term 'process' has to be interpreted more widely than its original intention. For example, the ever-growing use of algorithmic stock market trading is a far cry from manufacturing process control, but it is turning what was seen as a soft activity, based on human intuition and judgement, into a hard, if not mechanised process. Similarly, fly-by-wire aircraft represent an extreme development in control systems as do remotely controlled 'drone' weapons systems. There are also attempts, some successful some not, to manage recruitment and the flows of patients in health systems as a hard, mechanised process. At one time, hard systems would have been regarded as complicated, but well specified and understandable. These contentions have become less sustainable as processes have become ever more complicated, a feature exemplified by analyses of accidents (Perrow 1984) in many fields (e.g. Three Mile Island, Apollo 13 and forms of medical diagnosis) that indicate the presence of complexity that human operators find difficult to comprehend.

'Situations' are systems which may be characterised as 'a regularly interacting or interdependent group of items forming a unified whole' (Merriam-Webster's Collegiate Dictionary) taking the form of 'a social, economic, or political organisation or practice'. Checkland (1981: 317) takes these formal descriptions further, but in a different direction when describing a system as a model of a whole entity that ought to relate (this ought not to be a matter of choice!) to real-world activity that, in human made entities, have emergent properties as a crucial characteristic. Many of the notions laconically mentioned above recur in one form or another throughout this and later chapters. It is at this point

Figure 1.1 Streams of systems thinking and applications that the temptation to embark on a definition of systems thinking, is strong, but it is one that I will resist.

Living systems are usually thought to be soft, by default. They can be of infinite variety. Here, though, there is a more subtle separation within soft systems thinking between natural systems and human societies, organisations and their management, and behaviour. The effort put into understanding these activities has been and remains immense, and has become the subject of major modelling work. However, the separation of systems into hard and soft variants is immediately seen as naive as science and technology and social thought continue to blur the separation between the two. It is here that the more contentious aspects of systems now lie. The claim for systems to have emergent properties that lie beyond the properties of an assemblage of well-understood components, the gestalt aspect of systems, leads inexorably toward an argument for what Sheldrake (1988) and others have called the presence of the past. The importance or otherwise of Sheldrake's notions will be discussed further in Chapter 2. On occasions this has been dubbed a return to the notion of vitalism, of there being within a system some property that acts to glue component parts together so that there are emergent properties derived from the assemblage as a whole. These are deep arguments that lead towards Flood's conclusion that systems thinking requires an intuitive grasp of existence.

There have been some outstanding results from the systems movement; some have been indicated briefly in Figure 1.1. Similarly, the encroachment of systems thinking into what would otherwise be regarded as the territory of social studies has been considerable, but often unrecognised. Examples are too numerous to mention without being invidious. In parallel, theme-based professional societies have been created for which there are no parallels in the foresight world, though the act of foresight underlies the themes of the systems world.

If there is an intertwining of foresight and systems thinking then there are no better places to look than in the writings of H.G. Wells, Aldous Huxley, Vannevar Bush, John von Neuman, Richard Feynman, Eric Drexler, Hans Moravec, Ray Kurzweil and many other authors. Similarly, every major paradigm shift (Kuhn 1962), whatever its field and consequent new theory, results from foresight, the act of anticipation. None of this prevents foresight as a generic activity being regarded as disreputable, a mere guessing game about the future that may or may not travel with the wholeness of systems thinking. In this association, the notion of systems, so well established elsewhere, can promote a sigh with the response 'so what?' when the claims to wholeness are seen to be vague and more of an obeisance to correctness. As will be seen in later chapters, the conjunction of foresight and systems thinking has considerable power. It is hard to know whether this conjunction should be regarded as symbiosis or symbiogenesis. By contrast, at present there is not a shred of evidence that any form of foresight is characterised by wholeness, but is fragmented into either single ideas or multiple sets of them with only the barest attempt to cope with of Weinberg's more general statement) that hang on the answers to questions that can be asked of science and yet cannot be answered by science (Weinberg 1972: 209). Issues, or situations as they more properly are, of this kind are now a common feature of life and throw the activities of policy makers into sharp relief. As the situations cascade, positions taken up by agents and agencies shift as new theories and new data are preferred, arising perhaps from the Assessment and Pedigree categories of the NUSAP (Funtowicz and Ravetz 1990: 28) way of examining data. Situations frequently involve preference shifts among the people involved, appreciators in the following section, and may involve the equivalent of a Kuhnian (1962) paradigm shift in science, but these are unlikely to have the same depth of foundation as the arrival of a new theory in science.

Throughout the holism debate there is a frequent recourse to the Aristotelian claim that the sum is greater than the parts. However, Buckminster Fuller's idea of synergy, from the Greek *synergos*, working together, may be a more appropriate way to describe the claims of systems thinkers, if only because it is gradients between a system's elements that drive the synergy between them in any situation. By an analogy with the Second Law of Thermodynamics, a system of ever-declining gradients is one of increasing entropy and rising disorder, notions that are important in situations.

What of the practical characteristics of situations? M'Pherson's rebuff of Popper's criticism of holism had its roots visibly in the world of the systems practitioner, with a sense of exasperation over the philosophical debate concerning the validity or otherwise of holism. In a discourse about rational science, which many would call normal science, Maxwell expressed concerns for the way rational science passes real world problems by (Maxwell 1984: 65). Maxwell turned his attention toward how the practice of science could be changed to get closer to what he termed 'the problems of living' as characterised by what is of value to people in their lives. As an aside, Maxwell conducted his debate under the titles of the philosophy of knowledge (rational science) and the philosophy of wisdom, which is concerned with the problems of living. 'Situations' is the term I prefer to the 'problems of living' as it conjures in one word the theatrical nature of the problems of living in all their dimensions. Practically, situations need learning, judgmental comprehension and anticipation that, through synergy (or symbiosis?), create foresight and adaptation (or prepare for it) to changing circumstances. Throughout there is a necessity to combine reduction and holism together in the difficult process of fixing a situations boundaries, a matter Dempster (1998) discusses in an extension to Maturana and Varela's theory of autopoiesis (1980). Simon's (1957) strictures of bounded rationality, with its escape route via satisficing, always needs to be borne in mind, but without sacrificing the rigour and quality of the investigative process of inquiry into a cascade of situations. By their nature situations are rich in symbiosis where elements live together in a mutually supportive way. There will also be evidence of symbiogenesis

(Margulis and Sagan 1995: xiii) in which elements of the situation are acquired totally by another, creating a new and more complex element in the evolution of the situation (symbiogenesis is probably more complete than merger and acquisition activity in human organisations, especially, but not exclusively, in business).

The practical process of learning, anticipation and the judgmental comprehension of a situation is similar to that described later (Chapter 6) for scenario building; both can be aided through systems modelling, discussed later in this chapter, in any appropriate form, as this transforms the concepts and perceptions from abstract internal patterns into a form that can be worked with in the physical (practical) world. The need to learn poses questions about what to learn and how to go about it? Why are the themes chosen? Who to turn to for advice (which raises the political-cum-technical matter of expertise)? Where are advisors and information to be found? And when, in the life of the situation and its cascade, are particular forms of learning needed? The synergy of the learning process is through discriminating judgement of the appreciative kind which leads to anticipation and foresight concerning the situation, all of which is a complex process controlled through the combination of reduction and holism. Learning and discriminating judgement of the appreciative form are the key parts of working with situations. It is these that permit well-founded thought experiments on which anticipation of both further learning and foresight depend. It also raises the questions of personal learning, organisational learning and *in extremis* social learning by entire societies. These are subjects in their own right; all that can be done here is to indicate their presence while raising three particular issues: the need for reflexivity to constantly test what is being learned; the transition from information to knowledge, which is usually glossed over; and the necessary shift from broad to directed learning.

Reflexivity is needed to ask whether what is being learned can be used without thinking through its use in the situation, what Argyris and Schon (1978) call theories-in-use. The addition of reflexivity transforms this into double-loop learning (ibid.) in which the premises of the theory are examined in relation to the situation. Throughout the use of reflexivity, the NUSAP way of examining data helps in its conversion to knowledge. The common ground in the process will be the transformation of information, which is currently related to problem solving. Even if this transformation is not well understood, it is an everyday practical occurrence and, to that extent, is familiar. By comparison the transformation of information into knowledge, and subsequently into wisdom, as in Maxwell's (1984) argument, to ameliorate the problems of living has, perhaps, barely been considered in the foresight world. Problem solving remains a dominant feature of society, as does the fallacy that integration of individual problem-solving solutions can be a solution to a complex situation.

Common ground is an important building block in the transformation of information into knowledge. It depends on successful sharing of information, which is itself difficult and uncertain. Information itself has two parts (Devlin 1999: 14) as set out in an information equation as follows:

information = representation + procedures for encoding/decoding

Here representation is any kind of symbol or set of symbols, and the procedures are how the representation is encoded or decoded. The representation may take any form including numerical, linguistic, ideographic, drawings or pictures.

How information becomes knowledge is likely to be along the following lines for the individual:

[information] × [transfer function of unknown format] ⇒ [individual knowledge]

[individual knowledge] × [appreciative setting function of unknown format] ⇒ [individual wisdom to act]

Devlin (ibid.) prefers to interpret Davenport and Prusak's (1998) definition of knowledge as a single step (knowledge = internalised information + ability to utilise the information). I believe the two steps indicated above are a better scheme since an individual may create personal knowledge unrelated to any need for action.

Representation is a primary building block in the form of language in all its guises. Language is fundamental since it must meet demanding requirements in information sharing in and between all the elements of a situation. As things stand now, language, not simply differing national languages, but the immense spread of social, scientific/technical, economic, ecological, political and value 'dialects', is probably the greatest barrier toward amelioration of situations. As a building block, language puts 'information technology' into a very different perspective and requires processes very different to what is currently called information management.

Language is also a vital part of the initial broad learning that proceeds in the first stages of appreciating a situation, as each tends to have a language of its own. The broad learning programme (illustrated later in Figure 6.3) needs to make every aspect of that language comprehensible to facilitate the deeper learning that follows in the directed phase. Determining when to make this shift is a fuzzy process that depends very much on how the interdependence between reduction and holism shapes boundary setting and the ever-shifting context of the situation. For the individuals involved, the greatest gift education can give them is knowing how the process of learning proceeds best for them because of its potent linkage to Vickers notion of appreciation (Vickers 1963) that has been termed judgmental comprehension earlier.

Foresight, systems and appreciation

Both foresight and systems thinking are influenced by the behavioural traits of those involved, an aspect that has largely been ignored but will be explored now. Foresight is intensely dependent on pattern recognition: it provokes and is provoked by the recognition of a new situation, itself composed of patterns of inter-linkage between elements, which is akin to sensing a new object or new idea. To be recognised the new situation has to have sufficient familiarity to be interpreted through old experience, a form of mental handshaking, otherwise it will be neither perceived nor comprehended; this process is similar to Jean's (1943: 55) description of how communication occurs through perceptual space, which will be described shortly in developing the notion of an individual's behavioural pattern. Dissolving (or absorbing) new experience into accumulated existing experience, is then more than assimilation and involves the more subtle process of appreciation (Vickers 1963). As already described, situations occur in cascades, each posing a new experience requiring a further shift in appreciation to what Vickers called a new appreciative setting (Figure 1.2).

The notions of appreciation, appreciative setting and behavioural pattern are similar since the latter makes use of Vickers notions of values and norms (1973: 175), but makes more explicit use of simple aspects of brain science.

Appreciation, or sensitive awareness, may seem to be an old fashioned idea but understanding what it involves is fundamental to anticipation or foresight. Situations, themselves systems, need appreciation that comes from being open to the reception and interpretation of signals of low probability but with high information content. Few people understood appreciation better than Geoffrey

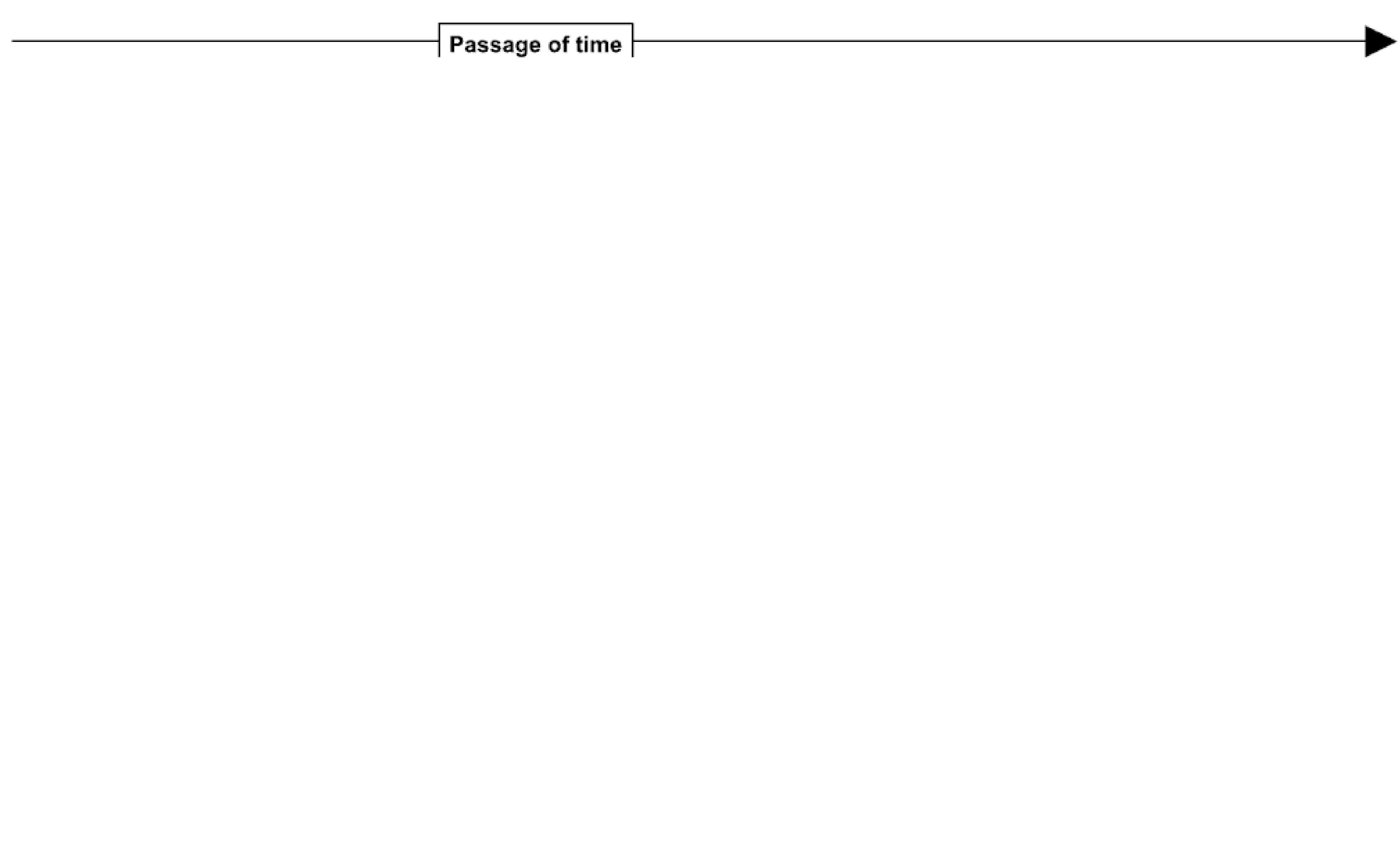

Figure 1.2 Appreciation, learning, anticipations and foresight: adaptation to a cascade of situations of ever changing shape

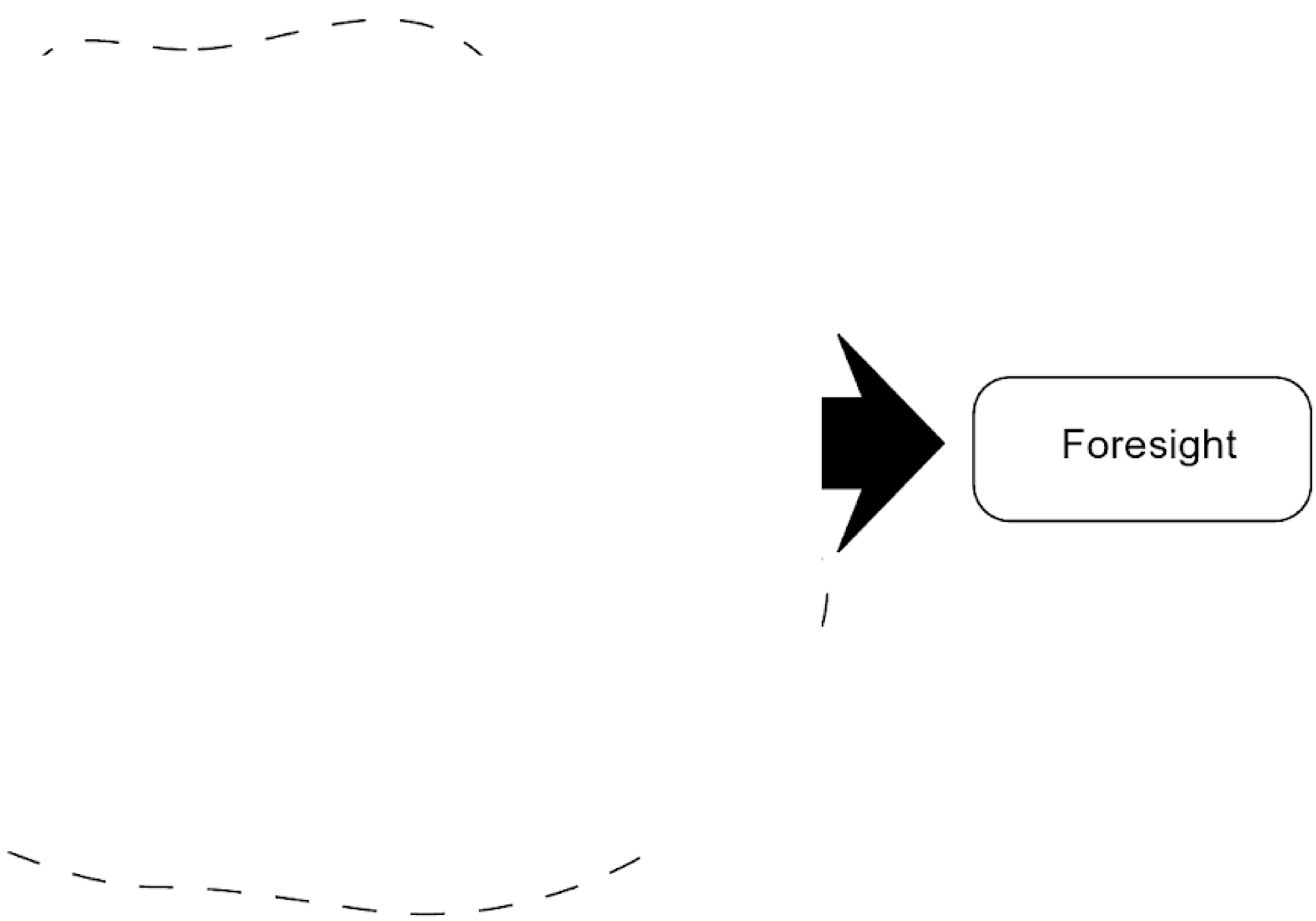

Figure 1.3 Evolution of learning, appreciation, anticipation and foresight

Vickers. His fundamental paper (1963) leads to the conclusion that appreciation has a circular relationship with anticipation and learning, with their internal feedback loops, all of which is fundamental to the assembly of coherent ideas about the future. (Figure 1.3)

Vickers (ibid.) drew on conventional feedback control theory to describe, for soft systems, the combined process of deriving the information that describes the current state and its comparison with the norm to provide a signal for action; it is this process that Vickers called appreciation. In soft systems, the resulting appreciative behaviour, the control action, is not the same as regulation since regulations formulated by statute are not dynamic, only being altered at irregular or fixed intervals (in hard systems, these two mechanisms would coincide). Appreciative behaviour allows responses to vary according to the extent of the departure from the norm recognised by appreciation. In a living system, as opposed to a hard control system, appreciation may seek action, but there is no certainty that it will occur, whereas the enforcement of regulations will invoke action in a binary 'go' or 'no-go' fashion. Consequently, appreciation requires judgements of reality and value to assess first, the state of the system (referred to as judgements of fact) and second, to value these facts with respect to the individual and society. Vickers saw the two kinds of judgement as inseparable constituents of appreciation (this amounts to a form of soft gap analysis).

To Vickers an individual's appreciative judgement depends on:

- Their relevant mental faculties
- The materials available to the individual via memory or external sources or derivable from these through mental processes

patterns shift. Appreciation also contains the value of coherence-incoherence in the inner world of the appreciator as indicated in Figure 1.4. The individual's internal mental codification of experience is largely coherent, but where it is not the mismatches are indicated by persistent discomfort. Some judgements cannot be embraced by the value pair coherence-incoherence, these Vickers (1963) calls fitness-unfitness, which seem to have connections with the idea of fitness for purpose (Loveridge 1997: 34) as that also involves valuations. The simplest of these valuations come from attitudes toward mental codifications of reality. For example, duty to a neighbour widens or shrinks with conceptions of who one's neighbour is (Vickers 1963). Valuations have their own mental codifications developed through criteria of value that, like criteria of reality, are latent in the mind, appearing to guide and change as the need for appreciation arises. The key is how appreciative judgements temporarily and dynamically settle valuations that involve issues of good and bad (and all shades in between) that are not resolved by ranking norms or goals.

It is customary to think of judgement in a dynamic context of weighing [evidence] and alternatives, but Vickers suggests this is inappropriate. What is needed is a way in which incoherence and unfitness in information can be minimised to benefit judgement. Resistance to new ideas is to be expected. In behavioural terms, it attempts to retain coherence in an individual's existing patterns of ideas in the face of their possible disruption.

In all studies involving systems and the future 'what is important?' is probably the most basic question after the nature of the situation has been set out in a preliminary way; it is also a deeply philosophical and psychological problem involving appreciation, anticipation, learning and judgement of reality and value. Vickers suggests that interest is the key factor, but this raises the question of 'whose interest?' In turn, this leads to the involvement of self-interest.

Finally, there is the hidden question of measurement where the use of the terms 'facts' and 'norms' needs examination. Facts are rarely what they seem and are often associated with considerable uncertainty as confirmed by Wilson in teasing apart the meanings of fact, value and concept in a very instructive way (Wilson 1971). Reality judgements admit of the possibility of some facts being more acceptable than others due to selective seeing and listening, a feature of the idea of 'pedigree' in the NUSAP system. Vickers' use of the phrase 'actual and hypothetical', the latter to cover reference to the future state of a system, is troublesome as facts about the future are restricted to a relatively narrow set, whereas both forms of judgement and the 'state of the system' are concepts capable of many different interpretations. The implied need for measurement of norms is a contentious matter. Any norm is characterised by a complex set of elements so that appreciation itself becomes complex and is inherently uncertain and risky. Vickers' later careful distinction between values and norms (Vickers 1973) simply accentuated this complexity. The natural complement to appreciation then becomes learning, provided it leads towards understanding, in an endeavour to modify uncertainty and risk. Learning itself cannot afford to be random so that anticipation of where to direct it becomes important, in this way completing the three pillars (Figure 1.3) that enable the export of foresight at irregular intervals. All the foregoing influence the nature of modelling which is a further neglected aspect of foresight, but is inherent in systems thinking.

Foresight, systems and modelling

I wonder how many sponsors of institutional Foresight take the trouble to model the task they are embarking on? Or understand the complexity of that task? Too often it seems that Wittgenstein's dictum that 'problem and methods pass one another by' (Wittgenstein 1953: 232) is de facto as too frequently there seems to be a rapid departure into deciding whether this method or that one should be used before the scope of the situation is grappled with. Some indication of this latter task is described in Chapter 3; my purpose here is to describe the modelling processes that could be used in developing institutional Foresight. For the individual or small group engaged in the 'skunk works' of real *f*oresight, similar strictures apply, except that I believe they are less likely to be enticed into the Wittgensteinian trap. But first some general comments on models as a genus.

Creation of the future is the intention of any model; the term itself is another omnibus word used indiscriminately to describe an interrelated set of ideas, a system. The word model conveys ways of representing ideas that grow in private conceptual space before proceeding via perceptual space to physical space (Jeans 1943). The final representation of the set of ideas may range widely from aeroplanes and every kind of physical model, to high fashion and to abstruse mathematical models of anything from neurological systems to climate change and any other computable form; some are purely descriptive. Some models are concerned with what was or what has been (history); some with what is; others with what may be (futures thinking or foresight). The notion of continuity, in the sense of the inevitable progression from the past through the present to the future, is central to any modelling endeavour though this does not prevent modelling including discontinuities as exemplified by catastrophe models (Thom 1972).

Model-making is an intrinsic feature of human cognitive life. It encodes knowledge in various forms, typified by signs, texts, codes, mathematical equations and various other representational forms; these are the direct outcomes of human model-making. Any model begins descriptively, in this way becoming part of the physical world. From then onwards its representation can take any appropriate form, as already indicated. The notion that the past and the present are understood well enough to eliminate uncertainty, to the extent that any model of them represents a universally accepted reality, is simply fallacious and has to be avoided. Research into history, to create models of the past, is uncertain enough without the overtones of ideology and culture that can be present. The rise of modernity, that did much to destroy the era of appearances from the 1400s onwards, illustrates the point and required a new model of human societies that is not yet complete, even while the disputed notions of post-modernity, with their denigration of expertise and much else, are gaining credence (see Chapter 2). The difficulty is that the descriptive model is likely to lean towards the current dominant sociological-cum-philosophical influences on discourse, which is currently a hodgepodge of modernist and post-modernist expression. How often are these influences incorporated into model building or recognised by the model builders? Is model building, the representation of the discourse, science or art? Many authors, for example Moravec (1988), Kurzweil (1990, 1999) and others suggest that increasing raw computer power will, over the next two decades, blur the distinction between art and science as artificial intelligence approaches (or exceeds?) the capabilities of the human brain.

What is it that a model represents? Are they value free as many might claim? Do models stray into sophistry? What kind of model does a composer have in his mind as he creates a symphony? With the diversity of meanings and intentions in models the answer to these and many other questions may well be 'who knows?' After models enter physical space they are public and enter the continuity of ideas. Almost as an aside, the above underpins the notion of anticipation (foresight). Backward anticipation (hindsight) is no lesser tool than foresight, as, once enunciated in the physical world, ideas never die and can never be erased. Their influence past, present and future may be argued over interminably, with emergent outcomes that the initiators can never anticipate; they are truly complex. Once enunciated, even future related ideas become history.

Systems thinking leads ineluctably to models, so how may it influence foresight of any form? From its formative moments, foresight of any kind is beset by the reduction versus holism argument, which is why M'Pherson was led to his comment about the practical world requiring their combination into a hybrid format. Foresight begins when an individual senses a mismatch between his or her appreciative setting (or behavioural pattern) and the situation being faced. Essentially this depends on mental modelling and pattern recognition to identify differences between an expectation and the likely reality, a form of gap analysis. The subsequent reformation of the mental model, through foresight and thought experiments leading to a new appreciative setting, then permits adaptation to new possibilities. Enlarged into the formal activity of institutional Foresight, closing the gap between expectation and reality becomes the purpose of the activity. The process involves organisation and structure appropriate to the situation, where organisation relates to time and functional hierarchies; structure to spatial distributions and part-whole interdependencies. Throughout these two hierarchies, the context and content of each level has to be established. Developing a model of an institutional Foresight programme in relation to the situation is then a process of inquiry that forestalls the rapid departure into the Wittgensteinian trap.

It is not my intention to describe the content of the modelling universe, which is populated with a diverse set of models making various claims to success or usefulness in the problems they claim to address. The evolution of models from those that are directed towards the solution of specific problems in hard systems towards those that attempt to cope with soft systems in a reductionist manner has now moved into the era where soft systems, situations in the terminology I have used, are the focus of attention. Typically, the pathway in hard systems has been into ways of controlling systems and processes that remove either the uncertainties of human intervention or human participation altogether: many of these are referred to in Figure 1.1 and increasingly, include aspects of war-fighting capability. Now, claims are also being made that there is sufficient understanding of human performance to include human beings more directly as an element in hard systems (e.g. Albus and Mystel 2001) forming a kind of hard-soft system. Modelling soft systems has proceeded very differently. A raft of qualitative descriptive models, scenarios for example (Chapter 6), survey methods, econometric and decision models have been developed, sometimes under the name of decision sciences or operational research or technology or some other variant of forecasting. In a different vein lie models for technology assessment, environmental impact assessment, life cycle analysis, energy analysis, ecological economics, behavioural economics and industrial ecology, and most wretchedly, cost/benefit analysis. The latter sometimes has ludicrous assumptions concerning the value of the unique and un-priceable artefact, a point made forcibly by Stafford Beer (1971) in ridiculing a value placed on Stewkley church, which dates from Saxon times, for the purposes of a public enquiry related to airport planning. From the 1940s onwards a new stream of models has appeared. Cellular automata appeared in 1941. Systems dynamics made its appearance in the early 1960s and the roots of climate models were set down in 1963. Fractals, which bridge the gap between science and art, catastrophe theory, dissipative structures, all of which have emergent properties, and genetic algorithms, each with their own unique modelling capability, all burst onto the scene during the 1970s. Much older, and still argued over, is the Kondratieff or long-cycle, a model of the interrelationship between the many facets of invention and subsequent innovation and the behaviour of capitalist economies. Ecology, both mathematical and descriptive, has often provided a rich source of models and ideas for them through analogy; these have come into their own in an increasing way and most recently through the notion of 'panarchy' (Gunderson and Holling 2002), a mixture of qualitative explanation, and quantitative modelling, that extends the notion of the '*r*' and '*K*' species behaviour into a powerful cyclic phenomena through the addition of two phases, release and reorganisation, as described in Chapter 5. The list of modelling processes is indeed a long one. The use of any of the forms of modelling indicated is rarely encountered in the foresight world.

Systems thinking in real foresight and its institutional counterpart

A model of the future is someone's vision of the future: to a starving man or woman the vision (or model) of the future may be bread, while to a NASA technologist it may be a space station or space travel. The basis of models may range from records of dreams to formal processes, such as simulation using special languages, including systems dynamics, econometrics or Monte Carlo simulations, through to interactive visual representations, as used in flight trainers or in virtual reality. As already indicated, models of the future begin as conceptual and later perceptual (Jeans 1943) thinking before being expressed as descriptions of mental constructs, often taking on or expressing some form of ideology, using that word in its broadest sense. An example is the current use of climate modelling. Models are not value-free as they draw strongly on their creators' subjective expectations of the future which can encompass an enormous diversity of ideas. Any model of the future will be synthetic and will have the capability of synthesising many different, but possible futures, in this way influencing the future of the polity through communication of their content and output, as is happening currently with climate modelling.

Figure 1.5 indicates that there are four aspects to models of the future, two that describe how they are created (Intentional and Accidental) and two that describe the nature of the model. Foresight plays a crucial part in creating any of these models, whether it is used unconsciously and informally or consciously and in formal processes, such as institutional Foresight programmes. There is a circular relationship between visions (or scenarios) and foresight as the creation of a vision requires content that foresight provides. Often there is a wish to prepare visions without explicitly acknowledging the role of foresight, while the creation of a vision will call for new foresight as new ideas evolve. Foresight and visions are interdependent and co-evolve once the initial content provided by foresight has been created.

Figure 1.5 Four types of models of the future