APPENDIX I - ELABORATION OF WHOLE SYSTEMS THINKING

Purpose: to further explore and elaborate the bases and nature of whole systems thinking as a basis for paradigmatic change.

Introduction

In the first section, I review succinctly some of the influences and trends, which, seen in relationship, may be viewed as informing bases for whole systems thinking. The four areas reviewed are systems thinking, indigenous worldviews, organicism/ecologism, and complexity. Whilst these areas are referred to in the main Thesis, this Appendix allows something of the provenance of whole systems thinking to be outlined in more depth. In the second section 'A Whole Systems Model', I further develop the triadic model of paradigm and experience (Seeing, Knowing, Doing) which is then used to help represent the dimensions of paradigm change, in parallel with the model of staged learning levels introduced in the main Thesis. In section 3 'Whole Systems Thinking and Sustainability', the model is employed as a framework for a discussion of a whole systems view of sustainability.

1 THE BASES OF WHOLE SYSTEMS THINKING

These four foundations are large areas in themselves - and the study of any one of them could easily constitute a separate Thesis. Thus, only a broad and concise review is given here, with an emphasis on the significance of these foundations rather than their substance. The areas chosen are those I feel to be most important: it is not to suggest that other relevant insights from, for example ecopsychology, sociology, and political economy would not also be relevant and fruitful. But boundaries have to be drawn here for reasons of manageability and coherence, and I am suggesting that these four areas reviewed below are fundamental and give substance to claims that whole systems thinking is an articulation of an alternative paradigm.

1.1 Systems thinking (and systemic thinking)

As noted in Part B.2, systems thinking has developed through a number of schools of thought over the last five or so decades, broadly stemming from two roots, cybernetics and General Systems Theory. These schools are often associated with key players who have developed their own interpretations and concepts in systems thinking. Flood (1999) for example, reviews von Bertalanffy's open systems theory, Beer's

organisational cybernetics, Ackoff's interactive planning, Checkland's Soft Systems Methodology (SSM), Churchman's critical systemic thinking - as well as Senge's 'Fifth Discipline' of system dynamics which is the book's key focus. In reviewing these contributions, and then looking at the implications of complexity theory, Flood is seeking a more whole conception of systems thinking, which has fragmented somewhat since von Bertalanffy's attempts to forge interdisciplinarity and a unified systemic 'general science of wholeness'.

Thus Flood appears to share my interest in (what has been called above) an expanded sense of systems that brings us closer to what I am calling here, whole systems thinking. So rather than review Flood's account or other accounts of systems thinking in any detail, I want to comment on change in the field that brings us closer to this idea. Thus, I am interested in aspects within the systems thinking traditions that help substantiate and give rise to whole systems thinking and ecological thinking.

The most significant point here is the shift of attention from 'hard' to 'soft' approaches (reviewed in B.2.1) where, as Checkland (1994, 80) notes, "assumed systemicity is shifted from taking the world to be systemic to taking the process of inquiry to be systemic". Put in more simple language, this might be summarised as the difference between the ostensibly *descriptive* 'how things are' approach which assumes real systems exist in the world, and the *interpretive* 'how things appear to be' (including reflexively, the nature of systems thinking itself). This is the difference between an ontological and an epistemological emphasis, and indeed Bawden (1991) suggests the terms "ontosystemics" and "episystemics" accordingly. In other words, systems thinking reflects the realism-idealism tension discussed in Parts A and B of the main study.

Flood (2001) distinguishes and labels these two approaches respectively 'systems thinking' and '*systemic* thinking'. While I am not aware that this distinction is widely employed, it serves my purposes here. Checkland and Scholes (1990) make the distinction by employing the adjectives 'systematic' and 'systemic' respectively. Ison, Maiteny and Carr (1997) helpfully suggest the two approaches can simply be distinguished by noticing whether the word 'system' is used as a noun (e.g. 'farming system' or 'education system') which implies the 'hard' approach, or as an adjective (as in 'systems thinking', or 'systemic') which implies the soft orientation.

The distinction is important because it is possible to surmise that systems field is experiencing something of a paradigm change, consistent with the arguments in Part B

which suggest that this occurs when a larger conception is required. Thus Checkland (1994), who himself developed SSM as a response to the limitations of mechanistic systems approaches, quotes Vickers who in rejecting both the goal-seeking (mechanistic) paradigm and the cybernetic paradigm, expressed the need for a changed epistemology. Ison (1993) quotes Atkinson and Checkland suggesting that the move in "new systems thinking" from thinking about models of parts of the real world, towards "models relevant to debate about change", has been liberating. Ison and Stowell (2000, 2) suggest that "new sites for development and renewal of systems theory are likely to emerge from moving beyond first-order cybernetics models upon which current systems theory are mostly based". My understanding of systems discourse is that some parts are moving away from this emphasis - towards a second order, understanding of systems as a necessary response to our 'postmodern' conditions of complexity, uncertainty and unsustainability - whilst still respecting diverse methodologies. At the same time, I feel that this constructivist emphasis can sometimes go too far and underplay 'first order' issues: if, as my colleague Paul Maiteny says, if all that matters is our constructions, then why is there so much concern about 'real world' sustainabililty issues?

Before continuing the argument, what follows is a fairly crude but necessarily succinct outline of key systems ideas contributed by some of the leaders of the field as it has developed over recent decades (alphabetical order):

Ackoff

- 'difficulties' and 'messes'
- 'plan, or be planned for'
- participative (interactive) planning and design

Bateson

- learning levels and higher order learning
- abductive and analogue thinking
- cybernetics

Beer

- viable systems

Capra

- paradigm

- emergence
- self-organising systems
- autopoesis (after Maturana)

Checkland

- Soft System Methodology

Churchman

- boundaries
- ethical systems improvement

Forrester

- system dynamics

Koestler

- holons and holarchy

Senge

- system dynamics
- dynamic complexity
- learning organisation

Vickers

- traps
- appreciative systems

Von Bertalanffy

- open systems theory
- feedback loops
- emergence
- organicism (rather than mechanism)
- self-organisation
- general systems theory
- learning through isomorphy
- interdisciplinarity

Such strands and other contributions are summarised in Ison's systems influence diagram of systems traditions which may be found in the **Appendix II**, under Part B.2.1 Despite the undeniable fragmentation in the systems field, there appears to be a growing interest in a fuller conception of systems thinking, which re-associates some of its disparate strands. It is a conception which has been given greater substance and confidence in recent years by the advent of complexity theory and the 'biology of cognition', and by a greater interest in and tolerance of cross-disciplinary and transdisciplinary thinking. Yet, although systems thinking presents a powerful and highly relevant and valuable approach to understanding and acting in the world, I feel - despite its concern with wholeness - that it is not in itself sufficient to offer a strong, persuasive and viable alternative to the dominance of mechanistic values, thought modes and practices, or more importantly, to offer a transcendent, more adequate paradigm within which - as Smuts hoped in the 1920s - mechanism would have its appropriate but subsidiary place. Flood's judgement (quoted in full in A.3.2) that systems thinking has, over recent years, remained "pretty much in the outback" lends credence to this view. Whilst 'systems as discipline' might need to maintain its boundaries in order to remain a discipline, an ecological epistemology requires a synergy between systems thinking and additional insights and areas, which might (at least) be listed as:

- complementary 'other ways of knowing' (including indigenous thought)
- organicism and ecologism
- complexity and holistic science
- revisionary postmodernism
- sustainability

If we take one critical area, that of ecology and sustainability, the systems thinking community has been slow to take this on board. For example, Critical Systems Thinking, an established school of thought in the systems field, is centred on 'five critical commitments' (Flood 2001):

- critical awareness
- social awareness
- human emancipation
- theoretical complementarity
- methodological complementarity

There is no mention of ecological awareness. To take another example: Checkland's criteria which help evaluate the success of any systemic transformation in a human activity system are the three 'Es' of *efficacy*, *efficiency*, and *effectiveness.* Checkland and Scholes (1990, 42) write that these criteria "cover only the most basic idea of transformation" and suggest they can be supplemented "if it seems appropriate". They suggest that considerations of ethicality and aesthetics would bring in *ethics* and *elegance* making '5 Es'. But this extension is hardly central to SSM as it mostly conceived and practised, and there is still no mention of a sixth 'E' which would be (arguably, should be) *ecology*.

At the same time, and to be fair, many of those working in the systems field are aware of its boundaries, and certainly aspects of the three under-represented 'E' areas listed above can be seen in systems literature. For example, the work of the Centre for Systemic Development at Hawkesbury College, Australia, was very influenced by one of the elders of systems approaches, Churchman, who in 1971 noted that an important feature of system approaches are not that they help the practitioner better achieve expected outcomes, but that such outcomes should be ethically defensible. (Hawkesbury's work is described in more detail in Part C.) Further, organicism has a fairly strong presence in systems thought, and in recent years a growing interest in complexity, and to some extent sustainability, has developed. (The subsections that follow in look at these areas in more detail, starting with indigenous thought).

Another limitation of most systems thinking as it is conceived and practised (as argued in Parts A and B), is that it is primarily oriented towards methodology, and despite some concern with ethics and aesthetics, is still fundamentally rationalist. Flood argues (2001, 141), that by contrast, when focused on human existence, "systemic thinking helps people to sense a deep holistic or spiritual quality". But only, I would suggest, if the idea of systems thinking can be supplemented and expanded to become part of - as argued previously - an encompassing 'systems as worldview', rather than (only) systems as discipline or methodology. Otherwise, there is always a danger that systems methodology is put at the service of mechanistic, instrumentalist, or economistic values (which is why, as we have seen earlier, in B.2.1, some environmentalists dismiss systems thinking as 'part of the problem').

The emergence and articulation of systems thinking, from the 1940s, was significant in the recent history of Western thinking, but it was hardly lacking precedence. It is possible to trace a lineage between this and antecedents of systemic thought in the

long tradition of organicist thought in western philosophy and science (see 1.3 below). Further, it is possible to argue that many indigenous cultures possessed or possess deeply systemic worldviews. Moreover, the roots of contemporary ecological thinking draw on, and find parallels with, these indigenous cultures - including those traditions in past Western culture which reflect a more integrated and relational view of society, culture and environment.

1.2 Indigenous worldviews and perennial wisdom

Amongst environmentalists, seeking sources to both attack modernity and offer alternatives, indigenous worldviews are often upheld as a paragon, and associated lifestyles an example of sustainability. At the same time, New Age followers tend to cite 'ancient wisdom' or 'perennial wisdom' as the key to transforming modern culture. Holroyd (1989, 98) notes that the term *philosophia perennis* was coined by Lebeniz and later taken up by Aldous Huxley to describe 'the highest common factors' of religions and spiritual and esoteric philosophies, referring essentially to the experience of oneness with a universal consciousness. But it is helpful to distinguish between 'indigenous culture' - which still persists if in embattled form in various parts of the world - from 'ancient wisdom'. Further - following Wilber - we can make a useful distinction between what he labels 'Ancient Wisdom' meaning ultimate reality, being, or 'Truth' as represented by such words as the Tao or Source, and 'ancient wisdom' meaning time-specific interpretations of this reality, through such expressions as the great religions and spiritual masters down the ages. Wilber's argument is the modern world badly needs Ancient Truth, but not ancient truths, for the reason that "modern culture is by and large incompatible with ancient culture" (1997, 65). He argues instead for "neoperennial philosophy" in tune with modern needs and problems.

This, I think, invites the elaboration of a contemporary ecological philosophy that can build on and acknowledge the insights and wisdom of the past, but is appropriate to the conditions of the present and probable future. It is here that the experience of indigenous peoples offer valuable insights both on the nature of sustainability, and in the kinds of thinking that support sustainability, if not directly transferable models.

A colleague recently argued in conversation that interest in indigenous thought is overplayed, and indeed, if the motivation for this interest comes from a romanticized disposition of the sort that Wilber attacks, then I would agree. But equally, such easy dismissal writes off the learning we might achieve from the 'triangulation' that the very different indigenous worldviews offer (in our increasingly homogenised global culture),

and the historical experience of living relatively sustainably that these cultures have largely demonstrated. As anthropologist Reichel-Dolmatoff (1996, 2) argues, the theoretical frameworks of modern scientific ecology have been developed only recently, but the Amazonian Indians have developed an "*intelligence du milieu"* over thousands of years, which has enabled them to live in "that state technically called 'sustained development' ".

However, the problem with gaining any insight from peoples who apparently perceive and think very differently to the Western tradition is that we, inevitably, use Western perceptions to interpret the difference. A key book which addresses this problem is physicist and science writer David Peat's *Blackfoot Physics – A Journey into the Native American Universe* (1995). Peat lived and worked with Blackfoot people and describes how his "Western scientific mind was opened to an alternative way of experiencing the world" (15). The book describes how profoundly different this is to the Western worldview, yet also reflects on the parallels between the Blackfoot and the recent emergence of a more holistic and qualitative science in the West. (This point is taken up in 1.4 below). According to a review of the book (Clarke 1999, 101), Peat's book "constitutes a far-reaching demolition of the notion that science is a discovery of pre-existing 'facts' independent of the cultural patterns of surrounding society".

Describing the impact of the indigenous approach to knowing and being, Peat (1995, 15) writes that he was "struck by the depth of its metaphysics and by the way in which Indigenous knowledge permeates every aspect of life, from education to healing, from sacred ceremony to an effective legal system, and the daily care of the environment….(and) struck by the way in which all aspects of life are based upon relationship and renewal, upon the balance of heart and head…upon harmony and balance…".

The predominantly informational Western view of knowledge as something that can be acquired, stored, and passed on is contrasted with the indigenous view where the "act of coming to know something involves a personal transformation. The knower and the known are indissolubly linked and changed in a fundamental way" (6). Peat explains that this worldview does not see a world of objects so much as a world of interrelationships. Similarly, categorisation is very different: "…a symbol is not an abstraction or reflection of reality, that a model in Western science is. Rather it is something that permits direct connection with the energies, spirits, and animating power of nature" (257). This is reflected in the nature of language. An Algonquin Indian

tells Peat that when he has to speak English instead of his MicMaq language, “he feels he is being forced to interact with a world of objects, things, rigid boundaries and categories in place of a more familiar world of flows, processes, activities, transformations and energies (231)”.

In this process view of the world, “every action is a spiritual act and has its effect on nature and the individual”. Therefore, in contrast to Western fragmentation, knowing, sacredness, action, society and nature are seen as being deeply interwoven. Further, unlike the value and possibility of abstraction and context-free meaning in Western science, in indigenous science, meaning is always context and place-dependent.

In some ways, it is difficult to get inside this way of viewing the world, yet somehow it also resonates with our own intuitive knowing, our non-verbal direct experience, and increasing awareness of the systemic nature of the world. Thus Heron (1996, 178) suggests that we experience a participatory ‘empathetic-imaginal’ “primary meaning in our lived experience…that is both prior to and continuously underneath and within our use of language”: whilst language is ‘secondary meaning’, a “partial and incomplete transformation” of our primary meaning (181). Interestingly, Peat achieved insight into the indigenous way of knowing by abandoning the stance of observer and “objective scholar of another society”, and instead entered “into its essence…in a spirit of humility, respect, enquiry, and openness (whereby) it becomes possible for a change of consciousness to occur” (10-11). Referring back to Bateson here, we might assume from Peat’s book that he allowed and went through a transformative ‘Learning III’ experience (at least in the pragmatic sense discussed in Part B): that consistent with the Indian view of ‘coming to knowing’, his knowing changed him. Indeed, we can further assume that he would have come away with a very limited understanding of the Blackfoot worldview if had not had this experience. Many earlier anthropologists’ accounts of ‘primitive peoples’ exemplify the more usual level of understanding from the Western perspective of ‘observer’.

Instead, in Peat’s account of indigenous knowing we find echoes of Bateson, of transformative learning, of participative knowing and participating consciousness, of a deep ‘systems sensibility’ and ecological worldview. Indeed, part of Peat’s argument is that currents in leading edge science in Western thought are now echoing and affirming the insights of indigenous knowledge. Thus, from indigenous thought and perception - so far as we understand them - we see parallels and insights that affirm, enrich and give historical legitimacy to the emerging postmodern ecological worldview.

The lessons from indigenous knowledge have an ‘inner dimension’ as outlined above, and an ‘outer dimension’. As indigenous knowledge emerges from time and place, there are similarities between indigenous cultures and Western locally-based cultures as regards the gradual evolution of knowledge, rootedness in place, and a relative social and ecological sustainability. In a book which seeks to analyse the ‘crisis of development’, Rich (1994, 287) argues that:

> Many community-based systems of environmental knowledge and management embody a historical co-evolution between particular local ecosystems and distinct human cultures. Some researchers suggest that since human societies have evolved until recently as subsystems of ecosystems, human communities all over the world have inherent self-organising capabilities to manage local ecosystems in a sustainable fashion, provided they are not dominated or destroyed by subsequently imposed top-down control and management…

Similarly, Dasmann (1984) makes a distinction between ‘ecosystem people’ who inhabit ecosystems or bioregions and depend on them for material support, and ‘biosphere people’ who occupy a geographical space but have little relationship to it as they draw on the resources of the wider biosphere. Arguably, modernity and ‘progress’ has seen the historical conversion of people from being primarily ecosystem people to becoming primarily biosphere people who often feel alienated from their immediate environment and whose ‘ecological footprint’ (Wackernagel and Rees 1996) is both great and not directly visible. This tendency is now accelerated by economic and cultural globalisation.

One lesson here concerns the relationship between systems and subsystems and the need to conserve the integrity, diversity and self-organising ability of subsystems if the greater whole is to survive. Rich (1994, 287) describes a concept of “critical importance”:

> local human communities and economies, while embedded in larger social and ecological systems, can be thought of as complex adaptive systems in their own right, evolving and creating their own conditions, within their environments, of order, feedback and adaptation.

This point is echoed and substantiated in Berkes and Folke’s study (1998, 429) “on the role of indigenous knowledge in responding to and managing processes and functions of complex systems” which give rise to what they term “a set of new or rediscovered

principles" for resource and environmental management oriented towards building resilience and sustainability. This topic is returned to in subsection 3.3 below.

As noted in Part B, a key part of the problem of our age is the dominance of and homogenising influence of the modern Western worldview, and its assumption of universal applicability (Marglin 1990, Norgaard 1994, Chambers 1997). By contrast, indigenous worldviews remind us of the existence and possibility of 'multiple epistemologies' (Berkes and Folke 1998), and provide insights for those who wish to develop whole systems thinking and sustainable design. There is a link here, it seems, with Einstein's dictum at the head of this Thesis, and with Ashby's 'Law of Requisite Variety' (1956) which states that to be successful the variety of methods, approaches or strategies must be as great as the variety of problems that are to be tackled.

We are also reminded - as implied in Berkes and Folke's use of the word 'rediscovered' above, that in the West, we have our own traditions of holistic and integrative thinking and practice and these are also bases for any resurgent whole systems perspective. This is my next topic.

1.3 The Western organicist tradition, holism and ecologism

While the Western organicist and holistic tradition cannot be adequately summarised here, it is critically important that these schools of thought are at least briefly acknowledged. As Marshall (1992, 6) has said, "Few in the green movement are aware of the deep-rooted tradition which underpins their beliefs" and therefore the tendency to talk about a 'new' ecological paradigm needs to be tempered with awareness of antecedents. The key point is that current ecological thinking has a lineage from philosophers and scientists over a long period. There are clear influences - for example in developing the ideas of 'deep ecology' Naess (1973) draws particularly on the 17th century philosopher Spinoza who in advancing an holistic, non-dualistic view of the world challenged Descartes' mechanistic philosophy.

Berman (1981, 73) gives a detailed account of alchemy and the Hermetic tradition which was "dedicated to the notion that real knowledge occurred only via the union of subject and object, in a psychic-emotional identification with images rather than a purely intellectual examination of concepts". This notion, "that subject and object, self and other, man and environment, are ultimately identical, is the holistic worldview" Berman suggests (77). This premodern participatory consciousness, and the Hermetic sciences, he says, lasted for millennia, but it took little more than 200 years to oust

them (73, 96). As I've noted above, Berman turns to Bateson to help reconstruct an holistic metaphysics for today which again has 'participative consciousness' at its heart. In parallel, Marshall (2001, 462), in his exploration and history of alchemy notes that "the world view of the new science is remarkably close to that of the ancient alchemists".

The profound paradigm change towards mechanism that the Scientific Revolution ushered in (outlined above in B.1.4) was not complete but always accompanied by critics, thinkers and visionaries who propounded alternative views. Yet the critical concept of 'holism' was not to emerge until 1926 with Smuts' classic work *Holism and Evolution,* where he described it as "the synthetic tendency in the universe…the principle which makes for the origin and progress of wholes" (Smuts 1926, ix). Smuts made a major contribution to holistic thinking, through his distinction between mechanism and holism, his promotion of the whole as a generic and unitary principle in the universe relating to "matter, life and mind" (1926, 2), and his description of the essential creativity of process in nature. Much of his work, including his explanation that the organic whole "is more than the sum of its parts" (a description of emergence), is now borne out by and extended by the new sciences of complexity, which is giving holistic science a new status and momentum. Yet Smuts' work was preceded, notably by Goethe who was also concerned with understanding the wholeness of phenomena, using a methodological 'science of qualities' that contrasted with the reductionism and positivism of his day (Bortoft 1986, 1996).

In the 20th century, according to Marshall (1992), three of the most important philosophers to contribute to an 'organic cosmology' are Henri Bergson (1859-1941), Alfred North Whitehead (1861-1947), and Martin Heidegger (1889-1976). Whitehead developed what he called the 'philosophy of the organism' which would contest what he saw as the inadequate philosophy of mechanism. This 'process philosophy' replaced the atomistic emphasis on discrete 'things' with a view of organisms that are defined by virtue of their relationship with their environment. Organisms and their relationships are seen as dynamic networks of events or patterns. In the 1920s, Whitehead proposed that the metaphor of organism could transcend the mechanist-vitalist divide. In this view, not only microbes, plants and animals, but atoms, molecules, crystals, societies, planets, solar systems and galaxies are treated as organisms (Sheldrake 1999, 70).

Whitehead was influenced by Bergson, another process philosopher offering a counter thesis to scientific materialism, and in turn, Whitehead's work influenced von

Bertalanffy's work on systems theory. According to Marshall, Bergson also introduced process into Western metaphysics, breaking down separation between observer and observed, between mind and body, and part and whole.

Heidegger's concern was with being, with ontology. He argued against objectification and rationalist metaphysics, and for what he called 'essential thinking', an appreciative listening to the voice of being, without analysis and interrogation. Pepper (1996, 49) states that Heidegger "proposed a non-anthropocentric relationship between humanity and nature" which "let beings be".

According to Tarnas (1991, 383) in his history of the Western worldview, despite the challenge that Bergson, Whitehead, and later, Teilhard de Chardin, mounted - which was "regarded as brilliant and comprehensive by many" - their ideas did not turn the tide against or beyond the conventional scientific orthodoxy. Although their theories "gained wide popular response and began to influence modern thought in often subtle ways, the overt cultural trend, especially in academia, was otherwise" (Tarnas 1991, 383). And yet this holistic and organicist current of thought has evolved into what is now termed ecological thinking or the 'participatory worldview'. In this view, according to Tarnas - and an increasing number of other writers (and notably Maturana and Varela (1987) who largely founded the 'biology of cognition') - nature is not separate so that the human mind can examine it objectively from outside, but "nature's reality…. comes into being through the very act of human cognition" (Tarnas 1991,434). So the mind does not just produce concepts that correspond to an external reality says Tarnas, and neither does it simply impose its own order on the world. Significantly, Tarnas suggests that, at a deeper level, reality is articulated through the human mind, quoting Hegel that "the evolution of human knowledge is the evolution of the world's self-revelation". Thus, the human imagination and mind "is itself part of the world's intrinsic truth". But for Tarnas, this potential and realisation depends on "a developed inner life" which is "indispensable for cognition" (1991, 434) and that nature brings forth its own order through the mind when (implication, only when) "that mind is employing its full complement of faculties". What Tarnas is implying here, in what seems to be approaching a mystical view of mind and nature, is that humanity, both individually and collectively, needs to attain some state of full awareness and knowing if both are to be realised. Another implication is that we are in a participatory relationship with the world, yet for the most part, do not fully recognise this relationship.

The argument here echoes a point I have made above (see B.1.5, and Diagram A.1), that the participatory worldview is 'larger' than and subsumes the modernist view. As Tarnas (1991, 435) suggests:

> The dualistic epistemology derived from Kant and the Enlightenment is not simply the opposite of the participatory epistemology derived from Goethe and Romanticism, but is rather an important subset of it, a necessary stage in the evolution of the human mind.

For Tarnas then, the separation and fragmentation associated with the modernist, mechanist worldview was not an aberration - as it is sometimes presented by ecological thinkers (including Marshall 2001) - but a necessary stage of human evolution. This evolutionary view is reminiscent of Elgin 1994, mentioned in B.1.7.

Another key figure in the evolution of ecological thought in the 20th century was Lewis Mumford whose writing sought to underline the importance of organicism against what he saw were the mounting threats of mechanistic thinking and values. Mumford (1964, 393) made a plea for ecological, whole systems thinking, as is evident in the following quote:

> All thinking worthy of the name now must be ecological, in the sense of appreciating and utilizing organic complexity, and in adapting every kind of change to the requirements not of man alone, or of any single generation, but of all his organic partners and every part of his habitat.

From the past threads of organicism and holism, contemporary ecological thinking derives some of its key bases for an alternative, and potentially transcending, holistic epistemology. In recent years, this philosophical basis has been extended and strengthened through what is sometimes termed 'new science', which can be seen as the inheritor of the organicist tradition and legacy. But before looking at new science (in 1.4 below) I want to look at the place and significance of environmentalism. The notion of 'environmentalism', I will argue, is both a foundation of and an obstacle to the broader idea of the postmodern ecological worldview and whole systems thinking.

Environmentalism and ecologism

Within recent years, several accounts have been written about the development of environmental and ecological thinking through the past (Thomas 1983, Bramwell 1989, Ponting 1991, Marshall 1992,) and in and recent times (e.g. Pepper 1984, O'Riordan

1987, Dobson 1990, Merchant 1992, Pepper 1996). It is not necessary to rehearse the detail here, but it will be useful to look at some key developments and distinctions.

There is a long tradition in what might be termed 'environmentalism' in history, but also considerable change in how environmentalism has been and is manifested, particularly in recent times, including strong tensions and divergences of view (Pepper 1996). Indeed, Schlosberg (1999, 3) argues that there is now so much diversity and difference in the environmental field, “romantic preservationists, efficient conservationists, public-health advocates…deep ecologists, greens, bioregionalists, animal liberationists…ecofeminists…social ecologists, steady-state economists…indigenous rights activists” and so on, that there is no such thing as environmentalism *per se.* Clearly, some examination of this landscape is needed to allow some further insight into the grounding of the emerging ecological paradigm, as well as providing context to understanding the position and relation of different paradigms in environmental education.

'Environmentalism' is defined by Button (1988, 156) as “awareness of and concern for the total environment”. It is thus used as a generic term to cover virtually all views of the environment which include some element of concern. So views which take no regard of the environment, or assign the environment no value generally are not seen as falling within the spectrum of 'environmentalism'. However, Dobson (1990) writing about green politics, makes a useful and significant distinction between environmentalism and what he calls 'ecologism'. The main difference between them is that, “ecologism argues that care for the environment...presupposes radical changes in our relationship with it, and thus in our mode of social and political life”, whereas he views 'environmentalism' as arguing for a managerial approach to environmental problems which do not necessitate deep changes in values or economic patterns (Dobson 1990, 13).

The latter orientation is sometimes referred to as ‘ecological modernisation’ whereby the structural character of environmental problems is recognised, but the assumption that existing institutions can internalise and address the issues, is maintained (Birkeland, 2002, 254). At the same time, Drysek (1997,152) distinguishes between ‘weak’ and ‘strong’ (i.e. more radical) forms of ecological modernisation, but regarding the latter, states that “however far it is stretched, ecological modernisation does not easily admit the idea that nature might have intrinsic value beyond its material uses”. By contrast, 'ecologism' in green politics is a deeper, more integrative view of the

environment which brings in human activity systems, worldview and philosophy. Thus Dobson quotes Porritt and Winner's (1988, 247) call for 'metaphysical reconstruction' as an ingredient of ecologism. While Dobson's linguistic distinction has not been taken up particularly widely, it is useful insofar as it indicates the fundamental difference between worldviews expressed in political ideology. In ecophilosphical debate, it echoes Naess' (1973) seminal distinction between ‘shallow’ and ‘deep’ ecology.

Dobson suggests that ecologism is historically specific; that while it relates to earlier influences, it can only be understood by the current context which, in part, provides its definition (1990, 33). He sees the Club of Rome's 1972 *Limits to Growth* study (which was, incidentally, the first world systems model) as fulfilling three conditions necessary for the emergence of ecologism: a description of limits to growth, prescription of the need for fundamental change, and the means to communicate the message to wide audience. Dobson (1990, 34) adds:

> We are provided with a boundary beyond which (in the past) ecologism could not have existed, and therefore any movement or idea behind that boundary can bear only an informing relation to ecologism as I think we ought to understand it.

The appearance of Naess' distinction the same year as the Limits to Growth (Naess' lecture was delivered in 1972) lends credence to Dobson's theory (although I judge ‘deep ecology’ to be overall more radical than Dobson's political ecologism). Clearly, however, current ecological thinking is strongly influenced by the past, and this is consciously invoked by environmentalists (now using the term in an inclusive sense) today, for inspiration and legitimation. Hence Marshall (1992, 6) comments:

> Ecological thinking is unique in that it draws on science as well as philosophy and religion for inspiration. In their search for ancestors, ecological thinkers have delved into Taoism and Zen Bhuddism, invoked the Greek Goddess Gaia and looked to the old ways of American Indians for a model of harmonious relationship with Mother Earth. Within Christianity, they emphasize the idea of human stewardship of rather than domination over nature…

Marshall also mentions the “minority tradition in Western metaphysics, represented by such thinkers as Spinoza, Whitehead and Heidegger”, and later in his book also includes the new science. But like other writers, Marshall does not think this rich tapestry yet constitutes Porritt and Winner's metaphysical reconstruction.

Differing environmental paradigms

The interpretation and significance afforded to 'environment' by any party is influenced by that party's worldview. As Cotgrove has demonstrated (1982 - see B.1.1), shades of environmentalism cannot be understood in any depth without reference to worldview. Like Cotgrove, it was through studying different views of the environment that led O'Riordan to realise that the environmental movement was not a homogenous social grouping, but was made up of subgroups with sometimes radically different visions of reality and of the human/environment relationship. His conclusions were first published in his work *Environmentalism* (O'Riordan 1987), and his model of paradigms within environmentalism has been much quoted since.

O'Riordan makes a fundamental distinction, which he also attributes to other writers (some of whom are referenced in this Thesis including Capra 1982, Cotgrove 1982, Milbrath 1989 and Pepper 1984). This tension is between "a *radical* or *manipulative* perspective in which human ingenuity and the spirit of competition dictate the terms of morality and conduct" and "a *conservative* and *nurturing* view of society-nature relationships, where nature provides a metaphor for morality", that is, affords a sense of normative ethics (O'Riordan 1989, 82). Thus, he states simply, that "environmentalism is the clash of two world views" (1990, 143). The terms O'Riordan chose to describe these modes were 'technocentrism' and 'ecocentrism', terms which have since entered the debate. The first is a human-centred (anthropocentric) view of the environment, giving rise to a manipulative, managerial or interventionist approach to resource use and environmental protection. The other orientation is 'ecocentric' and is based on an holistic nature/Earth centred view of the world which gives rise to a nurturing approach. Other writers, perhaps more neatly, make the distinction between 'egocentric' and 'ecocentric' (Merchant 1992). Both these orientations are further subdivided in O'Riordan's model, which can be summarised as follows:

Egocentric / technocentric / environmentalism

1. Optimism – 'business as usual'
2. Accommodation – managerialism/reformism: 'light green' changes in practice and policy

Ecocentric/ecologism

3. *Communalism* - radical change: localisation, appropriate technology, low-growth or no-growth with equity, etc.

4. *Gaianism* – deep ecology position, with nature given primacy, and a bioregional approach to human systems.

O'Riordan suggests that while many individuals' or organisations' views do not neatly fall within one of these suborientations, the model does allow a useful key to underlying shifts in the debate. The author has modified this map to reflect this change (O'Riordan, 1990). Thus, O'Riordan surmises that Western societies have shifted from the first optimist position to the light green reformatory position, and that this in itself "is a significant shift of attitude" (1990, 143). The real issue is whether a further shift, in the pursuit of 'the sustainability transition' is possible (see discussion in B.1.8) as it involves higher order or deep learning which challenges fundamental positions in the prevailing worldview.

Whilst O'Riordan's model is very helpful, the distinction between 'anthropocentric' and 'ecocentric' views is also problematic. As we are humans, the critics say, then we cannot have anything other but a human view of reality, even if we wish to give the non-human world primacy. This has been the argument of those who critique deep ecology such as Skolimowski. Part of the battle here is between deep ecologists (such as Devall) and social ecologists (such as Bookchin) and who "are at odds as to whether the priority lies with challenging the dominant worldview as the mode for initiating transformation or whether the pre-eminent strategy lies in the pursuit of social justice" (Merchant 1994, 237): that is, whether we should seek first to change fundamental values or social and economic structures. There is probably no 'right answer' to this 'chicken and egg' argument, but meantime, a more fundamental problem is our dualistic thinking, which maintains the illusion of separateness. I agree with Boulding, (an associate of von Bertalanffy, who did much to apply General Systems Theory to economics), who suggests:

> There is no such thing as an 'environment' if by this we mean a surrounding system that is independent of what goes on inside it. Particularly, there is no sense at this stage of evolution on earth in talking about 'the environment' as if it were nature without the human race.
> (Boulding 1978, 31)

Boulding's view is affirmed by the notion of co-evolution and co-creation, which I discuss in Part B.1.6. Thus, while the notion of 'environment' is very important, it becomes flawed if we consider it a somehow separate part of our reality - *as is so often the case*. Wilber's (1997) distinction between 'differentiation' and 'dissociation' (see

B.1.4) is helpful here, echoing Bohm's (1992) distinction between 'distinguishing something' (meaning 'to mark apart') and 'division'. We tend to dissociate and divide, when we should often do no more than make the distinction.

- Keypoint: A large proportion of the environmental discourse has been founded upon the flawed idea and perception of the essential separateness of the environment from people and from human systems - (for example, the perception of 'environmental issues' as somehow separate from economic or political or sociological issues).

Having had some involvement in the environmental ethics debate (Sterling 1990), I would also suggest that too much of this discourse also seems to reinforce the separateness of environment. A further somewhat intractable problem here is the linguistic structure of the subject-object divide which embodies and encourages dualistic perception (see discussion in subsection 1.2 above). Thus:

- Keypoint: a simple or narrowly conceived 'environmentalism', which regards the environment as 'a thing', does not necessarily contribute to the ontology of the postmodern ecological worldview which has a more process-based view of reality as a whole, whilst not ignoring ecological realism.

That said, much of the thinking that contributes to the ecological worldview has arisen from a prior concern with 'the environment' (however diverse, returning to Schlosberg's point, those concerns might be). In other words, a simple environmentalism can sometimes be a starting point for a participative worldview. I would argue that a more whole, more relational, perception of 'environment' inevitably leads to something like Meadow's (1982a, 101) position (first quoted above in Part A.1.1):

> The world is a complex, interconnected, finite, ecological-social-psychological-economic system. We treat it as if it were not, as if it were divisible, separable, simple, and infinite. Our persistent, intractable, global problems arise directly from this mismatch.

In an insightful essay which reviews the status of environmentalism, McKibben (2000, 3) makes a parallel point:

> Whereas in the past environmentalism has concerned itself with preventing degradation to nature, in the future it will have to….make a far broader argument. Whether we will still call it environmentalism, and whether it will still draw its strength from the same places, is open to question, but the animating

> spirit will need to be a love of the world…and the web of relationships, human and otherwise, that still survive here.

Thus, many people have shifted from a simple 'environmentalism' to a deeper 'ecologism' and from there towards an existential sense of the ecological, participative worldview - a different epistemology, that is a key theme of this Thesis.

1.4 Complexity theory and holistic science

The development of complexity theory is significant, perhaps on three counts:

1. it is providing new understanding of conditions of systemicity and uncertainty and how to work with them
2. it is at the forefront of forging a postmodern science which directly challenges the dominance of mechanism and reductionism through emphasising emergence
3. it offers new credence, legitimacy and knowledge to the relational (ecological) view of the world.

One of the books which popularised 'complexity' states that the science of complexity is a subject:

> So new and so wide-ranging that nobody knows quite how to define it, or even where its boundaries lie.
> (Waldrop 1992, 9)

Whilst in popular parlance, people use 'complexity' to describe nothing more than 'many parts' as in a difficult jigsaw, a watch or a car engine, the term is more appropriate to describe a state of many relationships which are in a state of unpredictable change. Whilst a condition of many parts is 'complicated', the condition of rich interconnection is 'complex' and herein lies the difference.

A unifying theme throughout this Thesis is the tension between the mechanistic worldview and the organicist worldview. The dominance of the machine metaphor, as we have seen, has been the norm for little more than the last few centuries: "by contrast all previous worldviews took organisms as their principal metaphor and myth" (Sheldrake and Fox 1996, 16). The rise of the complexity sciences promises a shift again towards organicism - but in a new guise. The problem however, as Sheldrake points out, is that there is a time-lag between the emergence of new ideas in science and their general take-up as part of popular consciousness. He suggests the new ideas

of holistic science will probably not enter this consciousness till around 2030 by which time “it might be too late” (Sheldrake and Fox 1996, 16).

However, ecological thinking is turning to (as well as arising from) holistic science and complexity theory as a source of ideas and legitimation - in a society where science is still largely regarded as a fundamental source of authority. Holistic science and complexity theory appeal to non-scientists (like myself) because they follow the organicist tradition, putting emphasis on relation, qualities, wholes, and the essential creativity of nature. The focus of explanation, most significantly, is on *emergence* rather than mechanism. This “new vision”, coming from the world of complexity, chaos and emergent order, started in physics and mathematics and is “now moving rapidly into the life sciences”, according to Sole and Goodwin (2000, *ix*).

Yet it is the life sciences, where mechanism has held particular sway, evidenced in modern times in molecular biology and its consequence, genetic engineering. Birch (1988) clearly sets out the difference between mechanistic and ecological models of life, in a paper ‘The Postmodern Challenge to Biology’. Hence, the methodology of mechanism is to regard the living organism *as if* it were a machine; but a second metaphysical step taken by many, says Birch, is to conclude that the living organism *is* a machine. One result is that only phenomena and issues that are amenable to this approach are ruled within its compass, while issues such as complexity and emergent properties remain unrecognised and inexplicable.

Birch explains the difference between the mechanistic and ecological models as follows. Mechanism recognises external forces operating on a living organism, whilst the ecological model recognises the importance of internal relations (as well). The former looks for building blocks or *substances* that exist independently of environment and that - aggregated - explain the whole, the latter emphasises internal and external *relationships* that can explain changing properties at each level of the whole. A distinction is thus made, writes Birch “between a biology that is *compositional* (substantialist) and one that is *relational* (ecological) (1988, 70).

It is the latter view that has been affirmed by the emergence of the new sciences of complexity, even since Birch was writing in 1988. The significance of complexity theory, according to Lewin (1992) is that it answers and goes beyond the centuries long tussle between mechanism which sees organisms as fundamentally machines, or machine-like, and vitalism which - following Bergson and others - argued that life was explained

by an outside and added vital force. The holistic maxim, that the whole is greater than the sum of its parts, is interpreted and understood newly. The question that the new sciences of complexity are beginning to answer, say Sole and Goodwin (2000, x) is, "How can systems made up of components whose properties we understand well give rise to phenomena that are quite unexpected?". This, some 70 years later, is a re-working of Smuts' question (1926, 162): "the great mystery of reality is…how do elements or factors a and b come together, combine and coalesce to form a new unity or entity x different from both of them?". He goes on to say "the answer to this question will in some measure supply the key to all or most of our great problems". While this might be an overstatement, the new sciences of complexity are, according to its champions, a major advance in understanding. According to Waldrop (1992, 13), complexity researchers believe they are "forging the first rigorous alternative to the kind of linear, reductionist thinking that has dominated science since the time of Newton - and has now gone about as far as it can go".

One of the critical differences between the mechanistic paradigm and complexity is non-linearity. The former is based on Newtonian physics and focuses on linear causality, simple determinism and predictability (if A then B). Complex systems, by contrast, are characterised by high levels of non-linear interconnection. Until recently, and the development of computing power, scientists largely confined themselves to studying linear systems and equations, and if necessary discarding the non-linear parts in the description of the system. This, say Clayton and Radcliffe (1996, 39) has led to "a rather distorted and simplified view of the world". Yet in natural systems, they say, "linearity is the exception rather than the norm". The critical change in science over recent decades, according to Capra (1996, 122), is the recognition that nature is "relentlessly non-linear" and that also non-linear phenomena dominate much more of the inanimate world than had been previously thought. Indeed, Lewin and Regine suggest that "95 per cent of the world is non-linear, unstable and far from being in equilibrium" (1999, 28).

A key consequence is unpredictability. According to chaos theory, this partly derives from the existence of 'bifurcations' at which a non-linear system may take any one of several different paths or states, depending on the system's history and external circumstances and "can never be predicted" (Capra 1996, 177). For the scientist, unpredictability also lies in the phenomenon whereby small errors in calculating initial conditions produce great errors in calculating expected outcomes (Capra 1996, Sole

and Goodwin 2000). This is why the weather, say, is unpredictable except over the short-term. A further source of unpredictability is the phenomenon of emergence.

Capra says that the philosopher Broad coined the term emergence in the 1920s to describe properties that emerge at levels of complexity that do not exist at lower levels (1996, 28). Reductionist and mechanist thought holds that the whole is *no more than* the sum of the parts, and that it is in principle, possible to predict the properties of the sum by knowing the properties of the parts. Complexity theory refutes this. As Sole and Goodwin (2000, 17-19) point out:

> Rarely can we can go from the properties of the constituent parts to a description of the whole…We believe that reductionism is inadequate as the primary explanatory framework of science…Progress in understanding natural phenomena involves grasping relevant aspects of whole systems.

Each level of organisation shows properties or behaviours which emerge at that level, and that cannot be explained by the properties of the parts - and as complexity increases, then further properties emerge. Yet, complexity science has discovered that - contrary to the long-held belief in science that complexity arises from complex processes - that complex systems often result from the basis of a few simple rules.

Because of the richness of interactions within a complex system, be it a cell, a brain, an animal, an organisation, a society, the system is capable of spontaneous *self-organisation* - that is, develop order and structure without central control or design, and as an emergent property of the whole (or of the sub-system, if large enough). Further, all organic systems, including social systems and organisations, can be seen as *complex adaptive systems,* made up of interrelated parts that through their dynamic interaction, generate novel behaviour. They are adaptive because as the external environment changes, so do the parts and the whole so that the system as a whole evolves in relation to its environment (Lewin and Regine 1999). However, the influence of the environment is not deterministic. According to Maturana and Varela's (1987) theory of *autopoesis* (self-making) (quoted by Capra 1996), which refers to the pattern of organisation in a living system, the system both maintains itself and changes through interaction with its environment, through 'learning'. Indeed, the organism and its environment co-create one another (Goodwin, 1999), or co-evolve.

This is a very brief outline of complexity, but we can now revisit the three points above which summarise the significance of complexity theory:

providing new understanding of systemic issues

As society has moved from conditions of relative certainty to increasing uncertainty, from 'difficulties' to an increasing state of 'mess' (in Ackoff's sense), old forms of management, strategy, and command and control have become increasingly ineffective. Complexity theory is underpinning new forms of organisational change, management, and research (and this theme is discussed in Part C).

forging a postmodern science

Many of the pillars of mechanistic science - objectivism, positivism, materialism, reductionism, determinism, prediction - are modified or replaced by the concepts and methodologies emerging from postmodern science and complexity.

supporting the process (ecological) view of the world

The new concepts of complexity such as self-organisation, complex adaptive systems, and emergence, give substance to and new ways of thinking about living systems and human systems.

In science as a whole, there has been a movement away from extreme positivism and reductionism. In sum, there is a shift from a fragmented and mechanical conception of the world toward a holistic and organicist conception, accompanied by a shift from concern with objectivity, towards the notion of critical subjectivity including the role of perception and cognition in the process of scientific inquiry (Harman 1994). This science lacks a widely accepted name but 'holistic science' (Briggs and Peat 1985), 'a science of qualities' (Goodwin 1999) and a 'science of wholeness' (Harman 1994) are some contenders. Consistent with my argument regarding paradigm change, such a science would "contain most of present science, but in an expanded context" (Harman 1994, 377). Similarly, Jencks (11, 1992) notes that the Newtonian "simple sciences are now seen to be special cases of the more elaborate sciences of complexity".

This shift is often described as a *participative* view of science, and of human interaction with the world. The increased understanding that complexity theory is affording does *not* mean that we now have a better means of controlling processes. On the contrary, paradoxically 'knowing more' has underlined a position that has gained in strength since the formulation of Heisenberg's uncertainty principle - that we 'know that we do not know'. As Goodwin (1999, 8) remarks, the complexity sciences suggest: "why we cannot control the processes that underlie the health of organisms, ecosystems, organisations, and communities. They are governed by subtle principles in which

causality is not linear but cyclic, cause and effect are not separable and therefore not manipulable" and only apprehensible by careful attention to 'qualities'. Goodwin makes a plea for a shift "from control to participation", from trying to manipulate and change things, to appreciate 'what is', to allow things to be, to respect and value self-organisation as a principle of life. This brings us back to our central concerns with perception, participative knowing, and co-evolution (as outlined in Parts A and B), and links with our view of indigenous science (above). Yet it is as well to be reminded that the 'new science' and the 'participatory worldview' is still - as yet - very much a minority view:

> Nature controlled by human thought is the essence of the reductionist dream. It is a dream that persists even in the face of its evident failures.
> (Briggs and Peat, 1990, 201)

Summary

The four bases of whole systems thinking outlined above reflect some of the intellectual concepts and frameworks that can help us expand our consciousness to embrace a broader spectrum of reality, recognise the limits to our own thinking, and construct more whole ways of perceiving and thinking. In sum, as argued at the outset of the Thesis, such whole systems thinking may be seen as a syncretization of:

- the methodology of systems thinking (emphasising inclusive and integrative approaches)
- a co-evolutionary ontology (emphasising duality, pattern and relation) and
- the worldview of ecological thinking (emphasising extension of boundaries of concern and compassion)…

…whereby each is strengthened through the synergy of the whole. This convergence suggests a three-part model of paradigm and experience, and this is explicated in the next section.

2 A WHOLE SYSTEMS MODEL

This section elaborates on the origin, validity, detail and use of the whole systems model of paradigm and of knowing that was introduced in Part A. 'Seeing, Knowing and Doing' are suggested as the domains of human knowing and experience, and this model is used to represent and illustrate the key qualities of *re-perception, re-cognition* and *realisation* that are discussed as fundamental to the emergence of the postmodern ecological worldview. This paradigm change is illustrated further through aligning the Seeing, Knowing, Doing model with the learning levels model (elaborated in Part B).

2.1 A triadic whole - Seeing, Knowing, Doing

During the years I worked on this doctorate, a triadic model or conceptual framework gradually came to mind. This is summarised in Diagram A.4 ‘Domains, aspects and dimensions of experience’ in Part A.3 of the main Thesis. As I read many sources and reflected further, it seemed to become increasingly valid through echoing and representing much that I read. Further, it seemed to offer a way of thinking about issues that was helpful and insightful. While I have seen parts of this model represented in different sources, I have not seen the model presented as below and I would claim the model as an original contribution. I see it as an attempt at a whole systems model of paradigm, and of human experience Like all models has strengths and weaknesses, and I would not claim that it should be *the* model to the exclusion of others. Nevertheless, I have shown it to a number of colleagues who agree it has power and validity. True to the philosophy of soft systems thinking, it is not offered as a representation of reality but a lens through which we might gain insight on human experience.

This model (or framework) extends the three-part description of systems thinking, which I first derived from reading a paragraph in Senge (1990), and which is summarised in A.2.2. To quote from that section:

> The first is the *personal knowledge* aspect, which relates to perception, awareness, intuition and values. (This corresponds to Senge's 'sensibility'.)
>
> The second is the *propositional knowledge* aspect, which relates to theoretical constructs and concepts. (This corresponds to Senge's 'general principles'.)
>
> The third is the *practical knowledge* aspect, which relates to methodology, tools and skills. (This corresponds to Senge's 'tools and techniques'.)

This model can be shown simply as:

Table App I.1: A framework for systems thinking

Sensibility	*or* Awareness	*or* Perception	*or* Normative/ purposive dimension
General principles	*or* Concepts	*or* Theory	*or* Descriptive dimension
Tools and techniques	*or* Methods	*or* Practice	*or* Applicative dimension

This also corresponds with Flood's suggestion (1999, 126) that systemic thinking suggests three necessary and fundamental learning modes:

- how things ought to be
- how things might be (i.e. how they seem to be)
- how things can be changed…

and Banathy's (1991) idea that systemic change requires the three components of

- vision
- image and
- design…

and Gallopin's (2002) idea that sustainable development requires

- willingness
- understanding and
- capacity.

Further, there seems to be a parallel with Reason 1988 (and Heron's) notion of 'extended epistemology' consisting of

- experiential knowledge
- propositional knowledge and
- practical knowledge.

This pattern of triadic models seems to confer validity to each and all, and I develop the notion of triadic pattern further below.

A problem, as I have suggested, with a number of schools of systems thinking is that they have appeared over-concerned with methodology, (that is, the third aspect above) at the expense of attention to other areas of experience, not least 'ethical defensibility', as Bawden (2000a) points out. Not only that, but in a technocentric culture, a particular methodology tends to prevail. Take Schratz and Walker's comment::

> The significance of the use of the term 'methodology' is that it requires an argument to connect the choice of particular methods to the way that the problem is conceived and the utility and limitations of the outcome.
> (1995, 12).

The technocentric culture tends to be manipulative, managerial or interventionist. Values such as efficiency and effectiveness are to the fore, and our focus is often problem-centred. Operating within this culture, systems thinking has - understandably - often been oriented towards problem-solving methodology. But the uses to which any methodology is put is very important, and therefore we need to look critically at the role of ethics, of worldview or what might be called our 'sensibility orientation'. At the same time, environmentalists who think holistically tend to be strong as regards awareness and values (first dimension), but weaker on methodology (third dimension). The model thus helps map the under-represented dimensions both in systems thinking, and in environmentalism. In addition, I believe it helps us understand something of the difference between mechanistic and ecological worldviews, and this is discussed below.

I will now elaborate on the three key parts of the model. In Part A.3.1, I outlined the whole systems triadic model which attempts to map three interrelated *aspects* of human experience (cognition, knowing, and paradigm or belief), each of which could be said to have three *dimensions*. The table in Part A.3.1, summarising these aspects and their dimensions, is repeated below for convenience.

Table App.1.2: Aspects and dimensions of Seeing, Knowing, Doing

ASPECTS ⇩	***Seeing domain***	***Knowing domain***	***Doing domain***
Dimensions of cognition:	Perception	Cognition/conception	Practice
Dimensions of knowing:	Epistemology	Ontology	Methodology
Dimensions of belief:	Ethos	Eidos	Praxis

Overtime, the validity of this model seemed to me to become more affirmed through the realisation of a list of linked 'triads' which describe human knowing and experience. From an original list of thirty-five sets, I now *tentatively* suggest the following descriptors of the three domains identified:

Table App.I.3: Domains of human knowing, experience and learning: a tentative list of descriptors

'Seeing' domain	**'Knowing' domain**	**'Doing' domain**
Epistemology	Ontology	Methodology
Ethos	Eidos	Praxis
Ethical	Theoretical	Technical
Experiential	Propositional	Practical
Knowing	Being	Becoming
Aesthetics	Science	Craft / art / technology
Philosophy	Theory	Practice
Intuition	Intellect	Capacity / ability
Feel	Think	Act
Spirit	Mind	Body/matter
Metaphor	Theory	Tool
Purposive	Descriptive	Participative
Affective	Cognitive	Conative
Value	Knowledge	Skill
Imagination	Rigour	Relevance
Heart	Head	Hands
Insight	Hindsight	Foresight
Vision	Image	Design
Why	What	How

It would be a lengthy exercise to comment on all these sets of descriptors. What is important here is the *pattern* rather than the detail, that is, the overall sense that is conveyed by reading down or across the columns. I now summarise these three interrelated domains of experience, which together shape our being:

- ***the Seeing domain***

  This is to do with how we know and how we see. This is our sensibility or sentience, which relates to our inspirational knowing as well as our experiential

knowing. It is the *perceptual* domain - how we see the world, make sense of it, and how our filters affect this experience. In more detail, I include under 'inspirational' the *affective* and *imaginal* dimensions, because I believe that our perception is affected by our spiritual grounding and awareness, our belief system, our creative imagination and intuition, as well as by habits of thought and by our experiential histories. Thus, while Harman (1994, 378) notes an inner knowing in an "intuitive, aesthetic, spiritual, noetic and mystical sense", Milman (1998, 145) suggests that experience is coloured, shaped, informed and often distorted by interpretations, expectations, assumptions, beliefs, associations, fears, desires and opinions,

- ***the Knowing domain***

  This is to do with our ontological view of reality, and related to that view, our interpretation of the world, the meaning we ascribe and express through our stories, our constructs, theories, heuristics and concepts. This is the *conceptual* domain - how we conceive the world and represent the world to ourselves and others.

- ***the Doing domain***

  This is to do with how we actively participate in the world, which relates to capacities, skills, tools, methods, designs, communication and utility. This is the *practical* domain – how we act on and in the world, and with others.

I find this simple model helps me understand our own way of thinking and experiencing. It also helps indicate the meaning of the more 'integrative consciousness' that arises from epistemic learning . A first observation perhaps, is that in Western culture, while all three areas of knowing are inevitably operative, they tend to be *dis-integrated* in our consciousness rather than mutually informing. Second, that different groups tend to focus on or in one area, or two areas, rather than all three. I make these claims on the basis of observation of pattern, which I now suggest in more detail.

In the dominant Western paradigm, the focus is primarily in the second and third domains. So intellectual knowledge (second domain) is valued, to the extent that other forms of knowledge are often regarded as having less value - such as 'intuitive knowing' or 'spiritual knowing' (first domain) or 'practical knowing' (third domain). Similarly, 'spirit' and 'emotion' (first domain) and 'body' (third domain) tend to be

undervalued. This pattern tends to be reflected in the way that knowledge is regarded and relayed in educational institutions. Most education privileges propositional knowledge at the expense of both personal and practical knowledge ('head' rather than 'heart' or 'hand'), or academic strands are separated from vocational. Further, the scientist who pursues 'pure knowledge' without reference to his/her inner knowing or conscience, and without regard to the use to which the research might be put, has often been upheld as the model for objective scientific research.

Yet - and paradoxically - our culture at the same time gives emphasis to the Doing domain in terms of emphasis (as we have seen above) on intervention, manipulation and managerialism, particularly through technology. This might be seen as an instrumental emphasis on *techne* rather than praxis. Indeed, Bawden and Macadam (1988, quoted in Ison 1990), make a distinction between my dimensions second and third domains by using the terms *scientia* and *techne* respectively, and distinguish the latter from *praxis*. People who regard themselves primarily as practitioners (and this includes many teachers) tend to have disregard for theory and for theorists (second domain) or philosophy (first domain). Meanwhile, spiritual followers sometimes deny both reason (second domain), and the body or worldliness (third domain). By contrast, ardent consumers are very interested in material things but often appear to have lost touch with their inner selves or sense of deeper human purpose (first domain), and this material view of the world tends to be reflected by the mass media.

Similarly, technocrats typically have high interest in both theory and practical application, but often little interest in ethics. It has often been stated that our scientific knowledge and technical skills have outstripped our capacity to make ethical judgements (for example Peccei 1982, Capra 1982), and this tension has every prospect of being exacerbated with the new technical advances in biotechnology and nanotechnology, and the ability to change life forms (Ho 1998). A further example of the divorce between domains is the lack of aesthetic sense (first domain) reflected in so many examples of material goods, architecture, townscape, and landscape, where functionality and utility overrides beauty or elegance (Papanek 1995). In philosophy, the fundamental conflict between 'idealists' and 'realists' may be seen as a tension between those who focus on the first and second/third domains, respectively.

These examples indicate an endemic imbalance. The three areas of knowing tend to be *dis-integrated* in the person and in our culture, resulting in little sense of wholeness

in either. Further to this dis-integration, the focus of consciousness tend to be *disproportionately weighted* towards the second and third domains, whereby:

- the key role of the Seeing domain is under recognised or undervalued
- rationality is seen as sufficient to understand and address the world
- an 'external' material reality is seen as the prime or only reality
- consciousness tends not to be aware of itself, that is, its role in colouring perception
- perception, cognition and action are believed to be a linear process.

This locus of consciousness in the Knowing and Doing domains, helps explain our focus on our outer rather than our inner worlds; why indeed, there is the crisis of perception described earlier in Parts A and B.

A further problem with the dominant mechanistic paradigm is not only that the domains of knowing are fragmented, and unevenly weighted, but that they tend to be *narrowly drawn.* Referring back to the discussion in B.1.4, the paradigm and its knowledge system (Marglin 1990) tends to narrow what counts as legitimate ways of knowing, ways of conceiving, and ways of doing. This argument indicates that a fundamental difference between the ecological and mechanistic paradigms is that the former represents or attempts:

- *an extension* of each domain
- *connection* between areas of knowledge within each domain
- *re-integration* of the three domains, and systemic coherence of the whole.

I suggest that re-integration is conducive to wisdom. Consider this example and quote from Daly (1996, 43) which suggests that wisdom arises from integration of the three domains (represented here by 'purpose', real world 'limits', and 'techniques'):

> Wisdom involves a knowledge of techniques plus an understanding of purposes and their relative importance, along with an appreciation of the limits to which technique and purpose are subject.

So the necessary shifts from mechanistic thinking towards ecological or whole systems thinking, in individuals, groups and wider society, can be represented and summarised by three keywords: *extension, connection*, and *integration*. The next table follows on from Table App.1.3 above, and attempts to summarise the nature of this three-part qualitative shift using keywords:

in *assumptions* - leading towards greater compassion

in *distinctions* - leading towards greater understanding of connectivity
in *intentions/actions* - leading towards wisdom and action which is more integrative and ecological.

Table App.1.4 Shifts in the three domains of knowing associated with whole systems thinking

Seeing domain	**Knowing domain**	**Doing domain**
Assumptions	***Distinctions***	***Intentions / actions***
Extension	Connection	Integration
Re-perception	Re-cognition	Realisation
Compassion	Understanding	Wisdom

This change is explicated in more detail in Box B.4 'Fundamental shifts towards an ecological paradigm' in Part B of the main Thesis. As noted there, I argue that

- extension/compassion,
- connection/understanding and
- integration/wisdom

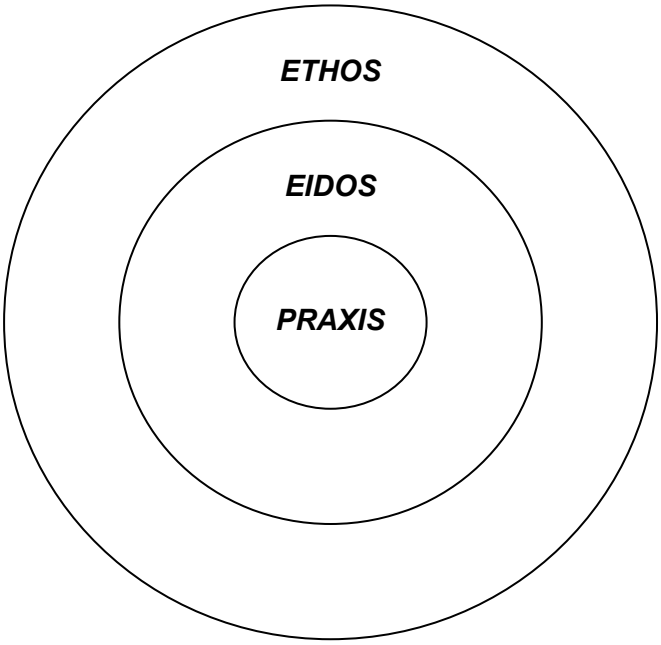
are - respectively - needed to heal the *narrowness of perception*, *disconnective thinking,* and *disintegrative practice* so often manifested both in education and society. The guiding principle here is *wholeness* ('heal' and 'whole', having the same semantic root in the Greek term 'holos' meaning whole or complete). Thus:

- wholeness in *purpose*, that is, wholeness as an ethical idea and invoking integrity
- wholeness of *description* as regards such things as multidimensionality, multiple perspectives and emergent properties, and
- wholeness in *practice* which is more integrative and coherent.

A key point to make about this recurrent three-part model, is that the domains are mutually informing and illuminating, which is illustrated by the key Venn Diagram A.4.in Part A.3. It should not be seen as a linear model - that we perceive something through our senses, then we conceptualise it, then we act on it - but as a systemic model of knowing and learning where each aspect of knowing continuously informs the others. For example, as Reason and Bradbury suggest (2001, 11) practical knowing (equivalent to my Doing domain) derives its validity from its grounding in experiential knowing (equivalent to my Seeing domain), while practical knowing consummates experiential knowing in worthwhile action. However - and echoing my systemic levels of

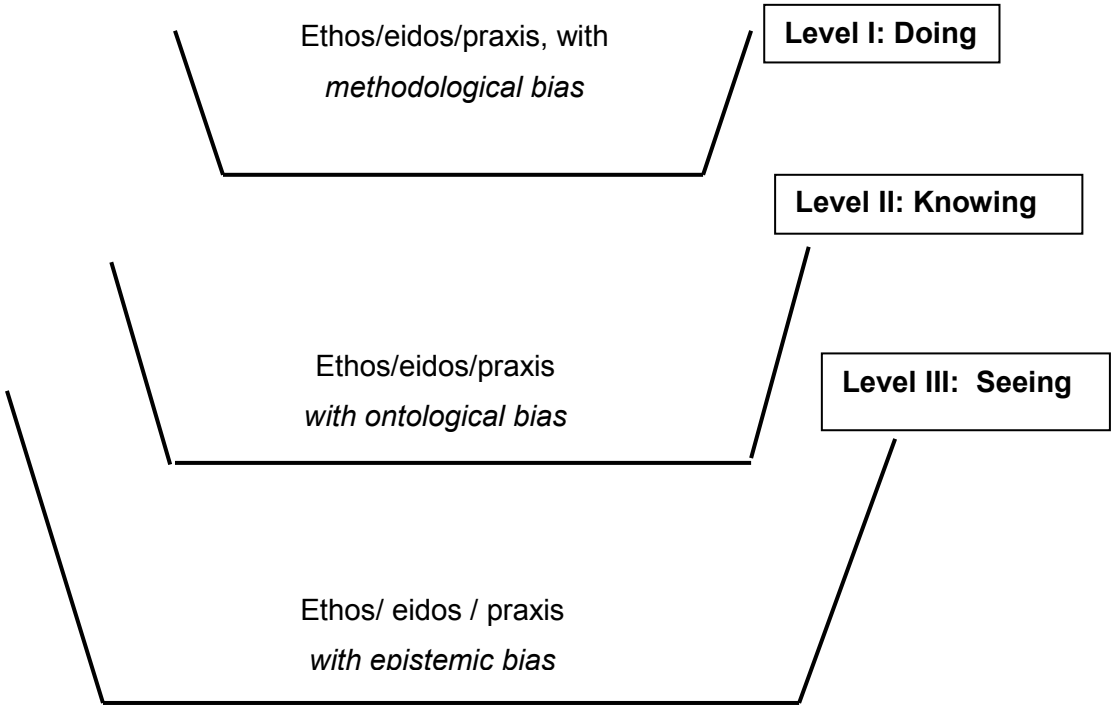
knowing model (Part B.1.3) - we can suggest the Seeing domain is the most fundamental level, and this can be interpreted in terms of ethos. (As introduced in the Thesis and above, paradigm is one aspect of the domains of knowing, and paradigm can be said to consist of the three dimensions of ethos, eidos, and praxis.) The relationship between these dimensions can be shown as a nesting systems diagram:

Diagram App I. 1: Paradigm components as nesting systems



So I'm claiming that the 'Seeing' domain, or ethos aspect of paradigm is the most fundamental aspect of knowing, and therefore is the key to change. If we now superimpose this triadic model of domains of knowing and experience onto the model of learning levels, it helps illustrate the nature of paradigm change. I think it is possible to discern correlations between these two models both within and ascending (or descending) the nesting levels as shown in the following diagram.

Diagram App.I. 2: Combining the model of learning levels with whole systems model of knowing



Clearly, *within* each learning level, there is an operative paradigm of *ethos/eidos/praxis*, which is influenced by the operative paradigm in the contextual learning level below. Using my interpretation of learning level theory (see Part B), I suggest that:
Level I is a *subparadigmatic* level, corresponding primarily with *Praxis/methodology.* The 'Doing' domain is dominant: 'knowing how'.
Level II is the *paradigm* level, corresponding primarily with *Eidos/ontology* (with implications for changed praxis). The 'Knowing' domain is dominant: 'knowing what and how'.
Level III is the *metaparadigm* level, corresponding primarily with *Ethos/epistemology.* The 'Seeing' domain is dominant - knowing why, what and how, and giving rise to a changed operative paradigm at Level II (a changed view of reality), and a changed operatiive subparadigm at Level I (a changed set of practices). Level is epistemic learning.

If these are seen as nested levels (as noted in B.1.3), we can see that the deeper levels subsume and influence the higher. The following App.I.5 suggests that the three

part model of learning and change that I have developed here is echoed and validated by others' models which are shown alongside. I am not suggesting strict equivalence but a pattern of similar views of learning and change.

Table App.I.5: Orders of learning, orders of change - some triadic schemes

Note: the second part of the table is a simple continuation of the first but the two parts cannot be fitted together across one page.

Learning I	Reflection in action Single loop	First order learning	Basic learning	Functional, maintenance, adaptive	Accommodative	'About' sustainability	Learning as maintenance	Praxis
Learning II	Reflection on action Double loop	Second order learning	Learning about learning	Reflective, critical, adaptive	Reformative	For' sustainability	Learning for change	Eidos (Praxis)
Learning III	Contemplation Triple loop	Third order learning	Learning about learning about learning	Creative, systemic, epistemic	Transformative	'As' sustainability	Learning as change	Ethos (Praxis / Eidos)
Bateson	*Agryis and Solon*	*Bateson Watzlawick Ison*	*Bawden*	*Banathy/ Sterling*	*Sterling*	*Sterling*	*Sterling*	*Sterling*

Methodology bias	'Doing things better	Design	Integration	Practice Dimension	Wisdom
Ontology bias	'Doing better things'	Image	Connection	Conceptual Dimension	Understanding
Epistemology bias	'Seeing things differently'	Vision	Extension	Perceptual Dimension	Compassion
Sterling	*General currency*	*Banathy*	*Sterling*	*Sterling*	*Sterling*

Essentially, the shift towards whole system thought and the ecological worldview involves a move from first and second-order change, towards third-order or epistemic change. But profound change *starts* with second-order change, the attainment of a meta-view, without which further paradigmatic change is not possible. In this shift, the role of the first domain of knowing - that is, Seeing: 'epistemology/perception/ethos' - is critically important, because this is at the heart of epistemic change.

A critical point to clarify here is that currently, the dominant worldview reflects levels of learning, but within the context of and from the basis of the mechanistic/modernist epistemology or paradigm. This, as I have argued, is largely unexamined yet deeply influences the other levels of knowing, learning and experience. Logically then, an ecological epistemology would also deeply influence the other levels of knowing, presenting and manifesting - as discussed in Part B.1.3 - *different sets of possibilities and practices* through the hierarchic 'systemic levels of knowing'. Indeed, I would suggest that the emergence in recent years of ecologically-informed management, ecodesign and participative inquiry methodology (examined further below) is evidence of such manifestation.

In this section 2, I have used the triadic model to elaborate the ideas of *re-perception, re-cognition* and *realisation* in the domains of our individual and collective Seeing, Knowing and Doing. I have argued these are qualities of change that are essential to the emergence of the postmodern ecological worldview The historic challenge is how we can accelerate a shift towards the ecological worldview in the three domains of knowing reviewed in this section. The next section looks at some of the implications of this shift in the three domains in more detail, beginning with epistemology. Not least, this provides further grounding for thinking about transformative learning, which is a key theme of Part D in the main Thesis.

3 WHOLE SYSTEMS THINKING AND SUSTAINABILITY

In this section 3, I use the model of three domains of knowing 'Seeing, Knowing, and Doing' to look at whole systems thinking in relation to sustainability. At the same time, the learning dimension of sustainability is discussed. Whilst these three domains are mutually informing, they are dealt with consecutively here. It may seem a little reductionist to deal with these separately, but in fact their interrelatedness is apparent in what follows. In subsection 3.1, I look at perception in more detail, and bring together the idea of a relational ontology, participative consciousness and epistemic learning. In section 3.2, the nature of sustainable and healthy systems is examined. I suggest parallels between educational values to do with self-realisation and autonomy, and sustainability values to do with self-organisation. In subsection 3.3, I look at ecological design and adaptive management as applied theories consistent with the ecological worldview, wherein learning plays a central role.

3.1 Seeing - epistemology and perception

I have argued that the sustainability transition is contingent on the emergence of an ecological worldview and culture. Whereas section 1 above has looked at the bases for a change in epistemology, and section 2 above has looked at my whole systems model of knowing and experience, I now want to focus briefly on *epistemology* as the key domain through which knowing and experience as a whole is framed. If we can better understand our dominant epistemology, we are more likely to be able to achieve or attain a profound shift of worldview or epistemic change. As Keeney states (1983, 7): "A change in epistemology means transforming one's way of experiencing the world". This may described as a change in perception, but this term underplays its significance. To echo Bateson's learning levels again, if Learning II is perceiving the bases of our perception, then Learning III appears to be a deep level of realisation or 're-perception' (Harman 1988) (as introduced in Part A.2.1).

As suggested in section 2 above, if the domains of knowing are disintegrated, a first step in changing our perception is to examine it, to re-perceive it. An emerging ecological view of perception and consciousness is helpful here. But first, we need to look at the mainstream debate, in order to distinguish the ecological view of epistemology.

The main tension in ontological debate has been between *'idealists'* who assert the primacy of the non-material world, and *'realists'* who assert the primacy of the material world. The first position is associated with naturalism, the second with positivism. Clearly, the dominant mechanistic/modernist paradigm that has been discussed in this Thesis is a materialist one.

As we have seen in B.1.5, the materialist paradigm has been under considerable attack from deconstructive postmodernism, an idealist position which holds that reality is largely (or even entirely) a human construction, and language the medium by which it is constructed or mediated. The problem here, as noted earlier, is one of validity: if everything is fundamentally text, then everything is relative. While deconstructionism exposes the values and constructions underlying mechanism, and is therefore liberating in this regard, it offers little to help us address the problems that mechanism has created. It clarifies the critical role of construction in our view of reality, but in extreme form denies the independent existence of the 'more-than-human-world' (Abram 1996). In other words, for some postmodernists a subjective epistemology

becomes a subjective ontology. From a whole systems viewpoint, as noted in B.1.5, it is not the important and valid notion of cultural construction that is the problem with deconstructionism, but as Spretnak says (1991,5) the belief that there is "*nothing but* cultural construction in human experience" (her italics) - despite our everyday experience of body, nature and place. Hence, deconstructionism makes the error of presenting a partial truth as a complete truth.

An ecological epistemology needs to go beyond the inadequacy of modernism, and the incompleteness of deconstructionism, beyond their respective metaphors of 'machine' and of 'text', and beyond the limits of their respective beliefs in universalism and relativism, whilst recognising their partial validities. Such an epistemology builds from these partial validities and - echoing Wilber (see Part B.1.5) - seeks a more adequate *weltanschauung.* Hence, my point in C.2.1 above about the need for perceptual extension.

An ecological epistemology agrees with materialism regarding the actuality of the independent world (this is Spretnak's 'real' - body, nature, place, or Heron's 'given cosmos'), while rejecting objectivism. It agrees with deconstructionism regarding the important idea of human construction in perception (constructivism) while rejecting the notion that 'this is all there is'. Hence, ecological epistemology stresses our systemic role - our participation - in the interplay between the ideal and the real, and beyond this, our participation in the sacred whole (Reason, 1993). The crucial point then is the need for a shift (of perception about perception) from one of *universalism*, and from *relativism* (characteristic of deconstructionism), to a *'relationalism'* (participativism) which can accommodate both previous positions. I shall now discuss what quality of perception this might involve.

Philosophically, a key foundation of ecological epistemology is 'phenomenology', which seeks to understand relation and is associated with such thinkers as Husserl (1859-1938), Heidegger (1889-1976), and Merleau-Ponty (1908-61). This method of enquiry is concerned with the nature of phenomena as they are experienced through human perception and consciousness. Thus Merleau-Ponty asserted the 'primacy of perception' (1964) as the foundation of human experience. Abram has summarised Merleau-Ponty's key ideas as:

- perception is an inherently participative event, a reciprocal interplay between perceiver and perceived

- perceived things are encountered by the perceiving body as animate, living powers that draw us into relation
- this relationship both engenders and supports our more conscious, linguistic reciprocity with others. Language is rooted in the non-verbal exchange always going on between our own flesh and the flesh of the world
- human languages are informed not only by the human body and community but by the shapes and patterns of the more-than-human terrain. (After Abram 1996, 90)

The problem, as Abram notes - drawing on Merleau-Ponty – is, if immediate perception is so basic to our experience, and so participatory and animistic, how come we seem to inhabit a non-participatory "inert and determinate" world? (90). Part of the answer, suggests Abram, lies with language which can influence "our sensorial experience".

Another reason (related to the linguistic problem) that the world appears non-participatory is our mode of consciousness. (This of course relates to the whole issue of the Western worldview, and associated beliefs and habits of thought reviewed earlier.) Bortoft, a Goetheian philosopher of science, suggests that humans have two major modes of consciousness, the action/analytical and the receptive/intuitive modes. Whilst the latter mode is dominant from early infancy, the analytic mode becomes dominant through interaction with our physical environment, where we learn to discriminate, to perceive boundaries and to manipulate objects. This mode, he says, is strengthened by the subject-object structure of our language (and, one might suggest, our educational norms). The receptive mode, Bortoft suggests is very different:

> Instead of being verbal, analytical, sequential, and logical, this mode of consciousness is nonverbal, holistic, non-linear, and intuitive. It emphasises the sensory and perceptual instead of the rational categories of the action mode (1996, 16).

This mode, in Bortoft's terms is based on 'taking in', or I would say 'appreciating', the environment, while the former is based on manipulating it. This picture of two modes of consciousness is also reflected in O'Riordan's distinction between nurturing and manipulative approaches to the environment (subsection 1.3 above). The analytic mode, Bortoft suggests, has become dominant in human experience. It corresponds with the object world, and we tend to see the object world as the only reality. Further, through empiricist method, we tend to think that we know of the world directly through the senses. Bortoft points out that empiricism makes the error of not recognising the

role of mind in cognitive perception. Purely sensory experience, (he suggests in an earlier paper), would be a state of difference without distinction, diversity without differentiation, “a state of awareness without meaning” (1986, 23). Instead, the world we see “exists in an ocean of mind” - physical objects are not simply physical objects but “condensations of meaning” (23). It is not just a matter of interpreting experience, that is, the meaning *of* what is seen (or heard), but the meaning which is brought to the act of perception, “the meaning which *is* what is seen” (24). This is the difference between the reflective mind, and the constitutive mind, says Bortoft. It is our ideas that organise - find pattern and meaning in - our sensory perception. But, because of the deeply-held Cartesian notion of the separation of subject and object, or consciousness from world, we tend to overlook that which we bring to perception, i.e., consciousness tends not to be aware of its participation in making or bringing into being the world it sees. In other words, we have a limited perception of our perception, and of our participation - illustrated for example, in the realist idea of objectivity.

Bortoft’s view of perception echoes Heron’s (1992, 12) point about the culturally endemic separation of 'intellect from affect' (Part B) and Bateson’s concern to balance rigour with imagination (A.2.2). An integrative consciousness appreciates that reality is, as Heron (1996, 164) suggests, “subjective-objective, that is, always dependent on personal mind and never exclusively dependent on personal mind because of the presence of the cosmically given in which the mind participates even as it shapes it”. This parallels Heisenberg’s statement that “What we observe is not nature itself, but nature exposed to our method of questioning” (quoted in Capra 1996, 40). The problem of course, is how we collectively can come to see (or perceive) that this is how we perceive. In sum, the argument here is that the world is participatory but largely we do not perceive it or think it to be participatory. This is why I have argued the necessity of journeying through the Batesonian learning levels, of growing realisation, and transcendence of the realist-idealist divide. Thus, Reason (1994a, 327) suggests that, “critical subjectivity”, a state of consciousness which neither entertains “naïve subjectivity” nor “attempted objectivity”, involves “a self-reflexive attention to the ground on which one is standing and thus is very close to what Bateson describes as Learning III”. This deeply systemic view is of course a defining characteristic of the participatory worldview that has been discussed above (see Tarnas in C.1.3 for example).

This discussion illustrates some possible conditions for, or descriptors of, epistemic learning that gives rise to a participatory worldview. These appear to include:

- reconciliation of our analytic and intuitive modes of consciousness,

- recognition of the role of our perceptual outlook in filtering and interpreting experience, and
- realisation of the spiritual, intuitive, affective, and imaginal (as well as sensory) bases of our perception.

This is a question of the individual and collective learning experience, and the nature of that transformative journey (paradigm change) is discussed in Part C of the main Thesis.

3.2 Knowing - the connective meta-pattern

An ecological epistemology recognises the link between perception and our consciousness. It recognises that 'the way we see' and 'what we appear to know' are intimately linked. This subsection is about the adequacy of the latter, and looks specifically at what we appear to know about sustainable/healthy systems.

The journey towards an ecological worldview, building on old and new bases - as sketched out in Part B and this **Appendix I** - is affording a more integrative view of reality. As a relational view of the world, it sees pattern and relationship as the primary reality. The ecological view of reality then, is of a connected material/non-material world, characterised primarily by process and dynamics, rather than discrete things. This view thinks less about 'things-in-themselves' like objects, artefacts, or organisations, and much more about 'things-in-relationship'. Indeed, living systems like families, communities, businesses, schools, are seen essentially as *networks of relationships* rather than 'things'. This subsection suggests some key insights that are emerging from this view.

As noted in Part A, Bateson was keen to discover and appreciate 'the pattern that connects' diverse phenomena. Earlier (in Part A), I posed the question, 'What is that mutually illumines learning, education, systems thinking and sustainability - is there a pattern that connects these areas?' Employing what Bateson called 'abductive thinking' or search for pattern and metaphor, I believe we can begin to address this question more fully. But this whole area is characterised by tentativeness because of its newness.

Complexity theory and our emerging knowledge of living systems is confirming a widely-shared intuition: that healthy, sustainable systems are those which are self-organising, self-healing, and self-renewing, and that are able to learn in order to

maintain and adapt themselves. They exert autonomy but in relation to and as integrative parts of larger systems. They maintain a dynamic balance between structure and flexibility, between order and chaos, in a state of bounded instability known as the 'edge of chaos' where creativity is able to flourish (Stacey 1996a and 1996b). These are said to be 'complex adaptive systems'.

From a systems point of view, the health of any living system - be it a family, a community, a farm, a local economy, a school, an ecosystem, *etc.,* - depends on the health of its subsystems, and they on their subsystems and so on, as well as its metasystem or environment.

- Keypoint: Sustainability can be seen as the ability of a system to sustain itself in relation to its internal and external environments, given that all systems are made up of subsystems and are parts of larger meta-systems.

So a system that either undermines the health of its own subsystems or of its meta-system can be said to be unsustainable.

Thus, a critically important aspect of this integrative pattern principle is the relation between systemic levels. As we have seen, in the discussion on Koestler's holons, it can be said that living systems display both integrative and self-assertive tendencies. In terms of sustainability, a sustainable state occurs when there is a dynamic balance between these tendencies within and between systemic levels. According to Gunderson and Holling (2002, 76), such a holarchic view affords insight on 'sustainable development':

> Sustainability is the capacity to create, test, and maintain adaptive capability. Development is the process of creating, testing and maintaining opportunity…sustainable development is not an oxymoron but represents a logical partnership.

But what can we can construe as a sustainable system? It is not as simple as some environmentalists seem to believe. Gunderson and Holling's book (2002) represents some of the latest thinking on sustainable systems and managing for sustainability, and much of the text underlines how new and tentative this thinking is. One theme that emerges is that we have a more sure idea of what constitutes an unsustainable, maladaptive system than a sustainable, adaptive one (Holling, Gunderson, Peterson 2002, 95). Unsustainable systems, are those which show:

- low connectedness

- low potential
- low resilience

at one end of the spectrum. These are said to be in a ‘poverty trap’ whereby their self-sustaining and adaptive abilities are compromised. Yet other systems are also unsustainable but for different reasons. These are systems which show:

- high connectedness
- high potential
- high resilience

These are said to be in a ‘rigidity trap’ such as some bureaucracies or organisations where resilience and stability is so high that the system is unable to adapt to changing conditions even when it needs to. One might suggest that the whole global economic system is in such a state, or even in both states at the same time. This ‘too little, too much’ spectrum appears to accord with the ideas of ‘edge of chaos’ from complexity theory. The first state perhaps, can be said to be one of ‘can’t adapt’, the second is one of ‘won’t adapt’. The first shows low resilience and too much integration into the greater whole, the second too much disconnection with the greater whole and individualistic autonomy. This perhaps gives us some insight as to the state of unsustainability in the world today - we seem to have a mix of system states that too often operate at either end of this spectrum, rather than the healthy, creative, adaptive systems at the ‘edge of chaos’ that suggest sustainability. (The ‘edge of chaos’ in relation to learning, management and sustainability is looked at in Parts C and D of the main Thesis.)

Wan Ho (1998, 231) sees the organism as an ‘ideal sustainable system’, and suggests that the organism should be seen as the pattern for human attempts to work towards sustainable systems. A healthy organism, she suggests, is “an irreducible whole, that develops, maintains and...renews itself, by mobilising material and energy captured from the environment”. She emphasises the need for “nested sub-cycles….the more there are and the better they are coupled, the longer the energy is stored within the system and the less is dissipated as entropy” (233). However, she suggests, our global money system is depleting our real wealth at local level and increasing entropic costs. It seems that a natural order, of high connectedness locally and low connectedness globally, is being reversed, and the whole system is highly vulnerable and unsustainable as a result. Another way of seeing it is as an imbalance between global integration (too strong) and local autonomy (too weak) - the whole is losing its

necessary parts, while the parts are losing their wholeness. This is prejudicial to the whole: as Holling, Carpenter *et al* point out (2002, 403), “sustainability is maintained by relationships among nested set of adaptive cycles arranged as a dynamic hierarchy in space and time”.

Such thinking suggests sustainability is about developing or maintaining *self-sustaining, adaptive abilities and wholeness at different systemic levels in the holarchy.* (Incidentally, Holling, Gunderson and Peterson, curiously, make no mention of holarchy but instead coin the neologism *‘panarchy’* to “capture the adaptive and evolutionary nature of adaptive cycles that are nested…across space and time scales” 2002, 74.) Thus any strategy for sustainability seems to involve appreciating and respecting what is already there, with developing and maintaining inherent creative potential, with assisting self-reliance, self-realisation, self-sustaining abililties and resilience. Bossel (1998, 294) sums up this perspective as the four ‘S’s: “sustainability, sufficiency, subsidiarity, and self-organisation”. Seen this way, it is possible to see connections between sustainability discourse and educational discourse: to see an integrative pattern of thought that connects ecologically sustainable development practice and an ecological view of education: that connects sustainability and learning.

Instead of an ethos of manipulation, control, and dependence, the ecological paradigm emphasises the value of 'capacity building', that is, facilitating and nurturing self-renewal and self-organisation in the individual and community as a necessary basis for 'systems health' and sustainability.

The insight that whole systems thinking affords us here is extremely useful and widely applicable. There is a dynamic principle here which applies differently but similarly to the way sustainability applies, say in relation to soil or wildlife management, or developing local economies, or trading relations with Southern countries, or children in the classroom. Such principles as diversity, relative autonomy, resilience, community, and integrity have an echo in both natural and human contexts. It is only a very short intellectual jump to see how long-held educational values such as differentiation, empowerment, self-worth, critical thinking, cooperation, creativity and participation are resonant with this systemic perspective.

What is emerging is an integrative theory linking human and natural systems in relation to sustainability: what I am calling here the ‘connective meta-pattern’. In sum, whole systems thinking and ecological sustainability give us bases for envisioning an applied

ecological paradigm in many fields, including health, education, economics, land management, architecture, organisational change, community regeneration, and many others. This brings us to the field of methodology and design, which is the next topic.

3.3 Doing - Sustainable development: design and management

This subsection is about the third domain of human knowing and experience, that is, how we should or might act in the light of our epistemological insights and knowledge arising from an ecological sensibility and orientation.

I am concerned with three interrelated aspects of methodology. I believe all three are mutually necessary to an holistic approach, and are relevant to the development of a sustainable education paradigm:

- ecological design (or sustainable design)
- adaptive management
- participative inquiry and learning.

The last aspect is discussed not here but in Part C, in the main Thesis.

Ecological design

The relatively new field of 'ecological design' is much more than natural landscaping: it is an emerging philosophy, theory and methodology which seeks both to fit 'human activity systems' within the limits of the ecosphere, and to use nature's patterns of organisation to design human machines, structures and organisations.

As argued above, the sustainability crisis is one of faulty *perception*, and of an incomplete *ontology,* but it is also one of inappropriate *design* (the three domains, again). As Van der Ryn and Cowan suggest, design manifests culture, and culture firmly rests on the foundations of what we believe to be true about the world (1996, 9). Thus design expresses epistemology, and, I would argue, a mechanistic epistemology is indeed manifested in human design in agriculture, land use, industry, organisational structures and so on. (It was Le Corbusier, for example, who expressed the view that houses are machines for people to live in.)

Change can happen in one of two ways, by *default* - where change happens to us, or by *design* - where change is intended (or both ways at the same time). Design in this sense then, equates to *purposeful intent.* Van der Ryn and Cowan (1996, 8) suggest that design is:

> the intentional shaping of matter, energy, and process to meet a perceived need or desire.

The sustainability problem arises, the authors suggest, because our patterns of agriculture, architecture, engineering and industry are "largely derived from design epistemologies that are incompatible with nature's own". This, the authors call 'dumb design' - standardised solutions, vastly replicated, which require huge amounts of energy and resources to implement. This is contrasted with 'ecological design' which is:

> Any form of design that minimizes environmentally destructive impacts by integrating itself with living processes.
> (1996, 18)

The term 'ecological design' (Todd and Todd 1994, Wann 1996, Van der Ryn and Cowan 1996, Zelov and Cousineau 1997) largely equates to 'sustainable design' (Papanek 1995) or 'regenerative design' (Lyle 1994).

Papanek notes the paradoxical challenge that this new aesthetic and ethic presents to designers: "to design things that will last, yet come apart easily to be recycled and renewed" (1995, 238) as opposed to (one might argue) things that are not sustainable but yet become lingering waste! This gives rise to an important distinction. Sustainable design and permanence is more about designing for elegance and conservation of regenerative ability, capacity and potential than preservation - more about persistence than monolithic perpetuity. This links perhaps with Whitehead's process view of the world - of events rather than things, and with 'edge of chaos' ideas where, paradoxically, a degree of redundancy is the price of creativity. I do not want to delve too deeply into the principles here of ecological design, but there is broad accordance between its proponents (Todd and Todd 1994, Wan 1996, Van der Ryn and Cowan 1996, Zelov and Cousineau 1997, Birkeland 2002) who seek to close the gap between human design and the design immanent in natural systems. For the sake of illustration, the Todd's ideas which they have developed in evolving 'living machines' (designed natural systems that meet human needs) are summarised below.

Box App. I. 1: Emerging precepts of ecological design

1. The living world is the matrix for all design
2. Design should follow, not oppose the laws of life

3. Biological equity must determine design (the just access and distribution of resources)
4. Design must reflect bioregionality
5. Projects should be based on renewable energy resources
6. Design should be sustainable through the integration of living systems
7. Design should be coevolutionary with the natural world
8. Building and design should help heal the planet
9. Design should follow a sacred ecology

From Eco-Cities to Living Machines, Nancy Jack Todd and John Todd, 1994

We think of 'design' as something we apply to material things like machines, tools, houses, and roads. But arguably, sustainability requires design in all areas and all levels. Inevitably, this extends the meaning and scope of ecological design*:*

> Our machines, our value systems, our educational systems will all have to be informed by this switch, from the machine age when we tried to design schools to be like factories, to an ecological age, when we want to design schools, and families and social institutions in terms of maintaining the quality of life not just for our species, but for the whole planet.
> (M C Bateson, in Zelov and Cousineau 1997, 84)

In relation to education, Banathy (1991) has written extensively on re-designing educational systems to meet current needs and the societal context, and Banathy's work is examined further in Part C.

In terms of systemic learning, ecological design may be seen as a corrective response - a correction strategy in response to the threat / opportunity of unsustainable / sustainable development. In terms of the autonomy / integration model (discussed in Part B.1.6), it may be seen as a realisation of the need for the integration of human systems into the matrix of the greater biophysical/ecological system.

From an ecological viewpoint, this corrective response needs to go far beyond making adjustments in existing systems (a first order learning response). This brings us back to the discussion on the need to replace our notion of 'controlling complex systems' with that of 'conscious participation'. The idea of control, that is, being able to predict, plan and control outcomes is replaced with design, management and reflexive learning

towards healthy emergence. Such work cannot be achieved through ‘command and control’ but through a reflective dialogic approach with the subject of concern or ‘problem’ . As Rapport (1998, 12) suggests:

> It is not control that is needed, but rather an understanding of these complex systems’ natural dynamics and a strategy that works with, rather than against these dynamics.

Or as Bossel (1998, 274) comments:

> Omniscient design of the sustainable society is not possible. The task is rather to determine and apply…principles which lead to self-organising evolution of sustainable human systems (of whatever shape) in a sustainable environment.

This is not a matter of imposing order but working with, or restoring, patterns of self-organisation through a co-evolutionary approach, where learning plays a central role. Instead of the convention of developing blueprints and faithfully implementing them whatever the consequences, ecological design is essentially an iterative learning process - and one which is particularly sensitive to the phenomenon of emergence. An ecological view recognises that all actions have consequences, and that emergent properties in a system might be (said to be) relatively healthy or unhealthy to the wellbeing of the whole. There are no ‘side-effects’, no ‘externalities’, no ‘by-products’ in ecological design, but evoked synergy and emergence. There is no optimisation or maximisation of single goals, but integration of multiple goals such as is demonstrated in sustainable agriculture or ecoarchitecture.

According to Papanek (1995,7) ecological design means our design questions need to change. We need to go beyond ‘how does it look?’ or ‘how does it work’ to the critical question, ‘how does it relate?’ - (a question which appears to me to subsume the first two). This of course is a question with temporal, spatial and dynamic aspects - and indeed ethical aspects - and this brings us to the idea of *adaptive management*.

Before looking at this, it is as well to be reminded that ecological design is in its relative infancy. As Kelly neatly suggests (1994, 3), while “the logic of Bios is being imported into machines” (and human systems through ecological design and biomimicry), “the logic of Technos is being imported into life” (1994, 3). While Kelly is sanguine about this and believes in the benefit of the growing congruence ‘of the made and the born’, I am unconvinced. Of these two trends, arguably the second, evidenced through bio- and genetic engineering, backed up by corporate interests and informed by a

mechanistic worldview and a reductionist science unable “to take account of complexity, interconnectedness and wholeness” (Ho 1998, iv) is the more powerful. It is also, in my view, antipathetic to whole systems thinking.

Adaptive management (and resilience)

The ideas of ecological design have clear implications for management, both of natural resources and of human systems. A starting point is to question the traditional division in Western epistemology between natural and social systems, and the separate schools of management theory that have grown up around this distinction. Thus Berkes and Folke’s important book *Linking Social and Ecological Systems* (1998) is based on the idea that the distinction is “artificial and arbitrary” (1998, 4). In most of human history, they suggest, this distinction has not been reflected in ‘traditional ecological knowledge’ systems (TEK) that have always seen humans as part of nature. Gunderson and Holling’s more recent book on *Understanding Transformations in Human and Natural Systems* (2002) takes the view that human and natural systems are different but closely coupled. This requires a theory of what they and others (Berkes and Folke 1998, Carley and Christie 2000) call ‘adaptive management’ or ‘integrated management’ which recognises that “the wellbeing of social and ecological systems is closely linked”(Berkes and Folke 1998, 21).

In the face of complexity and uncertainty, this model of management (that is now emerging) is concerned with “the unpredictable interactions between people and ecosystems as they evolve together” (Berkes and Folke 1998, 10). This differs from conventional management because it emphasises iterative learning in response to feedback, and does not share conventional assumptions of “controllable nature, predictable yields, and exclusion of environmental perturbations” (1998, 21). So at a more profound level, adaptive management represents a break from conventional methodologies associated with Western resource management science which emphasises the role of the expert, universally applicable and decontextualised knowledge, and control. In other words, adaptive management appears to be a different management paradigm. As such, it represents a considerable challenge. According to Pritchard and Sanderson (2002, 163), most bureaucratic management is currently focussed mainly on ‘problem-solving’ - on how to reduce uncertainty. If management is to be adaptive they say, “it should be focussed on how to handle irreducible uncertainty…test hypotheses about system function and resilience…and maintain the productive capacity of the ecosystem” or organisation. Part of the solution they suggest, is to move towards “participatory adaptive management”.

At this point, I want to look further at why this adaptive approach is necessary, and to do this, I will look at the 'big picture'. The ecological viewpoint affords a systemic view of sustainability, whereby it is possible to discern patterns in the effect of the whole modernity project on the world. This may be making big claims, but thinking holistically, we need to consider the effects of the whole system - the dominant worldview and its associated economic system, management approaches *etc*, - on social/economic/ecological sustainability.

In general, if we take the key annual reports on the status of sustainability such as those from the Worldwatch Institute, the World Resources Institute, or WWF, a pattern seems to emerge which has broad application - as regards local economies, communities, landscapes, and ecosystems. From a systems reading, the following trends commonly appear to be in evidence, particularly at local level:

- reduction of diversity (e.g. cultural, biological)
- increase in incidence of negative 'surprise' (inadvertent unhealthy emergence)
- reduction in self-organising and self-renewing abilities
- increase in dependence on exogenous support and inputs
- reduction in closed coupling and local cycles, and in systemic integrity
- lower connectedness at local level, and increased but disparate connectedness between distant and local level
- erosion of readable signals/feedback, and
- reduction in resilience and increase in vulnerability.

Thus Chambers (1996, 173-179) argues that the "normal paradigm tends towards global homogenisation through the interlocking effects of the market, communications, technology and professionalism" and argues for 'paradigm reversal' towards the 'three D's' of decentralisation, democracy and diversity.

In sum, Western development patterns are tending to reduce sustainability in local ecological/social systems. The global elite's belief that the global ecosystem can be rationally managed (Sachs calls this elite the "ecocracy") tends to aggravate this problem (Sachs 1999). (Similarly, Togerson 1998, 110 notes that what he calls 'the administrative mind' with its emphasis on rationalism and fragmentation is "itself an environmental problem".)

A critical idea here is *resilience* - how it can be eroded and how it can be enhanced. But it is important here to define resilience and stability, because there are two very different interpretations in scientific ecological literature, associated with different views of science, and different methodologies. Berkes and Folke (1998, 12), and Gunderson and Holling (2002, 28) make the following distinction:

- *engineering resilience*: concentrates on stability near a presumed steady state, resistance to disturbance and speed of return to equilibrium state. The focus is on efficiency, control, constancy, and predictability. It is appropriate where uncertainty is low, but inappropriate for dynamic and evolving systems. This is the conventional cause-effect view of predictive science. In resource management, it leads to assumptions about maximum yield, relatively fixed carrying capacity and the possibility of predictive management. (This is the ecocracy's view.)
- *ecosystem resilience:* emphasises conditions far from any equilibrium steady state, where disturbances can flip a system from one state to another. Here, the measure of resilience is the scale of disturbance that can be absorbed before the system changes structure. The focus on persistence, adaptiveness, variability, and unpredictability. This is "a fundamentally different view of science" (Berkes and Folke 1998, 12) where systems are seen to be complex, non-linear, multi-equilibrium and self-organising. (This links with 'edge of chaos' ideas on management, which are looked at in Part C.)

The former approach is frequent and ubiquitous, and reflected in fragmented approaches to environmental management that derive from models from economics, engineering, human health, and ecology, "with little attention being paid to the pressing need for integration" and resultant "simplistic solutions that are generally based on the belief that all powerful technologies can deal with the problems after they have occurred" (Rapport 1998, 9).

These two views of resilience remind me of the distinction between 'difficulties' and 'messes' (Ackoff 1980) and the qualitative difference between hard systems and soft systems approaches, and indeed between mechanism and organicism looked at earlier in this Thesis. Thus, what is at stake here is the appropriateness and adequacy of worldview, and indeed by association, a new understanding of science, of management and of politics.

Gunderson and Holling argue that worldviews - as 'representations of reality' - are valuable because temporarily they offer sufficient certitude to allow action, but often their "partial nature ultimately exposes their inadequacy" (2002, 10). Consistent with the argument of this Thesis, these authors make the case for a dynamic, evolutionary and adaptive view of nature which they call 'Nature Evolving', and they point to complexity theory and interest in non-linear systems and self-organisation as evidence of the emergence of this view. This is contrasted with what they see as the more static views of nature that often prevail: four are identified and labelled as 'Nature Flat' (no feedbacks recognised, no real limitations to human activity given human ingenuity), 'Nature Balanced' (nature forgiving and existing at or near equilibrium, maximum sustainable yield can be identified), 'Nature Anarchic' (nature is fundamentally destabilised and therefore minimal demands must be made), 'Nature Resilient' (multiple states of stability and seemingly able to cope with human activity). All of these views are, in their words, "not wrong - just incomplete". As I have argued all along, what we need is a more *adequate* worldview.

As regards methodology, Gunderson and Holling state (2002, 28):

- Keypoint: "sustainable relationships between people and nature require an emphasis on the second definition" of resilience and suggest that this shifts the emphasis in management and policy from command and control to modes that allow or build capacity for adaptation in systems.

Thus, they state, "the challenge is to conserve the ability to adapt to change, to be able to respond in a flexible way to uncertainty and surprises…maintaining options in order to buffer disturbance and create novelty" (32). Hence, perhaps, the movement towards localisation as a response to globalisation. By increasing resilience and integrity at local level, it improves the local system's ability to respond to and adapt to feedback.

The difference between the ecological and mechanistic approaches elaborated by Gunderson and Holling as regards management and sustainability might be summarised in the following table which I have devised to indicate the key shifts of 'extension, integration, and connection' reviewed in section 2 above.

Table App.I.6: Differences between mechanistic and ecological modes of thinking

Ecological mode of thinking	Mechanistic mode of thinking	Negative effects of mechanistic mode	Appropriate shift involves
Relatively open system	Relatively closed system	Conceptual boundaries (closed where should be more open)	EXTENSION
Integrative	Dis-integrative, fragmentary	Disintegration of local systems / subsystems (opened where relative closure/autonomy should be maintained)	INTEGRATION
Located/rooted	Dis-located, decontextualised	Dislocation. Loss of diversity and resilience	CONNECTION

However, it is clear is that there are no blueprints, no set strategies and no templates. But if there are no directives, there *are* directions (O'Riordan and Voisey 1998, xv), and I would argue that those who contend that sustainability is so vague that we can do nothing, misunderstand the nature of the problem/opportunity. It is worth summarising here Berkes and Folke's (1998, 429-430) general principles and patterns for building resilience and sustainability:

- using management practices based on local ecological knowledge
- designing management systems that 'flow with nature'
- developing local ecological knowledge for understanding cycles of natural and unpredictable events
- enhancing social mechanisms for building resilience
- promoting conditions for self-organisation and institutional learning
- re-discovering adaptive management, and
- developing values consistent with resilient and sustainable social-ecological systems.

The recent - and current - research and thinking from which such principles are developed imply radical re-thinking of many norms in many sectors and at many levels of scale from local to global. Such thinking then, is profoundly significant in my view. It appears to lend legitimacy, rigour and validity to the alternative and oppositional arguments and discourse that has surfaced in recent years, for example in economics, development, and community regeneration, (see, for example, Goldsmith 1992, Sachs *et al.* 1998, Sachs 1999). Rich's (1994,287) assertion is perhaps representative of this line of argument:

> …increasing humankind's freedom entails conserving different futures; it means living and working in the present in such a way as to conserve and create as many future options as possible….Making possible different futures… must start with, must be based on, the conservation and enhancement of existing natural and social diversity…Moreover, the existence of self-organizing capacities in human societies (at different, interconnected levels from the local to the regional, national and international) implies the possibility of an alternative global order - or rather, set of orders - to the one based exclusively on centralized nation-states, multilateral organizations like the World Bank, and transnational corporations.

Adaptive management emphasises the participative nature of living (as opposed to the detachment of the rational manager); it is a co-evolutionary view emphasising the importance of continuous learning, of appreciation, and of multiple perspectives. This brings us to the third aspect of ecological methodology, which is inquiry and learning. This is of course, key to the whole Thesis, and looked at in Part D of the main Thesis.

3.4 The whole systems thinker

To end this **Appendix I**, I employ the triadic model again, to look at some characteristics of whole systems thinking, not so much in terms of assumptions and values, as general outlook. Box App.I.2 below is such a summary, based on a number of sources and my own interpretation. It is organised roughly according to the three domains of knowing and experience outlined in the model above and suggests not just 'a way of thinking' but more deeply, a way of being. The validity of this outline is perhaps affirmed by considering the prevalence of its opposite in society and discourse.

Box App.I.2: Some qualities of the whole systems thinker

Systems thinkers tend to:

Seeing

- try to recognise their own assumptions, beliefs and influences at all levels from deep to immediate
- value multiple perspectives
- look at the bigger picture (spatially, temporally, culturally)
- be concerned with systems health (whole systems)
- be open-minded: their thinking is a relatively 'open system'
- appreciate what *is*, before thinking what might be

Knowing

- look for connections and patterns
- have a keen sense of emergence and relationship
- look for multiple influences and feedbacks rather than linear 'cause-effect' relations
- be wary of narrow, simplistic, 'obvious' or majority explanations in the face of complexity
- recognise and are comfortable with uncertainty, ambiguity and 'mess'

Doing

- look at 'relationships' and 'purpose' first rather than blame components of a system
- suspend judgement
- ask different questions (deeper, more inclusive)
- be critical and synthesising
- work for self-organisation, capacity and healthy emergence
- have most regard for the local, the human-scale, the bottom of the system
- anticipate consequences, and ask 'what then?'
- be critically reflexive learners

Similarly, in a paper on 'Whole Earth Models and Systems' Meadows (1982a) suggested how policies would look if they were consistent with a systems view of the world, and it is worth including here. They would be:

- *Respectful* - designed to assist and encourage the system to run itself, rather than impose from the 'outside'
- *Responsible* - for what happens rather than trying to blame outside influences
- *Experimental* - recognising that nature is complex beyond our ability to understand, and that therefore careful experiment is required, rather than undeviating directives
- *Attentive* - to the system as a whole, and to total system properties, rather than trying to maximise the performance of parts
- *Mindful* - of the long term, recognising that actions taken now might have effects for decades to come
- *Comprehensive* - recognising that no part of the human race is really separate from any other part or from the global ecosystem. We all fall or rise together.

  (based on Meadows 1982a, 108)

Further, Flood's (1999, 192) main conclusion from his review of systems thinking is the need for humility: "an awakening to the realisation that really we don't know very much about anything and actually never will".

Such dispositions suggest the (necessarily complementary) 'inner' and 'outer' dimensions of whole systems thinking, the bases of which I have attempted to explore in this **Appendix I**.

4 SUMMARY OF APPENDIX I

In this major Appendix to the Thesis, I have sought to:

- elaborate some of the intellectual and historical bases which inform the substance, nature, and case for whole systems thinking
- further develop the triadic model of paradigm, knowing and experience (Seeing, Knowing, Doing) to help clarify the dimensions of paradigm change, in parallel with the model of staged learning levels introduced in the main Thesis.
- Use 'Seeing, Knowing and Doing' to organise a discussion of the application and implication of whole systems thinking in relation to sustainability.

APPENDIX II (FOOTNOTES AND DIAGRAMS)

N. B. Diagrams, boxes and tables are shown under the relevant Part / Section / Subsection headings, and are numbered and cross-referenced in the main text.

PART A

1 RATIONALE

1.1 The focus and scope of the inquiry

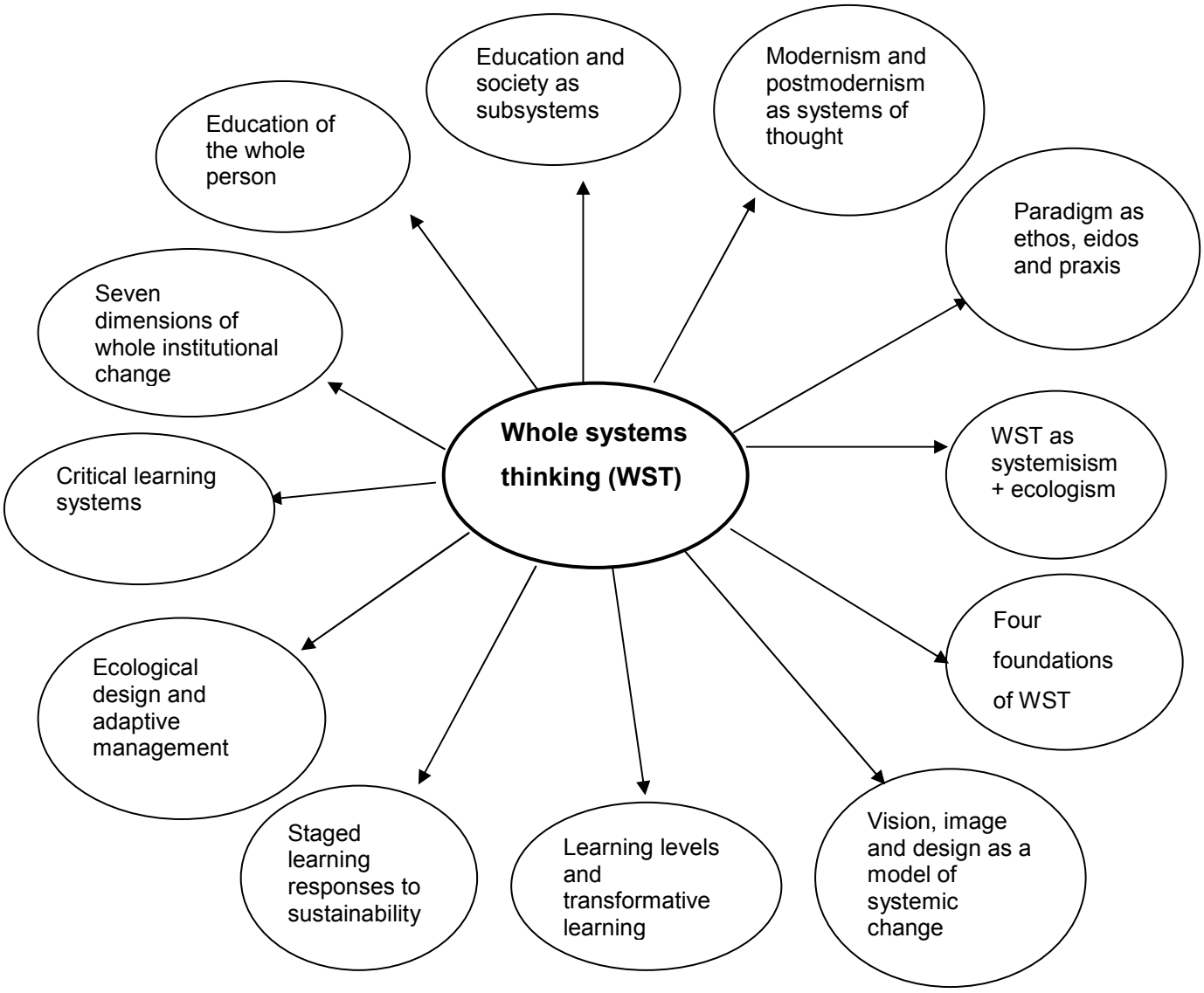


Diagram A.1 (b) The use of whole systems thinking to explore interrelated subtopics in the Thesis

PART B

1 THE EMERGENCE OF THE POSTMODERN ECOLOGICAL WORLDVIEW

1.6 The postmodern ecological worldview – looking at essential ideas

1.7 Evidence of the postmodern ecological worldview in cultural change

B.2.1 Evolutionary change in systems thinking

Diagram B.4 Traditions of systems thinking

Ison, R. Maiteny, P. and Carr, S. (1997), 'Systems Methodologies for Sustainable Natural Resources Research and Development', *Agricultural Systems,* vol 55, no 2, Elsevier, 257-272.

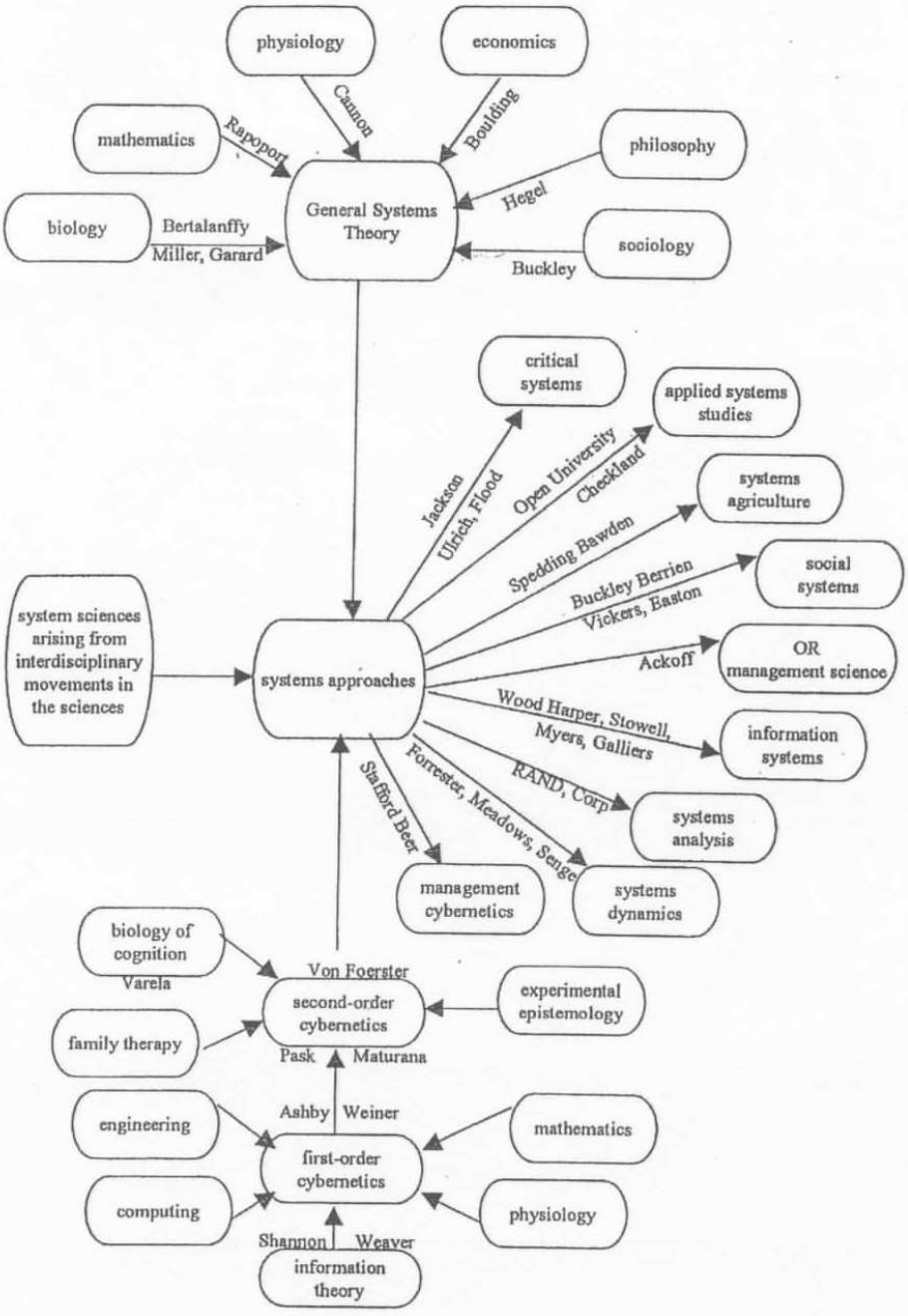


Figure 2. A spray diagram mapping some of the different influences within systems scholarship that have given rise to a range of systems approaches for managing complexity, and some key researchers associated with these influences. (Adpated from Ison, Carr & Maiteny 1997).

PART C

1 THE EDUCATION PARADIGM DISCOURSE

1.1 Educational paradigm: modelling, maintenance and movement discourse

Viable systems

A systems perspective on sustainability looks at certain qualities in a system. These checklists are based on Ravetz (2000, 17-18) and Bossel (1998, 99).

- *viability* – does it work?

Does it show self-organising behaviour?
Is it resilient to short-term change in its environment?
Does it effectively use a throughput of resources to maintain itself?

- *integrity* – is it a recognisable, integrated whole?

Does it maintain itself through feedback loops and communication?
Is it compatible with the viability of its subsystems (internal coexistence)?

- *longevity* – has it lasted? Is it likely to last? How does it relate?

Can it change, adapt and innovate in relation to a changing environment over time? (external coexistence)
Is it compatible with the viability of the larger systems within which it exists (its environment)?

OR:

- *robustness and resilience* – how far it can retain stability in the face of change
- *effectiveness* – using energy and resources effectively in maintaining itself
- *adaptability and innovation* – how far it can adapt to long-term changes in its environment
- *co-existence* – with its subsystems and with its larger environment

2 EVIDENCE OF AND ARGUMENTS FOR A MORE SYSTEMIC EDUCATIONAL PARADIGM

2.3 The ecological education paradigm

Box C.3: One image of sustainable education

Here is my image of 'sustainable education', drawn at very general level. It is an elaboration of the three-part model discussed in Part D in relation to education.

Sustainable education is:

Extended…
Appreciative – aware of the uniqueness and potential of each individual and group, of the qualities of any locality and environment, and sees personal and local knowledge as foundational to learning.
Ethical – extends the boundaries of care and concern from the personal and the present, to the social, environmental, non-human, and future dimensions.
Innovative – draws inspiration from new thinking and practice in a variety of fields, relating to education, learning and aspects of sustainable development.
Holistic – relates to the learning needs of the 'whole person' (including spiritual and emotional), of differentiated individuals and groups, and to the range of human intelligence.
Epistemic – aware of its own worldview and value bases, which are critically examined and reviewed. Second, and even third, order learning is facilitated.
Future oriented – concerned with creating a better future, from now on.
Purposeful – critically nurtures sustainability values with the intention to assist healthy change.

Connective…
Contextual – in touch with the real world, particularly sustainability issues, and grounded in the locality.
Re-focused – particularly on social development, human and natural ecology, equity, futures, and practical skills for sustainable living.
Critical – ideologically aware, deconstructive and constructive.
Systemic – pays attention to systemic awareness of relationships, flows, feedbacks, and pattern in the world.
Relational – connects patterns of change: local-global, past-present-future, personal-social, environmental-economic, human-natural, micro-macro etc.

Pluralistic – values different ways of knowing, and multiple perspectives.
Multi and transdisciplinary – regards disciplinary borders as fuzzy and puts greater emphasis on new ways of seeing complex issues.

Integrative…

Process oriented – constructs meaning through an engaged and participative learning process, reflecting different learning styles. Everyone is a learner, including the teacher/leader.
Balancing – embraces cognitive and affective, objective and subjective, material and spiritual, personal and collective, mind and body etc.

Inclusive – for all persons, in all areas of life and extending throughout their lifetimes.
Synergetic – deeply aware of emergence, and designs curriculum, organisation and management, culture to be mutually enhancing. Energy, material, and money flows are organised on sustainability principles and are reflected in the whole curriculum.
Open and inquiring – encourages curiosity, imagination, enthusiasm, innovation, creativity, community, spirit, to arise. At ease with ambiguity, and uncertainty.
Diverse – allows for variety, innovation and difference of provision and ways of knowing within a coherent framework.
A learning community – institutions promote learning through themselves engaging in reflexive learning (learning organisation).
Self-organising – balancing autonomy and integration through different system levels and practising subsidiarity and democracy.

Such an education and learning situation would be intrinsically transformational, of itself and of its community members, and would have systemic coherence.

From Sterling, S (2001) *Sustainable Education – Re-visioning Learning and Change,* Green Books, Dartington, 84-85.

Table C.3: Summarising the contrasting paradigms

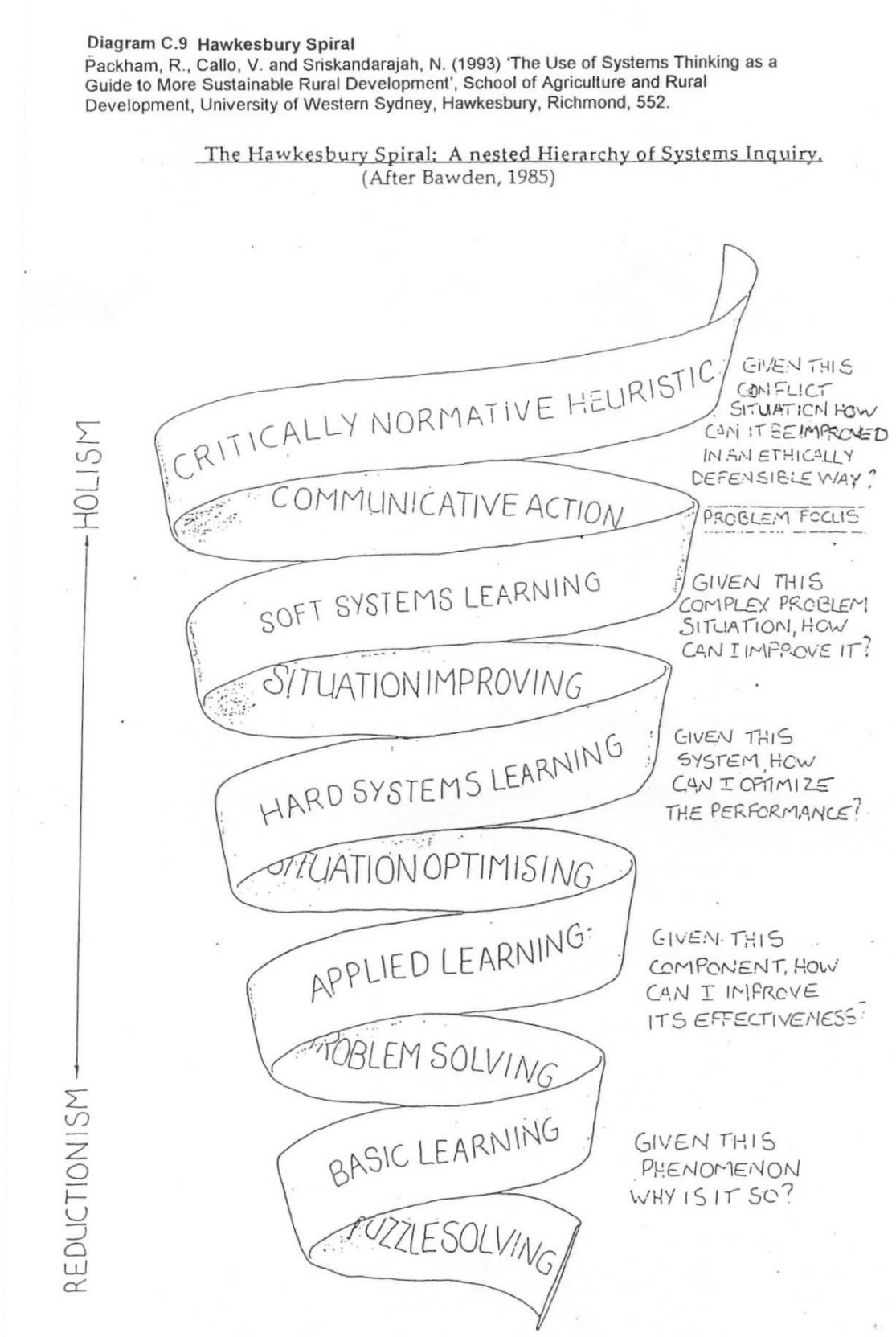
MECHANISTIC VIEW	ECOLOGICAL VIEW
LEVEL 1: EDUCATIONAL PARADIGM	
Core Values	
• Preparation for economic life	• Participation in all dimensions of the sustainability transition – social, economic, environmental
• Selection or exclusion	• Inclusion and valuing of all people
• Formal education	• Learning throughout life
• Knowing as instrumental value	• Being/becoming (intrinsic/instrumental values)
• Competition	• Cooperation, collaboration
• Specialisation	• Integrative understanding
• Socialisation, integrating to fit	• Autonomy-in-relation
• Developing institutional profiles	• Developing learning communities
• Effective learning	• Transformative learning
• Standardisation	• Diversity with coherence
• Accountability	• Responsibility
• Faith in 'the system'	• Faith in people
• Modernity	• Ecological sustainability
LEVEL 2: ORGANISATION AND MANAGEMENT OF THE LEARNING ENVIRONMENT	
Curriculum	
• Prescription	• Negotiation and consent
• Detailed and largely closed	• Indicative, open, responsive
• Discursive knowledge	• Non-discursive knowledge also valued
• Decontextualised and abstract knowledge	• More emphasis on local, personal, applied and first-hand knowledge
• Fixed knowledge and 'truth'	• Provisional knowledge recognising uncertainty and approximation
• Confusion of 'data', 'information' and 'knowledge'	• Ultimate concern with wisdom
• Disciplines and defence of borders	• Greater transdisciplinarity/ domains of interest
• Specialism	• Generalism and flexibility
Evaluation and assessment	
• External inspection	• Self-evaluation, plus critical support
• External indicators, narrowly prescribed	• Self-generated indicators, broadly drawn
• Quantitative measures	• Qualitative as well as quantitative measures
Management	
• Curriculum control and prescription	• Curriculum empowerment and determination
• Top-down control	• Democratic and participative
• Architecture, energy and resource use, and institutional grounds neither managed ecologically nor seen as part of the educational experience	• Ecological management, linked to educational curriculum and experience

• Scale not considered	• Human scale structures and learning situations
• Synergies and emergence not considered	• Positive synergies sought
Community	
• Few or nominal links	• Fuzzy borders: local community increasingly part of the learning community
LEVEL 3: LEARNING AND PEDAGOGY	
View of teaching and learning	
• Transmission	• Transformation
• Product oriented	• Process, development and action oriented
• Emphasis on teaching	• Integrative view: teachers also learners, learners also teachers
• Functional competence	• Functional, critical and creative competencies valued
View of learner	
• As a cognitive being	• As a whole person with full range of needs and capacities
• Deficiency model	• Existing knowledge, beliefs and feelings valued
• Learners largely undifferentiated	• Differentiated needs recognised
• Valuing intellect	• Intellect, intuition, and capability valued
• Logical and linguistic intelligence	• Multiple intelligences
• Teachers as technicians	• Teachers as reflective practicioners and change agents
• Learners as individuals	• Groups, organisations and communities also learn
Teaching and learning styles	
• Cognitive experience	• Also affective, spiritual, manual and physical experience
• Passive instruction	• Active learning styles
• Non-critical inquiry	• Critical and creative inquiry
• Analytical and individual inquiry	• Appreciative and cooperative inquiry
• Restricted range of methods	• Wide range of methods and tools
View of learning	
• Simple learning (first order)	• Also critical and epistemic (second/third order)
• Non-reflexive, causal	• Reflexive, iterative
• Meaning is given	• Meaning is constructed and negotiated
• Needs to be effective	• Needs to be meaningful first
• No sense of emergence in the learning environment/system	• Strong sense of emergence in the learning environment/system

From Sterling, S (2001) *Sustainable Education – Re-visioning Learning and Change,* Green Books, Dartington, 58-59.

2.4 Transformative learning, systemic change and sustainability

Diagram C.9 Hawkesbury Spiral
Packham, R., Callo, V. and Sriskandarajah, N. (1993) 'The Use of Systems Thinking as a Guide to More Sustainable Rural Development', School of Agriculture and Rural Development, University of Western Sydney, Hawkesbury, Richmond, 552.



Box C.7: Case Study – Schumacher College, Dartington

In 2002, I conducted an evaluation of the learning environment and effects of Schumacher College, the privately run 'international centre for ecological studies', at Dartington (Sterling and Baines, 2002). There is good deal I could say about the College, but space is an issue and my main interest here is to outline some of the characteristics of the College which appear to contribute to its unusual reputation for providing deep learning experiences for a significant proportion of its participants. In my view, it is an excellent and very rare example of a learning institution that has intentionally sought and designed its own systemic development in order to offer a systemic development learning experience (to adapt Bawden's phrase). In many aspects, it is the opposite end of the spectrum from most mainstream institutions. Whilst the latter are often characterised by *systematic* management and organisation including top-down control, explicit rules, defined structures and areas of responsibility, and a degree of rigidity, Schumacher College demonstrates a high degree of *systemicity* that is, internal connection, relatedness and coherence which is in many ways the key to understanding its operation and distinctiveness. In some respects – and this was part of our critique – the College has taken this operational systemicity too far, evidenced by a lack of clarity and inconsistency at times.

However, and in contrast to the mainstream, the aims and objectives of the education programme and of the individual courses are less tightly defined, subject to change and evolution depending on how a course evolves, not spelt out at the detailed level of course aims and learning outcomes, and where expressed, relate to levels of personal change and long-term change in the wider world. Further, the College's ethos and operating principles are based on a partly implicit philosophy of holism, ecologism and systemisism, where 'everything relates to everything else'. There is a fine and dynamic balance between explicitness and implicitness, autonomy of the part and integration within the whole, structure and spontaneity, and healthy emergence and synergy is inherent to the mode of operation.

In this situation, transformative learning is more likely, often reported (including in feedback to our questionnaires), but not of course, guaranteed. Part of our evaluation sought to understand how and why this took place. Without going into too much detail, it is clear that the College often provides an intense, engaged learning experience, where the teacher/learner distinction breaks down and a particular learning community emerges. There is a systemically coherent total learning environment that both

challenges *and* values/provides security for people and their beliefs, and further, works at different levels of consciousness and of knowing. Participants are challenged to look at their thinking, beliefs and actions and are offered new frameworks for thought. For many this is an extension and an affirmation, rather than a shift of fundamental thinking, depending on how 'ecological' their starting point is. For others, a more profound and sometimes unsettling shift is reported.

In brief, Schumacher College has evolved a 'learning system' which can, and often does, facilitate epistemic (or transformative) learning. This learning environment is characterised by its fluidity, integration, multidimensionality, intensity, ethical integrity, caring and synergy.

Rather like Hawkesbury, there was a strong element of design founded upon an expressed ethos in the development of the College, but from the early days, a systemic quality of learning has been intrinsic to the evolution of the 'learning system' that the College became over time. However, there was very little systemic learning theory involved in its development – rather this evolved from a set of guiding principles which reflected its ethos. Its director, Anne Phillips (1999) set out the College's values and principles which may be summarised as:

- reflective learning for individuals and the institution
- cooperation
- shared purpose
- the enjoyment of learning
- service and creating opportunity for service
- treading lightly and living simply
- the intrinsic value of work of all kinds
- celebrating diversity
- living with ambiguity
- a good experience for everyone
- self-regulation within a framework rather than coercion
- recognising limitations, and
- a spirit of rigorous inquiry.

This comprises a management ethos which is key to understanding the College. The principles interact in practice and achieve a synergy which gives rise to the ambience or spirit of the College which, in a positive sense, 'infects' everything - including in most cases, the participants. In essence, it is an ethos of caring, of goodwill, and particularly of trust. In short, transformative learning arises in conditions whereby the College's environment and operation is 'curriculum as lived experience', rather than a backdrop

to formal instruction. A summary of 'defining characteristics' of the College's learning environment are included below.

The defining features of Schumacher College

Human scale - a maximum of 25 participants on any course, so that the College retains an atmosphere of conviviality; also human scale architecture and site.
Inclusion – 'everybody does everything'. This means first, that all staff and resident helpers are involved in day-to-day running of the College. Second, that all members of the College – staff, helpers and participants – partake in daily duties maintaining the College, including cleaning, tidying and cooking in an expression of common service.
Ephemeral but intense learning community – the conditions encourage the emergence of a strong sense of learning community amongst participants, which is the more so as everybody knows it will soon disperse.
Unity in diversity – often, experienced people make up the participants, who are ecologically oriented but have diverse interests and backgrounds within that orientation.
Good food – high quality but simple vegetarian food, mostly locally sourced and mostly prepared on-site. This is a central part of the College's ethos.
Ecological principles - as far as possible operating according to ecological principles with regard to resource use and making this part of the everyday curriculum
Exploration - open-ended enquiry rather than working towards prescriptive 'learning outcomes'
Focus - only one short course running at any one time, resulting in a particular ambience and learning community in residence
Variety - in the working day, with most intellectual input in the mornings, and more opportunity for negotiated activities in the afternoons and evenings.
Aesthetics – a pleasing and atmospheric environment and location.
Emergence – no one attempts to know or control what might emerge from the dynamics of any particular group or course
These interact synergistically to produce the ambience and learning situation.
From Sterling S and Baines J, 2002.

3 CHANGE AND MANAGEMENT

3.1 Theory of systemic management and change

ESSENTIAL MANAGEMENT DIFFERENCES BETWEEN MECHANISTIC AND ECOLOGICAL MODELS OF EDUCATION

MECHANISTIC MANAGEMENT	ECOLOGICAL MANAGEMENT
STYLE OF MANAGEMENT	
• Goal oriented	• Direction oriented
• Product oriented	• Process oriented
• Controlling change	• Facilitating change
• Focus on single variables and parts	• Focus on sets of relations and the whole
• Aware of causal relationships	• Aware of emergence
• Power-based hierarchy	• Leadership and self-management at all levels
• Command and control	• Democratic and participative
• Vertical structures	• Flatter and integrated structures
• Intervention from 'outside' system	• Working with and from inside system
• Interested in prediction	• Interested in possibility
• Problem solving	• Problem reframing and situation improvement
• Adaptive learning	• Adaptive, critical and creative learning
• External evaluation	• Self-evaluation with support
• Quantitative indicators	• Qualitative and quantitative indicators
• Planning	• Design
• Closed	• Open
Effects on system (tend to be)	
• Standardisation	• Diversity and innovation
• Homogenisation	• Heterogeniety but coherence
• Dependency	• Autonomy-in-relation at all levels
• Externally directed	• Self-organisation
• Dysfunctional emergent properties	• Healthy emergent properties
• Poor ability to respond to change	• Flexibility and responsiveness
• Unsustainability	• Greater sustainability

From Sterling, S (2001) *Sustainable Education – Re-visioning Learning and Change,* Green Books, Dartington, 47.