PART A – INTRODUCTION

Purpose: to outline the rationale of the research, state the research questions, discuss methodology and research problems, introduce the field, and summarise the 'findings'.

Introduction

Part A is the foundation of the rest of the Thesis. In section 1, I outline the rationale, focus and scope of the research, and introduce the main foci - being the *postmodern ecological worldview*, *whole systems thinking,* and paradigm debate within *education as a whole*, and in *environmental and sustainability education*. The research questions are then outlined. In section 2, issues of methodology and validity are discussed including the assumptions I bring to the inquiry, and my thinking behind the organisation of the Thesis is outlined. In section 3, I introduce some key concepts and models employed in the Thesis, and then an introduction to the field of inquiry is presented. Part A finishes with a summary of key propositions arising from or confirmed by the research inquiry.

Setting the scene

The following quotations indicate my assumptions and the territory to be explored…

'No problem can be solved from the same consciousness that created it. We have to learn to see the world anew.'
- Einstein (in Banathy 1995)

'The fundamental challenge of sustainability goes far beyond that of environmentalism. The question is whether we can fulfil our unique potential as human beings, to understand our behaviour and its consequences. To do this, we must be prepared to discard our prejudices, and to review every area of human life. We must transcend the current limitations on our thinking if we are to become aware and rational beings in a way that no other species has ever had to do or been able to do before.'
- Clayton and Radcliffe (1996)

'The world partly becomes - comes to be - how it is imagined.'
- Bateson (1980)

'There is nothing either good or bad, but thinking makes it so.'
- Shakespeare (Hamlet, II, ii)

'The volume of education has increased and continues to increase, yet so do pollution, exhaustion of resources, and the dangers of ecological catastrophe. If still more education is to save us, it would have to be education of a different kind: an education that takes us into the depth of things.'
-   E F Schumacher (written 1974, published 1997)

'The development of ecological understanding is not simply another subject to be learnt but a fundamental change in the way we view the world.'
- John Lyle, 1994

1 RATIONALE

1.1 The focus and scope of the research

What is the nature of the change of consciousness that appears necessary to the achievement of a more ecologically sustainable society? What changes may be required in the way we view and practise learning and education if they are to contribute fundamentally to such a change of consciousness? What is the nature and basis of whole systems thinking and what is its relation to an emerging ecological worldview? Is whole systems thinking a key to paradigm change in education and wider society? These are the broad themes of this Thesis which underlie the more tightly focussed research question, with which this doctoral work first began:

> 'How might whole systems thinking assist the revisioning of (environmental)
> education in the light of an emergent postmodern ecological worldview?'

These questions emerged from some thirty years involvement in the field of environmental and sustainability education, as summarised above in the Preamble. From this experience, I have come to believe that the interlocking global crises of unsustainability require a far more fundamental social learning and educational response than environmental education, as a largely marginalised and contained body of thought and practice, has yet been able to effect. So while my focus begins with environmental education because this is my field, my main question (indented above) implies the need for a deeper and more extensive inquiry concerning education as a

whole - hence 'environmental' is shown in parentheses. This deeper inquiry is suggested in the opening questions above.

I intend to look at the issues through taking a systemic perspective: looking for 'the big picture' first, rather than the detail, the whole rather than just the part. Systems thinking argues that "valid knowledge and meaningful understanding comes from building up whole pictures of phenomenon, not by breaking them into parts" (Flood 2001, 133). Thus, in considering the issues raised, I settled on five interrelated dimensions of inquiry, as follows (see Diagram A.1(a) below).

1. the nature of what appears to be)an emerging *postmodern ecological worldview,* challenging mechanism and modernism and also going beyond postmodern deconstructionism (the main focus of Part B);
2. the nature of *whole systems thinking* (introduced in Part B and elaborated in **Appendix I**);
3. implications of 1) and 2) for change of dominant *educational paradigm* (the main focus of Part C);
4. the revisioning of *environmental (EE) and sustainability education (SE),* togethe*r* seen as a subsystem of education as a whole. (Part D);
5. the nature of *sustainability*, which provides an integrative context for these areas of study, and is considered as a recurrent theme in the Thesis.

Diagram A.1 (a): The five dimensions of inquiry
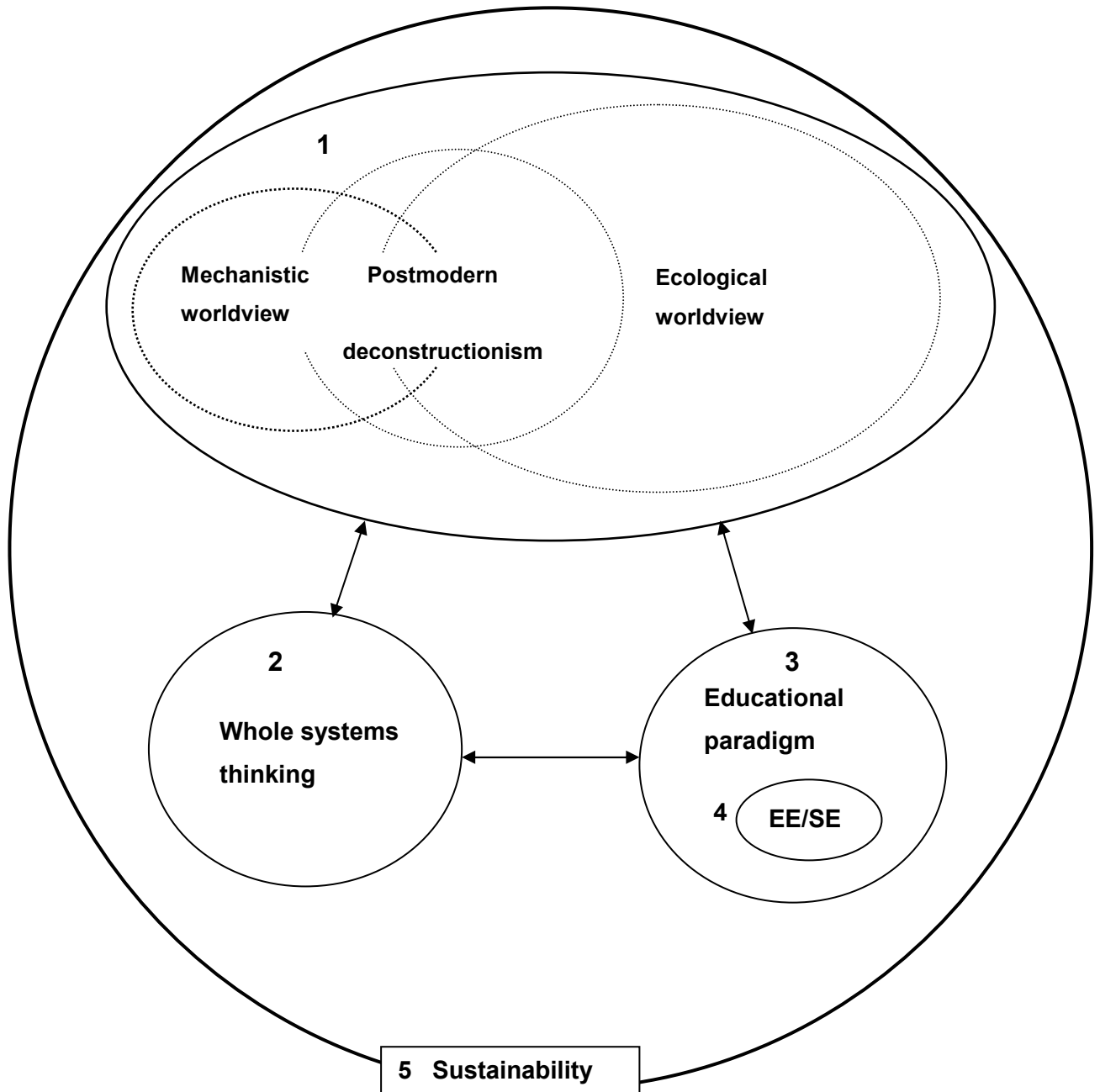
In what follows, I have taken a 'systems view' of the subject matter, and have employed systems ideas and models to analyse and synthesise concepts. Thus, the first four main foci are explored in contextual relation as a set of encompassing '*nesting systems'*, i.e. systems of ideas. I believe this to be a clear and helpful way of

suggesting their relationship. Hence, the emergence of the *postmodern ecological worldview* is the context for the emergence of what I am calling here '*whole systems thinking'*, which in turn has implications for *educational paradigm change,* which in turn sets a context for change in *environmental and sustainability education.* It is important to note that my reference to 'education' and 'education system' refers mainly to all levels of formal education, as this is the field of my experience, although I also refer in the Thesis to non-formal and community education where appropriate. As I am concerned with designed or intentioned educational experience, I am not including informal education which is usually seen as referring to incidental learning experiences. Following this introductory Part A, each focus provides the basis of a subsequent Part of the Thesis. The more detailed elaboration of whole systems thinking is located in **Appendix I** for reasons of economy of space. The idea of nesting systems is dealt with in more detail in A.2.2 below - see 'Use of models'.

Whilst Diagram A.1 (a) shows the five main dimensions of the inquiry, Diagram A.1 (b) (in **Appendix II**) shows how a whole systems thinking perspective has been used to explore a number of interrelated subtopics.

Box A.1: Clarifying sustainability education terms

In common with general practice, I use the term *sustainability education* as a catch-all to include the terms 'environmental education' (EE), 'education for sustainable development' (ESD), 'education for sustainability' (EfS), and 'education for a sustainable future' (ESF). Beyond these terms, I use *sustainable education* to suggest a change of educational paradigm, rather than a modification of or to the existing paradigm. A more detailed discussion of these terms and their meaning may be found in Part D.

I define 'sustainable education' as, "a change of educational culture which both develops and embodies the theory and practice of sustainability in a way which is critically aware. This would be a transformative paradigm which values, sustains and realises human potential *in relation to* the need to attain and sustain social, economic and ecological wellbeing, recognising that they are deeply interdependent" (Sterling 2001, 22).

I now introduce briefly the four main foci and explain why they are examined in the Thesis.

Paradigm change

The cultural worldview, or social paradigm, is a story about the way the world works. It is both a projection and reflection of how the world is seen, and is a characteristic of any society from history to the present. As Fromm has noted (1976, 137), "The impressive fact is that no culture has been found in which such a frame of orientation does not exist. Neither has any individual".

In a stable society, the dominant and mainstream story accommodates differences of view and debate within accepted parameters, and on the basis of accepted axioms and assumptions which are often unexamined and unarticulated. It has a *descriptive* aspect, influencing which aspects of and how the world is seen, and a *normative* and *purposive* aspect which legitimises courses of action. So two components of paradigm can be distinguished, the *eidos* which refers to the cognitive or intellectual paradigm (the "guiding idea" - Grundy 1987, 23) and the *ethos*, which refers to the affective level, values and norms. These give rise to and influence the *praxis,* a term which I am using here to refer to the 'theory in action' and behaviour, both what is done (and not done) and how it is done. Of these three dimensions of paradigm, it is the ethos which is often most hidden from people's immediate awareness.

➢ Key point: I use these three descriptors of the components of paradigm *ethos, eidos* and *praxis* extensively in the Thesis as a fundamental model of paradigm.

Thus the dominant shared worldview in any society affords a largely coherent epistemological and ontological sense, within which both examined and unexamined values, beliefs, assumptions, ideas and actions are played out. But there is growing evidence that the 'knowledge system' (Marglin 1990) that has dominated Western society for more than 300 years is unsustainable as a system of thought, and is giving rise to unsustainable patterns in human activity systems. My starting point here is based on Bateson's work. Gregory Bateson was a critically important figure in the history of systems thinking, and his influence on current developments is still strong, if not always recognised. Fritjof Capra (1988, 74) suggests that he will come to be regarded by future historians as "one of the most influential thinkers of our time". According to Bateson (1972) - and to many others since - our worldview is founded upon an 'epistemological error', a perception of and belief in separateness that makes it so. As Bateson (1972, 463) states:

> I believe that (the) massive aggregation of threats to man and his ecological systems arises out of errors in our habits of thought at deep and partly unconscious levels.

If this is so - and it is a point of view to which I subscribe - it raises the question of how we might escape this trap, and on what bases of thought.

Within the history of the modernist paradigm, there has always been tension between the dominant *mechanistic* and the alternative *organicist* ways of viewing the world. Hence Capra (1996, 17) states:

> The basic tension is one between the parts and the whole. The emphasis on the parts has been called mechanistic, reductionist or atomistic; the emphasis on the whole holistic, organismic, or ecological.

This remains in my view, the most fundamental struggle. Yet in the current age, the attention of mainstream debate has been the relation and tension between modernism on one hand, and postmodern thought on the other. But I will argue that the focus of the historic struggle - if we are to attain a more sustainable and just world - needs now to move on. Whilst a fundamental and important debate continues between modernism *and* deconstructive postmodernism, I will argue that *revisionary (or constructive) postmodernism and ecological thinking* suggest the possibility of an emergent social paradigm that allows Western thinking and culture to both subsume and go beyond the limits of modernism and deconstructionism, towards a more holistic alternative. Further, I argue that our collective experience of these worldview 'moments' allow us to transcend them through our developing a more integrative way of seeing the world.

I argue that the three fundamental 'moments' - of modernism, deconstructive postmodernism and revisionary postmodernism - may be seen as a deep and historic cultural learning journey. It is not at all clear cut. The use of worldview labels simplifies the complexity of relationships and currents involved, and the fact that for many people, their perceptions and thought processes are simultaneously enmeshed with a number of outlooks which are in tension, perhaps consciously, perhaps unconsciously. This, it would appear, is symptomatic of the transitory times that we live in.

Thus, according to Heron (1992, 251):

Today, a significant minority have abandoned the Newtonian-Cartesian belief system in favour of some elaboration of a systems theory worldview. But it may be that they, and certainly the majority of people, still *see* the world in Newtonian-Cartesian terms. It is a big shift for concepts to move from being simply beliefs held in the mind to beliefs that inform and transform the very act of perception.

Whilst Bateson suggests:

We are most of us governed by epistemologies that we know to be wrong. (1972, 461)

Many commentators maintain the most fundamental issue is a 'crisis of perception' which most of us share, and that a change of cultural worldview based on some form of systems thinking or holistic view is both necessary and emerging (Capra 1982, 1996, Harman 1988, Clark 1989, Bohm 1992, Wilber 1996, Ho 1998). This appears to entail a shift of emphasis from relationships based on separation, control and manipulation towards those based on participation, appreciation and self-organisation. Increasing numbers of writers are pointing to the emergence and nature of this ecological worldview, predicated on the idea of a co-created or participative reality. Thus this worldview is variously called 'participative' (Heron 1996, Reason and Bradbury 2001) 'co-evolutionary' (Norgaard 1994), or 'living systems' (Elgin 1997), and referred to as the 'postmodern ecological worldview' (Zweers 2000).

This movement expresses - to quote Capra (1996,3) - a "new perception of reality" which has "profound implications not only for science and philosophy, but also for business, politics, health care, education, and everyday life." Evidence of this emergent paradigm can be seen in aspects of ecological and integrative thinking, particularly in ecophilosophy, social ecology, eco-psychology and creation spirituality, as well as more practical expressions in major areas of human endeavour such as holistic science, ecological economics, sustainable agriculture, holistic health, adaptive management, ecological design and architecture, and efforts to develop sustainable communities.

This movement may be as a manifestation of epistemic learning, ultimately a profound transformation based on realisation of the arbitrary nature and inadequacy of the prevailing existing paradigm. Capra claims (1982, 1996) that humanity, or at least

Western and Westernized culture is at the beginning of a paradigm shift, equivalent to the first Scientific Revolution, informed by this new view. Davies and Gribbin (1992, 23), well-known writers on new science, state "the paradigm shift that we are now living through is a shift away from reductionism and towards holism; it is as profound as any paradigm shift in the history of science". Yet the participatory worldview is more than a scientific revolution, it holds the promise of cultural change whereby "meaning and mystery are restored to human experience, so that the world is again experienced as a sacred place" (Reason 1994, 10). Through our knowing participation, the contemporary existential crisis of identity, meaning and purpose is addressed through a new sense of our belonging to a greater whole. However, given the lingering power and momentum of modernism and its ability to adapt and change, and despite the evidence of trends of environmental degradation and social decay, it is not clear how, when or even that the new paradigm will gain the ascendancy. Eckersley (1992, 52), for example, sees "nothing inevitable" about "a new, ecologically informed cultural transformation". Eisler (1990, xx) adds that while a better future is possible:

> …it by no means follows (as some would have us believe) that we will inevitably move beyond the threat of nuclear or ecological holocaust into a new and better age. In the last analysis, that choice is up to us.

Not least, an ecological revisioning of the world and of ourselves involves a choice of alternative root metaphor, that of ecology or 'the living system'. From all the reading and thinking I have done over the years, I believe the key to understanding a culture is its root metaphor. Therefore, in critically appraising modernity, I would not point first to rationalism, or scientism, or technocentrism, or economism, or capitalism, or industrialism, but to *mechanism,* which underlies the whole paradigmatic structure of modernity. As Berman points out (in a book which has been a key text for my thinking since it first appeared in 1981), "our culture hangs onto mechanism, and to all of the problems and errors it involves, because there is no returning to Hermeticism and - apparently - no going on to something else" (1981, 136). His inclusion of the Hermetic (alchemical) tradition signifies the fact that Western science was once much more qualitative, organicist and integrative than modern science allows. Berman's own contribution to outlining the 'something else' that might in turn transcend mechanism, is significant. Based on 'Batesonian holism', it employs the root metaphor of ecology. 'Ecology' is still a science of course, but more significantly it is a powerful idea, and it is in this sense that it is discussed in this Thesis.

As Sachs suggests, since the 1960s:

> …ecology has left the biology departments of universities and migrated into every consciousness. The scientific term has turned into a worldview. And as worldview, it carries the promise of reuniting what has been fragmented, of healing what has been torn apart - in short of caring for the whole.
>
> (Sachs 1999, 63)

Often accompanying this sense of ecology is the notion of the 'living system' which gives rise to the notion of the 'sustainable system' which is at once healthy, viable, adaptive, and self-organising, and this metaphor can be applied to all system levels including individuals, groups, institutions, communities and whole societies as well as, by extension, having radical implications for human activity systems such as agricultural systems, production systems, companies, organisations and so on. This is not just an appealing idea, it represents in a sentence a profound shift of worldview, away from the Cartesian/Newtonian image of entities existing discretely in a deterministic and dead universe, to a dynamic view of process, relation and co-evolution.

What is often missing in calls for change of worldview however, is an elaborated theory both of what this 'new' postmodern ecological paradigm means in terms of ethos, eidos, and praxis, and of how paradigm change through learning might be accelerated, against a backdrop of mounting global ecological crisis. This, I believe, is the significance of whole systems thinking, as it appears to hold this important potential. However, with rare exceptions, notably Capra (1982, 1996), the nature and role of systemic thinking in relation to the new paradigm has been little explicated, and this again is one of the aims of the exploration in this Thesis. What is also often missing is a theory of why paradigms are resilient and resist change, or indeed, of how they can change. Here too, whole systems thinking offers a theory of learning - based upon Bateson and his successors - which offers powerful and useful insights. This theory centres on the idea of nested levels of learning, and this is introduced in section 3 below. Section 3 (subsections 1 and 4) also discusses 'paradigm' further, and contrasts views of paradigm change.

I now introduce my view and interpretation of whole systems thinking in more detail.

Whole systems thinking

The term whole systems thinking is used in literature, but more often in passing than in depth. My hope is that it will become much more familiar, and quickly in years to come.

I first encountered the phrase 'whole systems thinking' in Korten's work where he critiques the conventional economic order and the thinking and belief system that supports it. Thus, he suggests:

> Whole-systems thinking calls for a skepticism of simplistic solutions, a willingness to seek out connections between problems and events that conventional discourse ignores, and the courage to delve into subject matter that may lay outside our direct experience and expertise.
>
> (Korten 1995, 11)

In some ways, this reflects my approach to the Thesis and the inquiry. But essentially, I see whole systems thinking as a quality of thinking that is suggested by the postmodern ecological worldview, and which can also suggest this worldview. That is, I argue that those who reflect such a worldview tend to perceive and think in whole system terms, whilst for others, beginning to think in this way can lead them towards such a worldview. A number of antecedents and contributory strands to whole systems thinking are explored in the Thesis, but essentially, I see it as a coming together, a syncretisation, between ecological thought and systems thinking. It is equivalent then, to what is sometimes referred to as 'ecoystemic thinking' (Van der Hoorn 1995). It is interesting that the common phrasing is 'systems *thinking'* and 'ecological *thought'* rather than 'systems thought' and 'ecological thinking', implying a tendency towards an *active praxis in the former* and towards a *body of knowledge and ethical orientation in the latter.* Thus I see whole systems thinking as a synergy between the body of holistic thought inspired by an ecological view of the world, and the methodology of systems thinking: essentially a coming together of ecologism and systemisism, of critical thought and a sense of connectedness, yielding what might be termed 'systems as worldview'. In practical terms, such an inclusive view regards "ethical, spiritual, cultural, and ecological judgement criteria...as being just as significant as the more conventional technical, practical, economic, social and political dimensions" (Bawden 2000a, 11).

➢ Key point: whole systems thinking is a syncretisation of systems thinking and ecological thought.

Zohar and Marshall (2000, 43) note that the Western model of 'thinking' is inadequate because thinking is not just a cerebral matter of 'IQ': "we think not only with our heads, but also with our emotions and our bodies (emotional intelligence), and with our spirits, our visions, our hopes, and sense of meaning and value (spiritual intelligence)". They make a distinction between 'serial thinking' which is linear, logical, rational and rule-

bound, 'associative thinking', which is habit-bound and pattern recognising and associated with emotional intelligence, and 'unitive thinking' "which makes it possible for us to do creative, insightful, rule-making, rule-breaking thinking...with which we reframe and transform our previous thinking" (2000, 39). Zohar and Marshall's view of 'spiritual intelligence' appears to close to what I am calling here whole systems thinking.

At the heart of it is *wholeness* and *health* (both words having the same semantic root). These are hard words to define because they are qualitative, but they invoke the ideas of integrity, of both the unfolding and maintenance of creative potential in a dynamic state, of an aesthetic and of quality. For a culture focussed on detail and analysis, "the whole contains a richness, a perspective, a dimensionality not possessed by parts" (Zohar and Marshall 2000, 18). Hence, I argue that whole systems thinking, particularly when seen in relation to the quest for sustainability, has a teleological dimension, that is, a sense of purpose. A fundamental issue concerns how to recognise, and work towards - what systems thinkers term - 'goodness of fit' or coherence between identified nesting system levels of ecosphere, society/economy, and education (and their identified subsystems): so that increasingly, each becomes - and together become - a 'viable' or healthy system. According to Bossel (1998,75), a viable system is one which is "able to survive, be healthy, and develop in its particular environment". Similarly, I argue that sustainability implies the *survival,* the *security* and beyond these, the *wellbeing* of the whole system, whether this is seen at local level, such as community, or at global level. These are related stages; there is no wellbeing unless there is some level of security, and no security unless there is survival as a first step. So for example, aid agencies addressing extreme poverty and famine will work for immediate survival first, then for better food security and economic security, then for general social, economic, and environmental wellbeing.

Whilst necessarily imprecise, this notion of the healthy, sustainable system is a guiding idea in the Thesis, and applies at any and every system level. (Further ideas on the qualities of viable systems are given in the **Appendix II,** Part C.1.)

I now review why whole systems thinking is necessary. It is increasingly accepted that many complex issues in the contemporary world, and particularly those relating to the environment, can only be reasonably understood and effectively addressed by approaches which are multidisciplinary, holistic, flexible, and integrative; further, that culturally engrained analytic, linear and binary ways of thinking are no longer adequate

to understand and address many problems. Moreover, that the dominance of such 'incomplete' thinking can exacerbate problems which are fundamentally systemic in nature and characterised by complexity (Waddington 1977, Laszlo 1989, Meadows 1992, Clayton and Radcliffe 1996, Mulgan 1997, Bell and Morse 1999). For example, Senge, an influential systems writer suggests, "…the unhealthiness of our world today is in direct proportion to our inability to see it as a whole"(Senge 1990, 68). Similarly, Meadows (1982a, 101) states:

> 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.

Gregory Bateson was amongst the first to point to the deep epistemological nature of the problem, pointing to a "massive aggregation of threats to man and ecological systems" which "arises out of errors of thought at deep and partly unconscious levels" (Bateson 1972, 463). Three decades later, it could be argued that the complex interconnections between problems are becoming increasingly apparent, forcing a gradually more holistic way of seeing the world. Commoner's 'laws of ecology' (coined around the same time that Bateson was writing), include his 'First Law' that "everything is related to everything else" (1971, 29), and as we struggle with, say, the links between energy use, transport, climate change, global trade, food security and safety and health, the reality of this 'law' is beginning to become more widely appreciated than when Commoner first wrote.

➢ Key point: A fundamental argument of the Thesis is that, as the issues that surround us are fundamentally *systemic,* we need to *think and learn systemically.*

More positive visions are also encouraging a changed, more integrative, outlook. The idea of sustainable development, given international credence by the Brundtland Commission (WCED 1987), may be seen as a response to the problems and possibilities presented by a deeply systemic world. Yet ecologically sustainable development requires an extension of thought, beyond that which was the norm for most of the 20th century, towards a much more integrative perspective that brings together (at least) society, economy and environment, and present and future dimensions. But integrative thinking, or systemic thinking, is still unfamiliar; it tends to be an effort rather than a habit of mind. Indeed, it is fragmentary thinking that is

habitual - which is unreflected upon. As Bateson's daughter and collaborator (Bateson MC, 2000, vii) comments:

> Even with current progress in chaos and complexity theory, we remain less skilled at thinking about interactions than we are at thinking about entities, things.

David Orr (2002, 285) suggests that economic and political structures work against systemic thinking:

> We have difficulty in seeing whole systems in a culture shaped so thoroughly by finance capital and narrow specialisation.

Shifting our focus and attention from things to process, from static states to dynamics, from 'parts' to 'wholes', is the fundamental challenge, and this is why systems approaches - which bring a set of ideas, tools, and valuative orientations - appear so relevant.

In essence, systems thinking is relational thinking, and stands in contrast to non-relational or fragmentary thinking. In Flood's words, it "helps us sense as well as appreciate our connection to a wider whole" (1999,2). The term 'joined up thinking' has enjoyed increasing currency in recent years - even if it is often superficially interpreted, but its emergence is perhaps significant as the limits of fragmentary and linear thinking become increasingly apparent. De Bono (1994,9) describes systemic thinking simply, by suggesting the dominant question changes from "what is this?" to "what does this lead to?" or "what does this add up to?" Similarly, Capra notes that it marks a shift of attention from 'parts' to 'wholes', from structure to process, and that it is concerned with relationship, connectedness and context.

> To understand things systemically literally means to put them into a context, to establish the nature of their relationships.
> (Capra 1996, 27)

For this reason, a number of commentators equate 'systems thinking' and 'ecological thinking', the latter not just denoting concern with natural systems but with all process and relationship (Capra 1996, Van Der Hoorn 1995). Hence Capra states in his book *The Web of Life,* "I shall use 'ecological' and 'systemic' synonymously, 'systemic' being merely the more technical, scientific term" (Capra 1996, 17). However - and this is a very important point, I argue that it is *important to distinguish between systems thinking*

and ecological thinking and acknowledge their different origins and nature (see Box A.2 below).

➤ Key point: Systems thinking and ecological thinking have some similarities but also important differences.

Other descriptors commonly used are 'holistic thinking', 'integrative thinking', 'connective thinking' and 'linking thinking'. Yet the use of these terms does not necessarily imply that the user recognises the specific contribution that 'systems thinking as a discipline' has made and can make to this view of the world. My view is that systems thinking, that is 'systems as discipline', can help make holistic thinking and ecological thought - the nature of which are more often intuited than articulated - more comprehensible, accessible, communicable and operational. There are subtleties and arguments in the use of terminology which I return to later, but in Box A.3 below, I have tried to indicate the main differences.

A further key descriptor is '*epistemic'*, which means that systems thinking can give rise to a qualitatively different epistemology than that which is currently dominant. However, this is *not necessarily the case*, and this is why in the Thesis I make the distinction between most systems thinking and 'whole systems thinking', although this is a soft rather than a hard distinction. Through over 50 years of evolution, systems thinking has developed a number of schools of thought and practice, based on systems science. These are concerned with *systems as discipline* - and a discipline which is primarily methodological in emphasis. Although this observation is a simplification, it is nevertheless generally valid - the idea of problem-solving from the outside or 'intervening in the system' for example, is a fundamental part of systems approaches. As Flood writes (2001, 135):

> The methodology is an intervention that begins with problem identification and concludes with some final solution, perhaps with expectation that things will attain a desirable condition. The challenge is to find the most efficient means to achieve this predefined end.

My argument (which is expanded later in Part B.2) is that although systems thinking is founded in holism, and has attempted to present alternatives to reductionist and objectivist thinking, its various schools have nevertheless been operating within the context and constraints of the dominant cultural paradigm, and therefore the methodological and problem-solving aspects of systems thinking (which are more

pragmatically useful, and offer less challenge to the dominant paradigmatic ethos) have been in evidence, rather than the ethical and philosophical aspects which *are* challenging. As Richard Bawden comments:

> While practitioners of the 'systems approach' have long claimed that they do embrace fundamental concerns for 'ethical defensibility', their record has not been particularly noteworthy.
>
> (Bawden 2000a, 5)

At the same time, the applied and 'hard systems' approaches deriving from an engineering tradition have been in more general use in recent decades, than the 'soft systems' more participative approaches (although this is changing). It is for this reason that many environmentalists have tended to shun all systems thinking, seeing it as 'part of the problem' rather than 'part of the solution' - serving instrumental values too often rather than intrinsic human and environmental values. But this is to throw out the baby (systems thinking) with the bathwater (mechanistic worldview) before the baby has a chance to grow and prove itself: in my view systems thinking is, at very least, a critical part of realising a more sustainable future. Yet I believe it needs re-inventing in a 'more whole' and more accessible, comprehensible and ethically oriented form.

To denote such a form of systems thinking, I use the term 'whole systems thinking' as a neologism. It is not entirely new: an internet search using this term reveals its use by a number of institutions, but mostly the meaning of the term is not differentiated from 'systems thinking'. At first sight, the term appears tautologous as systems thinking is about wholes anyway. I would say in answer that the term indicates a difference from how *systems as discipline* is seen and practiced. In suggesting a stronger synergy and syncretisation between systemisism and ecologism, 'whole systems thinking' manifests *systems as worldview*, rather than systems primarily, or only, as methodology. In this sense, 'systems as worldview' is an articulation or expression of the postmodern ecological worldview - its emerging ethos, eidos and praxis - using relational or systemic language and concepts, and reflecting a transpersonal Earth ethic of 'inclusive wellbeing' (Bawden 2000). Further, I argue that this worldview addresses the contemporary existential crisis of meaning and alienation which characterises both modern and postmodern thought, by offering a sense and possibility of healing and wholeness - a spiritual sense of connection with "some larger, deeper, richer whole that puts our present limited situation into a new perspective" (Zohar and Marshall 2000, 18).

'Whole systems thinking' is not arising, of course, from a vacuum but from a number of foundations, and appears to be intrinsic to a new worldview arising as part of a historic process or movement. One of these foundations is the movement within 'systems as discipline' which is currently embracing and exploring the implications of the new sciences of complexity in tandem with the emerging 'living systems' view of the world (see 'Paradigm change' below). The four contributory foundations I have identified - being systems thinking, indigenous thought, organiscism and ecologism, and complexity sciences - are outlined further in subsection 3.3 below and subsequently examined in the Thesis (particularly **Appendix I**).

In sum, I suggest that 'systems as worldview' is a larger conception than 'systems as discipline' - a context that can incorporate, revitalise and change the nature of 'systems as discipline' and also that, for a number of reasons, the time has come for the elaboration of whole systems thinking in this sense. At the same time, systems methodology, seen within a larger framework of whole systems thinking, can be used to articulate and advance aspects of the ecological worldview. Further, I argue that 'whole systems thinking' helps a bridge to be built from dominant habits of thought towards a more holistic, ecological worldview in society as a whole which can support and substantiate the theory and practice of ecologically sustainable development. In other words, the articulation of whole systems thinking might be key to what has been termed the 'sustainability transition' (O'Riordan and Voisey 1988).This is elaborated further in Part B.1.8.

The following two Boxes help define key terms and relationships in the fields or orientations of systemisism, ecologism and holism: Box A.2: 'Clarifying terms', and Box A.3: 'Clarifying relationships'. They are my own definitions or descriptions. These relationships are discussed in subsection 3.3 below 'Systems thinking and changes in worldview'.

Box A.2: Clarifying terms relating to systems and ecological thinking

Systems thinking - modes of thinking which recognise relationship and process as the primary reality.

Systemic thinking - this term is sometimes used synonymously with 'systems thinking'. However, other writers use this term to distinguish between 'first-order' systems

thinking, and 'second-order' systemic thinking whereby the observer is fully cognisant of his/her construction of his/her own reality including his/her view of any system.

Systemisism - a belief or view that a systems view of the world is an appropriate metaphor for understanding the world, our interrelationship with it and acting in it. A related term is used to describe the systems practitioner, as in 'systemisist'.

Systems as discipline - an inclusive term for the various schools of systems thinking which emphasize systems thinking as a *methodology.* Has not embraced the ecological worldview, although some parts of systems thinking are based on organic metaphors and there is growing interest in the implications of complexity/living systems theory. Systems as discipline is not necessarily interested in sustainability and related matters – but there is a recent and current trend in this direction within the field.

Ecological thinking - the thinking that characterizes those who espouse aspects of, or represent, the emerging postmodern ecological paradigm. This recognises the primacy of relationship, but is not necessarily aware of systems as discipline. Further, those who identify with this position do not necessarily recognise the term 'systems thinking'. While their thinking is essentially systemic in character, this systemisism is implicit and applied rather than articulated. Ecological thinking embraces the issues of sustainability, and expresses ecologism. Ecological thought is the body of ideas that have emerged from ecological thinking.

Ecologism - a belief or view that ecology offers the most appropriate metaphor for understanding the world and acting appropriately in it. Ecologism suggests the need for a radical change in our relationship with the natural world, and in social and political life, and is distinguished from simple environmentalism.

Holistic thinking - a way of thinking which is attentive to wholeness, being the apparent tendency for living systems to produce complex wholes with properties that cannot be predicted from the properties of their parts.

Whole systems thinking - a form of thinking which attempts to explicate the ecological worldview, through revisioning epistemology, ontology and methodology in terms of wholeness. In so doing, it attempts to bring together and syncretize the methodology of

systems thinking, a co-evolutionary ontology, and the worldview and ethical orientation of ecological thought.

Box A.3: Clarifying relationships

My research has led to these conclusions about the relationship between descriptors of forms of thinking:

All systems thinking is holistic, but not all holistic thinking is systems thinking. This means that holistic thinkers are not necessarily aware of the ideas and concepts that have become associated with the field of systems thinking.

Ecological thinking is essentially holistic, but not all holistic thinking is ecological. This means that not all holistic thinkers necessarily share the ideas, values and beliefs of ecological thinkers who articulate an ecological worldview.

Some systems thinking is ecological and some is not. This means that many people use systems thinking for all sorts of purposes and ends, but do not necessarily have an ecological perspective.

Some ecological thinking uses systems ideas, concepts and methods, but much does not. Many people who regard themselves as having an ecological perspective, often do not know much - if anything - about systems ideas.

Educational paradigm

I have argued elsewhere (Sterling 2001, 14) that "most mainstream education sustains unsustainability - through uncritically reproducing norms, by fragmenting understanding, by sieving winners and losers, by recognising only a narrow part of the spectrum of human ability and need, by an inability to explore alternatives, by rewarding dependency and conformity, and by servicing the consumerist machine". To escape this matrix, I argue for 'revisioning' of the educational paradigm, but also that such change needs to be seen in the context of wider society.

Using a systems approach, I suggest below that the theory and practice of education may be seen as a 'human activity system' (Banathy 1991, 1992). Further, that it may be usefully seen as a subsystem of wider society, rather than as a parallel system. If this is a tenable analysis, it would suggest that education is deeply influenced by the socio-cultural worldview or paradigm of society which affords the context within which education operates (Banathy, 1991). From this point of view, the expectation - from the UN Stockholm Conference on the Human Environment of 1972 onwards - that education is the key to change towards sustainability in society may be seen as based on a simple and linear view of change and causation between 'education' and 'society', which ignores a large number of factors.

Hence, American educationist David Orr (1994, 17), describes a crisis 'of' education, which refers to its limited present ability to contribute to a better world and its reproduction of dominant assumptions. Secondly, he suggests a crisis 'in' education: its limited ability to assert humanistic and democratic values and practices. Whilst politicians and editorial writers are frequently occupied by a perceived crisis in education relating to 'standards', the larger crisis of education goes largely unnoticed. What is limiting education - I will argue - is the fundamental educational paradigm which informs its thinking and practice, and which derives from the context of the wider socio-cultural paradigm and its view of the nature and role of education. These frameworks have been overlain in recent years - not just in the world of education, but also in local government, health, police and other areas of public life – by quasi-market and managerialist ideas and forces which, arguably, have narrowed our shared conception of what education means and entails (Marshall and Peters 1999, Smyth and Shacklock 1998).

Meanwhile, the environment/development crisis continues, fuelled partly - as Orr has pointed out - by the human legacy of the last century's educational practices. Clearly, 'more education' is not the answer to this crisis - or at least, not more of the same. This is something that E F Schumacher recognised some thirty years ago (see quotes heading Part A). Schumacher's plea for an 'education of a different kind' begs the question regarding its nature, and also, how we might be able to learn our way towards forms of education that are more suited to the conditions of complexity, unsustainability and systemic breakdown that characterise our times. It is not that the idea of paradigms is unfamiliar in education - it is just that debate tends to be about or largely at the level of 'subparadigms' jostling largely within the framework of the larger

modernist-mechanist-reductionist cultural paradigm whose assumptions and values still tend to shape and colour thinking and debate.

One possible route out of this trap is systems thinking, as promulgated by what I have termed above 'systems as discipline'. But here, very limited progress has been made. Ray Ison, who, as professor at the Open University's Centre for Complexity and Change, is well placed to judge, comments thus:

> To date, the emphasis must be placed on 'potential' as the extent to which systems thinking has been applied in (education) remains relatively limited. For example, there is a very limited literature on the use of systems ideas and methodologies…
> (Ison 108, 1999)

The key issue is not about winning tokenistic change within the framework of an uncomprehending and uninterested dominant educational paradigm, but how to encourage systemic change in that paradigm towards holism and systemisism. In other words, I make a key distinction between 'learning *through* education' (relating to *provision*) which is the usual subject of educational discourse, and 'learning *within* education' (relating to the guiding *paradigm*). This is a shift of attention from education as '*agent* of change' (which is how it has often been represented in international mandating documents and by a variety of education for change movements), towards education as '*subject* of change'. This is a simple but critically important distinction which I first made in my Earthscan book (Sterling, 1996). Learning within education - primarily by policymakers and the educational community - requires both a theory of change, and a philosophical basis that can challenge and transcend the norm. This is where I believe whole systems thinking offers hope. The argument developed in the Thesis turns on the idea of different systemic *levels of paradigm*, and associated *levels of learning*, which derives from Bateson's work on logical types and learning. This model is outlined in more detail in section 3 below, and again in Part B 1.3.

The effect of patterns of unsustainability on our current and future prospects is so pressing that the response should not be predicated only on the 'integration of sustainability' into education, because this invites a limited, adaptive, response. Rather, I will argue, we need to see the relationship the other way round - that is, the necessary transformation of education towards the integrative and more whole state implied by a systemic and ecological view of sustainability in education and society, however difficult this may be to realise. I introduce and explicate the term 'sustainable

education' to indicate this visionary state, to distinguish between this and forms of sustainability education which tend to be contained, constrained and often marginalised. I now look at such forms, and specifically environmental education.

Environmental education

Issues here concern the status, constraints upon, and nature of *environmental education* (EE) and forms of sustainability education such as *education for sustainable development* (ESD). Again, using a systems approach, I suggest it is helpful to regard environmental education and education for sustainable development as systems of interest, and as overlapping subsystems within the larger context of the education 'human activity system'. *Sustainability education* is often used as a term which subsumes other related terms.

Whilst discourse within the environmental education field has developed rapidly in the last decade, arguably, the fact that this discourse has taken place largely *within* rather than affecting thinking *beyond* the field indicates that progress with the 'ecologisation' of education as a whole has been marginal, and in some respects behind the greening processes in wider society. If it were possible to assist systemic change in the dominant educational paradigm, which is considered in this Thesis, it might create more opportunities whereby environmental education could flourish further and influence the whole, rather than remain marginalised. Eventually, perhaps, there would be no need for any separately identified 'environmental education'.

A second issue concerns how far environmental education, education for sustainable development (ESD) and related fields of 'education for change' - such as development education, peace education, future studies, anti-racist education, human rights education, global education, human-scale education and holistic education - are also influenced by the larger educational paradigm within which they operate and which they seek to affect. I will argue that environmental education and education for sustainable development are inevitably shaped by this paradigm, particularly as regards an instrumentalism which gives insufficient attention to the nature of education and of learning, and that their claims to holistic bases are only partially valid. Yet at the same time, I will argue that because these fields link - to some degree - into progressive social and environmental movements, this lends them a certain power to effect change in educational systems and institutions that are often relatively closed in relation to these currents of change. To realise this power, however, sustainability

education needs to shake free of the instrumentalist and behaviourist assumptions that have underpinned much policy, discourse and practice for some decades.

Since the UN Stockholm conference of 1972 and the present, there have been many international resolutions and reports which identify and give a mandate to education as the most critical key to change with respect to addressing environment and development issues and ushering in a more sustainable society. In my work at national and international level, I've seen very many iterations of this idea; yet there is little evidence of social change at any other than the micro scale as a result of formal environmental education programmes.

It became apparent to me that however good specific environmental education programmes might be, and perhaps however widely provided, education as a whole is shaped by predominant values and beliefs in wider society. As Miller (1999, 193) suggests:

> ...holistic education is not going to save our society. We cannot educate a new generation and then hope they will change the world...it will only become accepted and widespread, to the extent that our culture itself changes.

Therefore, the question of the role of education in social change demands a whole systems view which looks at change in society and culture, and the opportunities and dynamics this affords in the relation between education and society. This view also has to take into account the important fact that formal education is but one influence among the many that form the total milieu that affects the individual or group.

For me, the question became less one of 'how can environmental education change people's behaviour in respect of the environment'. This has been a dominant question underlying much environmental education discourse over the last thirty years - one which reflects an instrumental view of education, and a rationalist and linear view of change, albeit for the best of intentions. If we see instead education and society in a co-evolutionary relationship, the key question then becomes 'how can education and society change together in a mutually affirming way, towards more sustainable patterns for both?' This is a change of focus which allows a more creative and perhaps subtle response to the sustainability issue. In systems terms, it is seeking a 'positive feedback loop' whereby change towards sustainability in wider society supports sustainable education, which supports change in wider society, and so on. It takes us from a model of education as one of social reproduction and maintenance, towards a vision of continuous re-creation or co-evolution where both education and society (or at least

parts of them) are engaged in a relationship of mutual transformation - what has been called a "future-creating, innovative and open system" of education (Banathy 1991,129) which can explore, develop and manifest sustainability.

Seen this way, and as suggested above, environmental education can potentially play a transformative role in helping re-orient wider educational thinking, policy and practice - and particularly if it can become more genuinely holistic in the ways which I explore later in the Thesis. Again, systems thinking and systemic approaches to learning and research have a key role to play in taking EE and ESD closer to being holistic modes of enquiry, but I have found relatively little development in this area. Work which clarifies the nature and potential of systems thinking in education for sustainable living, and which shows how to encourage a 'systemic literacy' relating to awareness, understanding and insight, competence and a sense of responsibility appropriate to a systemic world, is quite rare - particularly involving explicit (as opposed to implicit) systems approaches. According to Milbrath, this orientation is missing from education as a whole. Ecological thinking, he suggests, "requires people to learn how to think systemically, holistically, integratively, and in a futures mode" (Milbrath, in Slaughter 1996, 194).

At a deeper level, 'whole systems thinking' implies that educational purpose should go beyond nurturing systemic literacy towards developing a sensibility, an understanding and a *systemic wisdom* arising from a deepened appreciation of, understanding of and engagement with the connectedness of phenomena. This includes but transcends what has been termed 'environmental literacy' in two ways: one, that literacy tends to imply the ability to 'read and write' the environment, i.e. is concerned with perceptual and descriptive aspects, rather than wisdom which is to do with *action* as well as perception and conception, and second, systemic wisdom implies a changed epistemology and ontology towards a participative, relational view which is not necessarily the case in the environmental literacy debate. My assumption, examined here, is that both collectively and individually we need to re-discover and nurture this sense of engaged participation, for its own intrinsic value as part of becoming more whole and integrated persons, as well as allowing us to address more effectively and wholly the pressing issues of our age. From a whole systems viewpoint, these 'internal' and 'external' aspects are intimately connected.

Most environmental education discourse seems relatively unaware of the implications of the nature of revisionary postmodernism and ecological thought, and of the participatory research paradigm which is associated with this emerging paradigm. However, over the eight years of my research, the situation changed to some degree, and this is examined further in Part D.

In sum, I argue that the future efficacy of *environmental education* as regards the sustainability transition, depends largely on greater attention:

- to operative values informing ethos and practice and to working for change in the dominant *educational paradigm*
- to the nature of *learning levels* and the need for transformative learning
- to the significance and nature of *systems thinking and ecological thought*,
- to signs of change in *cultural worldview* towards a more ecological orientation
- to *sustainability* in relation to complexity theory.

These conditions are also relevant to education as a whole, and to systems thinking (see Box A.4 below).

Scope

The scope of the research is wide and includes:

- the predominant way we think (perceive, value, conceptualise and act) individually and collectively,
- the nature of limits to this thinking,
- the changes in thinking that appear necessary if people are to build more ecologically sustainable and equitable modes of living,
- the degree to which these are happening as part of a cultural movement,
- why deep learning is difficult and how it can occur,
- and the implications of such change for a transformed and transforming mode of education,
- evidence for the emergence of an ecological worldview in Western culture as a postmodern phenomenon, and arguments by commentators that this change is necessary to a liveable future.

An emerging neological conception of systems thinking - whole systems thinking - which goes beyond conventional systems science will be identified, elaborated, and critically justified both as an inherent and evolving part of the ecological worldview, and

as a rationale for change in education through which education might in turn better assist the realisation of ecological thinking in cultural change. The explication of whole systems thinking in Part B (and further elaboration in **Appendix I**) leads to an exploration of its potential and meaning for education in general and environmental education in particular, in terms of both 'change *in* education' and 'education *for* change' in Parts C and D. I argue for cultural change in education as a whole and introduce the label 'sustainable education' to describe this qualitative change.

In sum, my research interest is in the discovery, exploration and development of a theory (or set of theories) which:

- help explain the lack of fundamental change in educational paradigm, (that is, the relative inability of the prevailing educational culture as a system of thought to change through learning),
- help construct a theory of transformation that might assist such fundamental change - which would in turn…
- enable a transformed educational paradigm to support a quality of transformative learning necessary to societal movement towards sustainability.

➢ Key point: In sum, the task is to bring together, develop and indicate the grounding for holistic theories which may help a transformed and ecologically-oriented educational paradigm to emerge, which in turn supports the kind of transformative learning, that will support the sustainability transition.

The conditions for the emergence of such a paradigm are summarised in Box A.4. below. Clearly, the scope of the Thesis demands both sufficient breadth to embrace a large enough 'whole' in order to contextualise the parts of the argument, and sufficient depth to substantiate the argument. The difficulties of managing and bounding this are reviewed in section 2, Methodology.

Box A.4: Articulating and realising an ecological worldview in education - five conditions

Towards the end of the research period, I arrived at five critical conditions which may be used to assess progress towards articulating and realising an ecological worldview at an epistemic level, through the construction and articulation of a 'sustainable education' paradigm.

My argument is that if *education as a whole* and *systems thinking* and *environmental education* met these conditions, we would be close to realising such a sustainable education paradigm.

There is an *order of realisation:* generally speaking, systems thinking and environmental education might be seen as equally close (or equally far away from, depending on how one looks at it) to realising the ecological worldview through meeting these conditions – but in different ways. Education as a whole however, is way behind. The word 'sufficient' denotes that these conditions are relative rather than absolute. What I am calling 'whole systems thinking' in this Thesis, would be 'sufficient' i.e. would fulfil the conditions.

We need to ask how far *education as a whole*, how far *environmental education* and all forms of sustainability education, and how far *systems thinking,* viewed as systems of thought and communities of practice, each shows, respectively*:*
1. Sufficient awareness of its own value base at a deep level - in relation to dominant worldview - and of the influence of the dualistic epistemological 'error' or inadequacy.
2. Sufficient awareness of learning levels and the need for epistemic learning
3. Sufficient awareness of the postmodern ecological worldview
4. Sufficient awareness of whole systems thinking
5. Sufficient understanding of sustainability in relation to complexity theory

Each of these themes recur in the Thesis and the background to each is explored.

1.2 Relevance and significance

The research is based on my professional experience, as outlined in the Preamble, and on existing literature. I have both developed and evaluated many of the ideas that are elaborated here in my professional work, not least through my previous publications and teaching. Further, I've had a good deal of feedback over recent years to indicate that much of my work has been influential, and this indicates both a degree of validation and demand. My aim here is to explore, develop, consolidate, and present the argument as a deeper platform and integrated whole which can both further inform practice and help make a difference to discourse.

The relevance and significance of the research lies in the contribution the research might make, in the longer term, to help close the theory-practice gap between

international rhetoric and reality by offering a paradigmatic theory which might help explain why the reorientation of education towards sustainable development is slow and difficult, and how a number of tensions and limitations in environmental and sustainability education discourse and practice arise, and might be transcended.

Further, and more specifically, I see the research as a contribution towards a theory of whole systems thinking that might be used, post doctorally, as a foundation for applied research on the development of curriculum, pedagogy, and organisational change that can embody and enhance 'systemic literacy' and indeed 'systemic wisdom' particularly in relation to sustainability issues.

As regards originality, I am not aware of work of this scope and integrative nature taking place, although there is a good deal of contributory work to draw upon within the fields embraced here - systems thinking, ecological thought and its manifestations, revisionary postmodernism, complexity theory, sustainability theory and adaptive management, environmental and sustainability education. Indeed, it is the bringing together of concepts and insights from these fields which make for originality. Despite increasing calls for integrated and whole systems thinking, its nature and implications are little articulated, and I wish to make a contribution to that end. Further, whilst there is some interplay between systems methodologies, sustainable development discourse and practice, and participative theories of learning, there appears to be real potential in exploring those connections further, particularly in relation to ecological thought and implications for education.

In addition, I anticipate that the research will make an original contribution to discourse on the form and development of environmental and sustainability education and perhaps even on education generally. An anonymous referee for an unsuccessful ESRC bid based largely on this work stated that the proposal was 'intellectually exciting' and 'pertinent and timely' (ESRC 1997). Ultimately, and as discussed further in 'Methodology' below, the validity of the research hangs on its worth in influencing thinking and practice. This dimension is discussed further in Part D.

1.3 The context of the research

This subsection paints some of the contextual background to the research undertaken. This background can be set out as two groups of *starting points* which have informed the inquiry. The first group relate to:

Sustainability and the response of education

1. The critical state of the world in terms of the four dimensions of sustainable development identified by the Brundtland Report (WCED 1987) (environment, equity, quality of life, and legacy for future generations) and related indicators; increasing and urgent calls for reorientation of economic, social and political life towards more sustainable patterns, and progress in understanding and enacting sustainable development (World Resources Institute 2000, Brown 2001, Loh 2002).

2. The systemic nature of the world, accentuated by and manifested through economic and cultural globalisation, global electronic communications, and social and environmental stresses.

3. The repeated identification of education as 'the answer' in international rhetoric on environment and development issues. Between the UN Stockholm Conference of 1972 and the present, numerous statements have pointed to the key role of education from creating "new patterns of behaviour of individuals, groups and society as a whole towards the environment" (UNESCO 1978) to being "critical for promoting sustainable development and improving the capacity of the people to address environment and development issues" (UNCED 1992). Agenda 21 talks of the need to 'reorient' education towards sustainable development (UNCED 1992). . At the same time, debate has taken place regarding the constraints on education to fully realise the rhetoric regarding 'reorientation' towards sustainable development (Fien and Trainer 1993, Huckle 1996, Mayor 1997, Parry and Scott 1997, Fien 2000).

4. A quite separate discourse on the purpose of education in the postmodern world (Delors 1996, Hargreaves and Fullan 1998) has taken place, whilst at the same time, policymakers have put new emphasis on the need for 'the learning society' as response to a perceived need to develop skills to suit changing economic conditions, rather than to anticipated future sustainability crises.

Therefore, at one level, the research inquiry centres on the 'response-ability' of education - how far it is able to respond to the challenge of unsustainbility and contribute towards the reorientation of society towards more sustainable living patterns. By taking a 'whole systems approach' this leads to investigation of a deeper problem which concerns why society is characterised by unsustainable patterns of activity. This then raises the question of the dominant social worldview or paradigm, the need to examine its nature, and alternatives.

This points to a second set of starting points which have informed the inquiry. These relate to:

Changes in worldviews and the emergence of systems thinking

1. Critiques of modernism and of postmodern deconstructionism, and calls for new thinking based on recognition of a 'crisis of perception' (Spretnak 1997).

2. The emergence of and manifestations of an ecological paradigm in a number of fields within the context of postmodernity, such as holistic science (Waldrop 1992, Goodwin 1994, Harman 1994) ecological economics (Costanza1991, Daly 1996), and ecological design (Todd and Todd 1994, Lyle 1994, Wann 1996).

3. Renewed attention to systems thinking as an approach to addressing the challenge of sustainability (Meadows 1992, Clayton and Radcliffe 1996, Bossel 1998, Bell and Morse 1999).

4. Calls for whole systems thinking in education and learning (Milbrath 1989, Meadows 1992, Sterling 1996a and 2001, Mulgan 1997, Laszlo 1997), and work on alternatives to dominant neo-liberal views of education and learning based on more integrative and holistic values (King and Schneider 1992, Smith 1992, Toyne 1993, Posch 1996, Sterling 1996a, Banathy 1991, Delors 1996, Hargreaves and Fullan 1998, Laura and Cotton, 1999, O' Sullivan 1999, Smith and Williams, 1999). Further, the emerging idea of 'social learning' (Finger and Kilcoyne 1995, Slaughter 1995) pointed to the process and possibility of deeper cultural change.

These two sets of starting points present respectively, the 'bad news' and the 'good news'. The first invite an inquiry into how far a systems perspective can illuminate and explain both the unsustainable nature of current courses of development and the difficulty education has in responding to this critical issue. The second invite an inquiry into how far whole systems thinking and perspectives can renew and re-vision education generally and environmental education in particular to help create a more sustainable society and future.

1.4 Research questions

As stated above, the primary research question is:

> 'How might whole systems thinking assist the revisioning of (environmental) education in the light of an emergent postmodern ecological worldview?'

As noted earlier, the Thesis attempts to take a systems approach through identifying interrelated levels of inquiry. Four contextual levels are identified (which correspond

with the four foci identified in subsection 1.1 above. In terms of systems logic, these four questions can be seen as a nesting hierarchy which starts at the larger context and works down. (Note that sustainability is treated as an overarching context and is therefore a recurring theme.)

Thus, the first task is to examine the nature of change at the most fundamental and most general contextual level of study. This involves critical reflection on the idea of 'paradigm' (largely used here interchangeably with 'worldview'); the idea of 'paradigm change' in the current context of postmodernity; and evidence for and the nature of what appears to be an emerging postmodern ecological worldview in Western culture. Hence the first subquestion is:

1. What is the postmodern ecological worldview?
Exploration of this question will cover the following themes:
- modes of thinking, thought as a system, worldview and paradigm
- the nature of paradigm change and Bateson's learning levels
- outline of the bases of Western thought
- the postmodern condition and perceptions of crisis
- the possibility of revisionary postmodernism in the light of deconstructionism
- identification of and evidence for the postmodern ecological worldview

The next step is to examine the development of systems thinking, primarily in the last century. Secondly to critically reflect on how far systems thinking is ecologic, and ecological thinking is systemic, and how they may be coming closer together in whole systems thinking as an expression of an emerging postmodern ecological worldview in Western society. A simple original model or framework is suggested here to illustrate the meaning of whole systems thinking, representing philosophical, theoretical and practical aspects.

Hence the second subquestion is:

2 What is whole systems thinking and what is its contemporary significance?
Exploration of this question will cover the following themes:
- the emergence of systems thinking and a brief review of different schools of systems thinking

- emergence and development of whole systems thinking as part of the ecological worldview - including historical precedents and current developments, particularly in science
- differences and continuities between systems-as-discipline and whole systems thinking
- systems thinking as a bridge to and a means of understanding the postmodern ecological worldview
- an integrative model of whole systems thinking and key concepts
- systems thinking and sustainability
- criticisms and limits of systems thinking

The third subquestion examines the extent to which the theory-practice gap - as regards calls for education to lead towards a more participative and sustainable society - might be closed through the increased manifestation of whole systems thinking in cultural worldview and in education.

<u>3 How might whole systems thinking inform paradigm change in education as a whole?</u>
Exploration of this question will cover the following themes:
- the relative lack of engagement of education in sustainable development
- calls to clarify the nature of and role of education in the postmodern world
- different systemic visions of a transformed and transforming education
- paradigm discourse and the possibility of a participative, ecological paradigm
- a systems view of paradigmatic change through epistemic or transformative learning
- social learning and the current prospects for systemic change in overall educational paradigm towards sustainable education through a co-evolutionary relationship between change agents within education and in wider society
- management and design and the possibility of transformative learning systems

This discussion then allows the paradigmatic development of environmental education to be examined against a systems viewpoint. The idea that environmental education is ostensibly holistic but, seen as a 'subsystem', has largely been bound by larger educational and environmental paradigms is explored, particularly in relation to the emerging concepts of 'education for sustainability' and education for sustainable development. The extent to which an ecological paradigm is excluded or encouraged

by dominant paradigms in environmental education is examined by looking at some recent trends.

This includes discussion of which aspects of current thinking and practice in environmental education might be questioned, complemented or extended from a whole systems perspective, as well as a critical evaluation of the limits of whole systems thinking. Thus the fourth and final question focuses on how far whole systems thinking might lend greater coherence and direction to the theory and practice of sustainability education.

<u>4 What is the relevance of whole systems thinking to environmental education theory and practice?</u>

Exploration of this question will cover the following themes:

- the underpinnings of environmental education (educational and environmental paradigms)
- the limits of environmental education in relation to sustainability
- elements of systems thinking in environmental education discourse
- theory of systems change
- implications of whole systems thinking for ethos, curriculum, management, pedagogy and learning
- the limits of whole systems approaches

If this nesting hierarchy is seen from the bottom up, it seems that it is not possible to answer question 4 adequately without looking at the context of 3, or 3 without looking at the context of 2, and so on up the hierarchy. It should also be noted that a jump from 1-4, or 4-1 is difficult and therefore each stage is part of building the whole picture. Therefore, the Thesis structure reflects its argument: that understanding and meaning is deepened through consideration of context.

Sustainability is an overarching fifth theme, as noted in section 1.1 above. The main questions here are:

- how do systems thinking and ecological thought respectively view sustainability, and how do these views differ from mainstream views?
- how does sustainability imply the need for whole systems thinking, and how does whole systems thinking contribute to sustainability?

Lastly, the main research question implies further discussion of specific practice and effect which may be summarised by these questions:

- What pedagogies and methodologies exist or can be developed to nurture systems thinking competence in people?
- How does the introduction of systems thinking contribute to systemic awareness and sustainability?

These important questions are answered to some extent below, particularly in sections on transformative learning, but their detailed consideration lies largely outside the intended bounds of this particular study. There are two reasons for this: one that they lie beyond the main purpose of the Thesis which is primarily philosophically oriented, and second, they require a full study in their own right.

2 METHODOLOGY

2.1 Placing the research methodology

The nature of the inquiry

I now discuss the nature of this inquiry.

- It falls into the tradition of scholarly inquiry, rather than empirical study.
- It concerns an open and broadly-drawn question, and therefore is itself broad in scope.
- It is philosophically oriented, looking at fundamental questions of worldview, epistemology and ontology.
- It is partly descriptive, partly explanatory - and partly exploratory and speculative.
- It is an 'informative inquiry' not a 'transformative inquiry'. It is an informative inquiry about transformation, that I believe might help others engage with issues of transformative learning and paradigm change.

Heron (1996) makes a distinction between informative and transformative inquiry, as the two pillars of co-operative inquiry, the first being essentially descriptive and explanatory, the second exploring practice and in so doing being transformative of it. I believe the Thesis will have transformative potential for some readers (judging at least, by feedback on my Schumacher Briefing, Sterling 2001, which was based on my then uncompleted Thesis).

The research tradition

I have tried to employ a methodology consistent with my understanding of the emerging new research tradition of *participative inquiry,* which, I argue, can be seen as an expression of the ecological worldview within the field of research. Alternatively, (but consistently), this might be also be seen as a *systemic inquiry.* Thus, the Thesis is not in the traditions of positivism or critical theory (although it has more in common with the latter than the former in that it embraces constructivism and is to an extent reconstructionist), and while it has some commonality with interpretivism, I believe goes beyond this liberal research tradition. It may be that it should be named 'deliberative theorizing' (Scott, 1996) which is concerned with normative rather than empirical questions, but again I believe it transcends this interpretive position. It may be that it is 'critically reflective inquiry' (Hart 1993) but this appears too directly associated with the emancipatory tradition. I recognise the contribution and value of this tradition but emphasise 'appreciation' before 'emancipation' as a guiding value in methodology.

I think my methodological position is inclusive rather than exclusive, that is, it acknowledges the validity of mainstream research positions, whilst in some ways reaching beyond them. It has something in common with established research traditions, but can also be differentiated. This argument is pursued in some depth in Part C.

The methodology can be best positioned in the light of the 'new' research paradigm that is associated with the concept of *participative reality* (which as noted earlier, is a fundamental concept in this Thesis). This paradigm (discussed in Part C) is variously known as 'co-operative inquiry' (Heron 1996) or 'participative inquiry' (Reason and Bradbury 2001).

> (It)...is a form of participative, person-centered inquiry which does research *with* people not *on them* or *about* them. It breaks the old paradigm separation between the roles of researcher and subject.
> (Heron 1996, 19)

How can I call a literature based research study 'participative'? Firstly, it is *about* participativism, but also it is founded on my own experiential knowing from many years of full-time active participation in the environmental education and sustainability education debate and communities, interacting with many of the leading players as well as working with teachers and other educators. It is also active in the sense that I have

played a *creative* role in the research, and according to Heron (1996, 202) - referencing Popper - there is no precise methodology for creating new ideas. A number of the ideas arising in this research have been exposed to and derive from personal interaction with others, particularly through my association with Schumacher College, Dartington, an 'international centre for ecological studies' where I led a course on 'Systems Thinking and Learning for Change' in April of 1998, and have been privileged to engage with leading ecological thinkers and scholars over the decade of the nineties.

It is also participative in that I have as far as possible tried to be aware of my dialogue, (Greek *dialogos* 'through meaning') i.e. my engagement, with the meaning of those written sources to whom I owe great debt. 'Participative' is one word I would use in describing the methodology, but other descriptors may also be usefully employed. Not least, I see it as a systemic inquiry. These further descriptors are outlined below.

Methodology descriptors

I have claimed above that I have employed a 'systems approach' in writing the Thesis. What I mean by this is that it is underpinned by an essentially relational view of the world, that I seek to discover and explicate pattern, and that I use systems concepts and models, not least in the structure of the Thesis. In addition, to *systemic* I believe the following additional descriptors are appropriate:

- *appreciative* - my approach has been integrative, recognising and building from disparate 'partial validities', that is, different truth claims
- *creative* - I attempt to develop new ideas by bringing together insights and concepts from different areas
- *deliberative* - both analytical and developmental
- *critically reflective* - it is reflexive with regard to others and my own ideas
- *informative* - it is presented as a body of thought that can inform the debate
- *epistemic* - it is about an emergent epistemology: the research has changed me, and might help radical change in others' perspectives; and as far as possible I have sought to be critically aware and transparent about the role of my own values and perceptions.

Of these, I will comment more on the first descriptor ('appreciative') as I think it is one of the keys to the approach I have endeavoured to use. One of the recurrent themes in the Thesis is the persistence of dualism in our individual and collective psyche, and in our thinking. This extends to discourse whereby one party attempts to assert validity or

veracity by negating or disproving the opposite viewpoint. This is a method which is an inherent part of academic debate. It is an expression of binary thinking - 'I am right because you are wrong'. Whilst a useful and appropriate approach at times, it tends to ignore the value and veracity of 'opposite' views. Rather than this 'either/or' thinking, we can employ 'both/and' thinking, which does not deny difference but does recognise partial validity. Wilber (1997), for example, suggests that no mind can be 100 per cent wrong, and therefore he seeks to integrate partial truths into a greater, or more adequate, whole. This is consistent with the idea of multiple views of reality and that any claim to a more adequate view must embrace multiple views.

This appreciative approach links to *abduction* which is discussed in the subsection below.

Methods - and the role of abduction

The main methodological tools I have used are:

* *collection* - gathering sources across the field of inquiry. This included material and ideas gathered years ago, up to and including the whole period of Thesis writing. In terms of 'data' (although this is a somewhat arid term for the informational and conceptual sources of this Thesis) the main sources have been a large number of books and papers, followed by conferences, courses and seminars, and informal discussion. Four courses attended at Schumacher College, Dartington, between 1993 and 2000, ranging from one week to four weeks in duration, have been key influences on my thinking and writing. For one of these I was the lead tutor, for another, the facilitator, and a participant at the remaining two - including a month's course with Fritjof Capra in the summer of 1993.
* *analysis* - examing the elements to look at their relevance to the whole field of inquiry.
* *abduction* - attempting to perceive pattern between disparate elements.
* *synthesis* – using these findings to distill and substantiate insights, assertions, and generic models.

The process has included intense and continuing reflection, reading, note-making, cogitation, unplanned moments of insight, constant 'triangulation' of ideas against others' ideas, and iterative learning over a period of eight years. I have had discussions on aspects of the Thesis over the years with a small number of colleagues interested in systems thinking and learning.

Of the four methods described above, I wish to comment on abduction, as again - like appreciation - it is a key to my approach here. Bateson (1972) differentiates between *deductive* and *inductive* thinking on the one hand, and *abductive* thinking on the other. This is fundamentally about recognising patterns of likeness between things, and reasoning by analogy - 'this is to this, as that is to that'. In his seminal work *Mind and Nature* Bateson (1980, 9) coined the phrase 'the pattern that connects' - a phrase that has been much used by holists since. Van der Hoorn (1995, 63) whose research on 'ecosystemic thinking' (which I take as largely synonymous with 'whole systems thinking') is largely based on Bateson states:

> Abductive thinking involves perceiving patterns that connect by using both non-rational and rational logic. The usual duality between rational and irrational is complexified by the introduction of non-rational logic as a viable and scientifically valid form of reasoning. Non-rational logic encourages scientists to look for patterns across apparently disparate phenomena. Doing so may give rise to creative insights which cannot be generated through rational logic.

This describes an approach which seems to me to be part of my perceptual being, rather than just a methodological tool. As noted in the Preamble, I am constantly wondering how things relate, always looking for pattern in complexity. I seem to have an ability to find parallels and patterns of thought between and within different sources, and used this to a great extent in my use of written sources.

Along the same lines, the systems thinker Senge makes an important distinction between what he terms 'detail complexity' and 'dynamic complexity'. The former concerns situations characterised by many variables and "complex arrays of details" (1990,72), while the latter concerns subtle patterns of change over time. Senge's idea of systems thinking is very much centered on dynamic complexity, with "helping us see the deeper patterns lying behind the events and the details" (73). This perhaps echoes the holistic idea of being able to 'see the wood as well as the trees', and seems to tie in with Bateson's view of abductive thinking.

The field of inquiry - education, learning, holism, systems thinking, complexity theory, sustainability, and paradigm change - is enormous. If we take a 'detailed complexity' approach to this field, we are literally lost. It is not possible to make this intelligible by the analytic tradition of breaking the area up into separate parts. Instead, I have looked for *pattern,* to render dynamic complexity intelligible. And so the Thesis is largely about exploring tentative ideas and theses based on patterns, analogies or 'relations between

parts' (Bateson 1980, 9*). Essentially, I am interested to explore this question: w*hat is it that mutually illumines learning, education, sustainability, systems thinking, ecological thinking, and sustainability - are there patterns that connect these areas*?

Intuitively, and before this doctoral research began, I felt there were important patterns, and part of the motivation for the Thesis work was to discover, explore the substance of, and suggest such patterns - together with any insights that arose in the process. Hence, in advocating a 'whole systems' approach, I have tried to use whole systems thought, that is engage my feeling and intuition, and my non-rational logic, as well as my rational intellect.

This brings me to assumptions informing the research, and this is discussed next. (Further discussion of my interpretation and use of the terms 'epistemology' and 'ontology' may be found in section 3.1 below.)

Assumptions

My ontological assumptions are that:

- reality is ultimately unknowable, but this does not deny the existence of an independent reality.
- that reality has both physical/material and non-material/mind/spiritual dimensions, and that 'everything is connected to everything else' - that is, I proceed from an assumption of connection rather than disconnection, of relationship rather than separateness.
- that mind and matter are not separate in the Cartesian sense, but complementary, co-defining and co-arising (a panexperientialist view).
- that the cosmos is one of fundamental self-organising order rather than chaos and randomness. For example, I would agree with Flood's reading of complexity theory that it suggests if not fully explains "a hidden order, or simplicity, in the seemingly impenetrable complexity of the world" (1999, 2).
- that some form of holistic/systemic/ecological thinking and knowing allows us a more adequate approximation than oppositional realist or idealist positions allow.
- that an ecosystemic or whole systems view of ontology takes us beyond the realist and idealist argument whilst recognising the partial validity of both views. I call this position *relationalism*, a position which recognises a 'participative reality' (Heron 1996).

- that we live in a time of planetary sustainability crisis which has ecological, economic, social, and political aspects, rooted in an existential crisis of purpose, meaning and perception in Western culture.

My assumptions about epistemology are that:
- the adequacy of our epistemology particularly in Western culture is critical as we are in a participatory relationship with reality (whether we realise it or not).
- we know both far less about the world (in the ontological sense) than we think we know, and far more (in the intuitive, inspirational and non-rational sphere) than we commonly appreciate (if we did but recognise and access it).
- we therefore need to value and develop our capacities for 'other ways of knowing' - including intuitive and non-rational knowing - in addition to rationality, empiricism and scientific knowing.
- we need to recognise the subtle and pervasive power of dualism, separation, and reductionism in our perception and epistemology, even where we believe we have surmounted them (reference Bateson's epistemological error).
- propositional knowing based on rationality or empiricism is only part of our current knowing, and that the ecological, participative worldview implies an extended, deeper and more integrated epistemology.
- the knower is implicated in the known, and awareness of this is 'participatory knowing'.
- participative knowing involves both a sense of connectedness and critical thinking
- discussion about epistemology does not necessarily affect our operative epistemology.
- although epistemology and ontology are often discussed and considered separately, in our day-to-day operative worldview they are co-defining.
- 'system', 'organism' and 'ecology' are useful metaphors for understanding phenomena, and are key to an ecological epistemology.
- as taught by Eastern traditions of enlightenment and Western mystic traditions over hundreds of years, we can state that is possible to achieve greater levels of awareness and self-realisation in life through a process of 'coming to know', which can be triggered through transformative learning.
- epistemic, or transformative learning, inevitably leads towards some form of ecological or relational worldview.

This last point is key. It is a point which I have discussed personally with Richard Bawden (July 2003) (whose work has influenced mine) and with which he concurs.

My assumptions about the role of values in research is that they are inescapable and need as far as possible to be recognised and transparent. I believe my own values are apparent from the much of the text above, particularly the Preamble and Methodology sections. Essentially, I am interested in transformative research - work which makes a positive difference to the human and non-human prospect, and I hope that this Thesis may fufill this description to a useful degree. I now discuss some of the issues that have arisen in developing the Thesis.

2.2 Methodological issues

Paradigm change and self-reference

The key issue turns on the question of paradigms. The Thesis attempts to explore how we might transcend our shared cultural paradigm through whole systems thinking. The problem here concerns how far talking about worldviews inevitably still remains within the parameters that one wishes to escape. It is a problem of self-reference, which is indicated by this quote from Meadows (1999a,105):

> It is so hard to talk about worldviews. It's like trying to see the lenses of one's own eyes, trying to bite one's own teeth, trying to explain one's language without using that language.

In terms of the concept of learning levels (as discussed below in A.3.1 and B.1.3) the Thesis is trying to talk about transcending the trap of self-reference, and the possibility of re-constructing our cultural paradigm at a higher order of learning which represents a change of worldview.

Most discourse however, takes place within the bounds of what what systems thinkers term first order learning, whereby fundamental assumptions lie unexamined. Even where paradigms are the subject of debate, for the most part, this discussion is at a different and 'lower' logical level (than is being attempted here) and essentially concerns subparadigms within a constant (largely mechanistic) paradigm that remains fundamentally unchallenged. In other words, most debate and discourse revolves around differences of perspective, but within accepted parameters and on the basis of accepted axioms which are often unarticulated. This facilitates communication and discussion and reduces the need to negotiate common starting points, even where

viewpoints appear diametrically opposed. But where 'a new paradigm' is being discussed, by definition, the parameters and axioms change, beyond the limits of 'conventional wisdom'. They need to be identified, articulated, and negotiated. These new ideas challenge assumptions within the existing dominant paradigm, and can therefore be viewed as threatening, heretical or nonsensical.

Consequently, it can take considerably more time and space to generate understanding and facilitate discussion, because the new paradigm pushes boundaries outside common experience and norms. There are further problems. If there is indeed a current cultural shift in whole or in part towards a 'new ecological paradigm', no one can know for certain where on the spectrum of change societies (or parts of societies) may now be situated, where such change might be going; or even what - with any certainty - constitutes a paradigm which is in the process of formation. (Such understanding would only be achieved with the hindsight of our descendants.)

Therefore, clear identification and articulation of the characteristics of a worldview still-in-the-state-of-becoming is not simple. Then too, the dominant paradigm of modernism is not at all dead but in a state of adaptive change and in tension with postmodern deconstructionism. These orientations may or may not allow the growth of the 'postmodern ecological paradigm', with which they overlap. Further, as a product of the dominant paradigm, I may be advocating systemic thinking with a mind far more deeply rooted in reductionist and dualistic ways of thinking than I realise or can consciously know, and any reader might be similarly handicapped. As noted above (Heron 1992, 251), "It is a big shift for concepts to move from being simply beliefs held in the mind to beliefs that inform and transform the very act of perception". In other words, it may well be possible to discuss 'whole systems thinking' in a way which conforms with analytic logic and reason, but does not embrace forms of knowing which are suggested by a more holistic way of thinking and being.

The limits of propositional knowledge

Academic convention favours propositional knowledge, almost exclusively. As Heron (1996, 33) remarks, academic research "rests on the unquestioned assumption that intellectual knowledge is the only valid and respectable outcome of systematic inquiry. This one-dimensional account of research offends a fundamental principle of systemic logic, the logic of whole systems". Hence, he suggests that propositional knowledge should be seen as part of a larger or extended epistemology which includes other ways of knowing. Similarly, Reason (1994,12) suggests that the

Western separation of intellect from experience means that intuitive, practical, affective, analogical and spiritual knowledge is valued less highly.

Following academic conventions, the argument in the Thesis is largely presented as propositional knowledge, which is perhaps contrary to the idea of a larger epistemology implied by whole systems thinking. But I am at least aware of the limitation here: and the argument is informed by my own experiential, intuitive, and practical knowing. Further, my effort to reflect a systemic logic in the structure of the Thesis (see 2.4 below), to reflect systemic thinking approaches and models in the argument, and use abduction, distinguishes the text from a conventional linear narrative. At the same time, and in common with many ecologically oriented writers, I am intentionally using propositional argument as a 'necessary but not sufficient' means of attempting to help shift the mainstream ground of intellectual debate.

Writing and reading the Thesis holistically

One of the problems with an abductive approach is that as a writer, you cannot always explain how you made the connective leap between elements, and if you do try, you run the risk of losing the reader in 'detail complexity'. As I have tried to write more holistically - to indicate pattern, to use recurring models, to use iteration, to employ nesting system structures - it requires the reader to also read differently than is the norm, at least to some exent. Some of the content of this Thesis does not yield itself to simple critical analysis; rather it requires the reader to also engage in making connections, and to think integratively, to come with an appreciative mind first and critical mind second, and aware of his or her own participation with the Thesis in part and as a whole. In other words, to balance the tradition of academic rigour with a participative imagination.

A good deal of normal intellectual discourse is about detail complexity, rather than context and pattern, and while analytic rigour over details remains important, so too is an ability and willingness to recognise insights and arguments derived from overview and connectivity. In working towards a systemic worldview, Mary Catherine Bateson suggests "analysis is only a fraction of the task, for analysis has always been a means of control" and rather, suggests that what are required are "*moments of imaginative recognition*" (Bateson 2000, xiv, my italics). This phrase captures the essence of abductive thinking.

Use of models

The attempt to write in an holistic rather than 'building block' way about holistic content presents two related problems. The first concerns the difficulty of conveying multiple relations and connections in a sequential text, the second concerns the extent of material that might be covered. Because the territory is potentially borderless, not only does one have to decide where to draw one's *boundaries* (and this is a critical concept in systems approaches), but also, be able to navigate the territory.

To tackle both these issues, I have worked on, developed and used models a good deal (and this is a strategy I have used for many years in writing and teaching) because I believe they help change or deepen perception. As Lissack (1999, 4) writes:

> …old models of thinking persist long after they are productive. New ways of thinking don't just happen; they require new models that have to be learned.

To take a dictionary definition, a model is:
> an abstract way of presenting the relations between…phenomena. Models will not necessarily perfectly represent the actual world but will provide devices which simplify and aid understanding of the essential mechanisms involved.
> (Abercrombie *et al.* 1984, 158)

Models are essential to human understanding. From simple concepts like 'dog' or 'tree', to metaphors, diagrams, complex theories, and indeed whole paradigms (the Greek word *paradeigma* means model), their function is to represent and interpret the world. They are very powerful, not least as so often we confuse the map (model) for the territory, and can either liberate and enlighten or constrain and confuse.

Models and modelling are essential parts of systems approaches, to represent and generate new insights on a given reality. Following Bateson, I have sought to find and elaborate 'the pattern that connects' the many ideas and lines of enquiry I have tried to touch on in this study. In sum, I have tried to use a *systemic approach to develop systemic models to clarify a systemically related field.*

In so doing, I am aware that the models I have elaborated, do simplify – like all models. But I hope that they clarify and make the field more understandable. They are, to quote

the title of Waddington's unusual book of 1977 which was written to encourage relational thinking, 'tools for thought'.

The secondary meaning that models represent always raise questions of validity. As Heron (1996, 185) says, in a comment which might apply to the validity claims of the whole Thesis as well as the models presented therein:

> It is all the time a moot point how much (our) conceptual maps….reveal primary meaning by reflecting it and pointing towards it, and how much they obscure it by irrelevant, imported theorizing. There is no final account; only one that strikes the best available deal between (our) lived experience of primary meaning on the one hand, its linguistic and cultural context on the other, and (our) transformation into secondary meaning, which mediates between them.

In this Thesis, my emphasis is on sense making: I use conceptual maps to make further sense of my lived experience, in a way which, I hope reflects and points towards it rather than obscures it, and I hope, might help others.

Box A.5: Models developed in the Thesis

The main models elaborated are:

- Three part model of learning levels
- Three part whole systems model of paradigm (human experience and knowing)
- Nesting systems models (several)
- Four part model of learning responses – towards transformational learning
- Mechanistic v ecological management model
- 'Education in change' and 'Education for change' model
- Education *about, for* and *as* sustainability model
- 'Edge of chaos' model of learning

Apart from the first (which is after Bateson and others), and the nesting systems as a common device, these models are original and have been developed during the course of the research.

The 'nesting systems' model is employed frequently and variously in the Thesis both in the text and as a framework for the contents, and I shall explain it further here. One of the most important concepts in systems thinking, nesting systems derive from General Systems Theory (see Part C.1.1) and was notably developed in Koestler's (1967) idea

of 'holons'. According to this idea, reality can usefully be modelled as a hierarchy of systems nesting within each other, where the bigger context (suprasystem or metasystem) shapes, limits and helps give meaning to the smaller part (subsystem), rather like the analogy of the Russian doll. This is often drawn as a series of simple concentric circles, as in the diagram on the left. The diagram on the right is a variation to show nesting subsystems at equivalent level.

Diagram A.2: Nesting systems
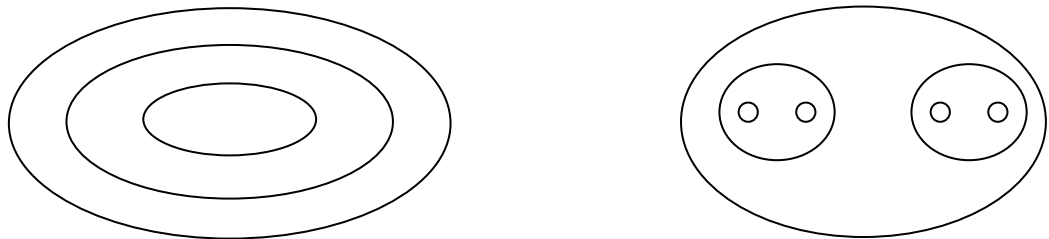
The nesting systems model is particularly useful in helping distinguish between contextual levels and helping understanding of the relationships between them. Yet, where one draws boundaries in any system model, or what the boundaries mean, is often a matter of debate - and sometimes contention. The 'real systems' that such models describe are open to a greater or lesser degree, and interact with sub- and supra-systems to a greater or lesser degree. For most purposes, the hierarchies of social, economic and environmental systems "culminate in the Earth system" or ecosphere (Clayton and Radcliffe, 1996, 48).

➤ Key point: The importance of the ecosphere as the bounding context is at the heart of the Thesis' argument.

Finally, there is a point here about labelling and sequence. Rapport (1998, 15) suggests that *models* describe how things work, whereas *theories* explain things, but *conceptual frameworks* help us think about phenomena - to "order material, revealing patterns - and pattern recognition typically leads to models and theories". So it may be that whereas I have used the term 'model', it would be more appropriate to call these models 'conceptual frameworks'. In the sense that they are all abstractions and representative, I am not convinced a hard distinction between 'models' and 'conceptual frameworks' is necessarily helpful, and I suspect they co-arise to some extent. But certainly, the models I have developed here are intended to assist pattern recognition.

For me, they both help give rise to and help articulate the sometimes tentative theories advanced in this Thesis.

Structure

Like any writer who seeks to adopt a holistic approach to be consistent with their holistic subject matter, I have been faced with the tension between systemic and systematic modes of organisation. Systematic order is reflected by sequence and the gradual building of argument. Otherwise, I have tried to follow systems ideas in the design of the Thesis. So for example, the four Parts (which follow Part A) are presented as nesting systems. Further:

➢ Keypoint: I have tried to write so that each Part has systemic coherence in itself and can be read alone, but also, so that the Thesis as a whole has systemic coherence from each of the Parts. In this way, the whole is suggested in the Part, and the Part is in the whole.

The task has been more akin to making a net than building a wall, and has often been difficult - how to convey backward and forward links, levels of meaning, and contexts as the text develops. I can identify with Goldsmith (1992, xvii), who, describing his account of writing 'an ecological worldview', *The Way,* observed, "the task has been more difficult than I originally thought, because it has meant describing each of its…propositions in terms of all the others, and hence in terms of the whole". So rather than construct discrete building blocks, I see each of my Parts as coalesences of ideas strung on themes that run like seams throughout the whole - themes such as postmodern ecological worldview, paradigm change, learning levels and transformative learning, sustainable systems, and so on.

Bounding the research

Boundaries are a key concept in systems approaches, particularly in 'second order systems thinking' which involves recognising and questioning assumptions and values. So the question arises - how have I bounded this research? The answer is approached by looking at two levels of boundaries which concern respectively the 'map' and 'the territory'. I recognise the difference between these - that my account say, of the postmodern ecological worldview, may differ from somebody else's account or map, as a cultural worldview cannot be definitively captured as such, quite apart from the limitations of language.

Further, I recognise that my interpretations (including of others' interpretations) are filtered, and constructions influenced, by my worldview and values. I recognise that this is not (and cannot be) a neutral or objective inquiry. I have an interest in substantiating the case for whole systems thinking, for an ecological worldview, for paradigmatic change - although this does not diminish the rigour of the work, I hope. Thus, I have chosen to look at the fields and those authors which help me build the argument, although I have acknowledged varying and sometimes counter views within the overall construction. I further recognise that how I conceive and present 'whole systems thinking' is influenced, and perhaps constrained, by my own perceptions.

A second boundary issue is what I've chosen to include and exclude from the territory in terms of subject matter. The continual paradox has been that while I develop and advocate the idea of whole systems thinking - which implies that to be consistent I should take a very inclusive approach to the content - one always has to exercise limits. The subject matter is potentially boundary-less, and judgements about what was necessary to the argument, and what was interesting but not necessary, were ever part of the process. Periodically, I have indicated below where and why I have drawn boundaries. Finding valid and coherent patterns and conclusions rather than dealing with exhaustive content has been the key here, but I always had to decide how much background was necessary in order to inform and justify any conclusion or assertion. The juggling was between breadth and depth.

First, *breadth.* The Thesis constitutes a similar volume of work as more conventional doctoral studies but is more a 'horizontal' sweep than a vertical in-depth study. This breadth is consistent with the emphasis on looking at whole systems, and allows me to look at and draw out patterns from range of fields, and thereby I think strengthen the validity of the argument as a whole. For example, the system writer Banathy suggests that in designing new educational systems we should "develop the largest possible picture of education within the largest possible societal context" (1991, 16), but this is a formidable task, and boundaries must still be drawn. I have at times been daunted at the difficulty of doing justice to the richness and relevance of this field of enquiry.

I could instead have concentrated specifically on systems thinking as a competence and its place in environmental education in a very focused way, and indeed, this might be a more conventional approach. In the attempt to demonstrate rigour and find some virgin territory where the flagstaff of originality can be implanted, research degrees tend to be in-depth, and by so doing often omit reference to broader levels of context.

Arguably, this can be problematic from both environmental and epistemological aspects. Orr's quite scathing remarks illustrate a view of the first point. In a chapter with a title (adapting Thoreau), 'What Good is a Rigorous Research Agenda if You Don't Have a Decent Planet to Put it On?' he comments:

> the fact that human survival now hangs in the balance is not itself of much interest to social scientists unless it can be translated into familiar terms, and converted into a well-funded research agenda.
>
> (Orr 1992, 164)

Another reason for the breadth adopted here is that the subject matter of the Thesis is probably contentious in as much as it challenges some conventional wisdoms, and therefore it is necessary to indicate the contextual justification for some of the directions and arguments that are explored here. Lastly, there is a danger that systemic approaches become incorporated by modernist paradigms in education, and unable to perform any useful transformational role. For this reason, it is necessary to review the broad foundations of the case for whole systems thinking in environmental and sustainability education, rather than leap into elaboration of say, practical methods, which might be regarded by others only as an 'add on', rather than a paradigmatic challenge to dominant educational theory and practice.

Despite the breadth of the research, I have deliberately made decisions to limit some lines of inquiry. In particular, the Thesis is less detailed on the history of systems philosophy, ecopsychology, 'inner knowing' and spirituality, thinking skills, critical realism, and detailed examples of sustainable education and transformative learning. It covers design and management for change briefly: it would be wrong to omit this, yet I recognise this is a large subject in its own right. Other areas - including my chosen four bases of whole systems thinking, and ecological design and adaptive management - are discussed in **Appendix I**. These decisions were largely made on grounds of space and economy. Intentionally, I do not discuss the politics of knowledge in terms of critical theory in detail, or employ a deconstructive approach to paradigm and language. This is because my first concern is with the primary power of the dominant paradigm in shaping Western identity, thought, discourse and action.

The potential cost of breadth is lack of *depth.* I was reluctant to go into areas of interest where it was obvious that only superficial treatment would be possible. I have tried to provide enough depth to capture the essence in any area - to be simple but I hope, not simplistic.

Triangulation

Another problem is that because the thinking both researched and developed is fairly 'leading-edge', there aren't many critiques of the ideas which can be drawn on. This made it difficult to assess validity at times. Similarly, a further problem has concerned 'triangulation'. As a creative researcher, it has been difficult to find sufficient people with expertise and similar interests to bounce ideas off, and my supervisor has been honest about which areas he felt less qualified to comment on. Where discussions have taken place, it has often been on specific aspects of the argument rather than greater wholes. Again, Schumacher College has been important resource in this respect.

This brings me to the next subsection which concerns validity.

2.3 Reliability and validity

Conventional measures of reliability i.e. dependability are not appropriate to this research. The orientation and findings of the research are consistent with an emerging understanding in this area, not least evidenced by a growing literature which reflects integrative thinking in the areas of sustainability, ecology and education. The extensive Reference section is a reflection of this movement. What is more questionable is how far my interpretation of and contribution to the field is sound, and this raises the question of validity. On this matter, I've drawn particularly on Heron who, in advocating the participative research paradigm that I also outline in the Thesis, assesses the questions of validity in relation to more established research traditions.

Thus, Heron (1996, 172) states that 'informative inquiries' are valid according to three criteria: *linguistic* (meaning grammatical and intelligible); *logical* (showing internal coherence of meaning) and *contextual* (relating to propositions made by others in the same field of inquiry). He adds that they also need to be grounded, on the basis of *experiential knowing*. On all these criteria, and in particular on the basis of my own lived experience both personal and professional, I believe the research can claim validity i.e. can claim well-foundedness. In particular, I think the Thesis displays *systemic coherence*, and that the argument as a whole, is more than the sum of its parts. It relates to and draws on others' propositions, and it is grounded in my own experiential knowing. Heron (1996, 173) notes that, "A proposition about the world is well-grounded in experiential knowing when it integrates both empathic communion with the interior presence of what is there, and intuition of significant pattern in its perceptual appearing" and this I believe reflects my approach.

Further, in relation to the contextual criterion - I have demonstrated a critical awareness of key debates - for example, between systems thinking and systemic thinking (or first order and second order systems thinking), between simple environmentalism and ecologism, between deconstructive and revisionary postmodernism, between realism and idealism and their expressions in the sustainability education literature, and so on. I've shown and discussed brief histories of the main fields discussed to put them into context.

I also recognise, as noted above, that my perspective will still be *my* perspective, even where I seek to describe what I claim here to be an increasingly shared perspective. But in writing the Thesis, clearly I am making some truth claim, not in absolute terms but in the sense of 'articulating reality' - which Heron defines as "a combination of both revealing and shaping, of finding meaning in and giving meaning to". Thus, whole systems thinking implies knowing, and knowing implies some relation with truth in the sense that Heron uses the term.

However, to the extent that the research is creative and concerns an emerging field of study, validity will be shown partly in hindsight. Further, some aspects of validity will only be established through practical manifestations of the research findings: I agree with Heron's assertion that an informative inquiry is not complete until the outcomes are taken into transformative enquiry (practical validity), although to no small degree this has happened and is happening through my previous work: this is described in more detail in Part D. Direct and indirect feedback on this work has helped validate the sort of ideas that are presented here: people working at different levels of educational systems are finding them practically useful.

Post-structuralists and postmodern deconstructionists, might want to critique this Thesis and question its claims to validity. I believe their position has certainly helped the health of intellectual debate, but is also problematic for reasons which I present in section B.1.5. Most notably, in relation to the crisis of unsustainability, I think deconstructionists leave us intellectually adrift, that is with no guidance on action. Heron goes further in describing the poststructuralist denial of the possibility of validity as "suicidal and nihilistic" (1996, 158). There is a further issue here relating to both the value and limits of constructivism, and this is returned to in some detail in Parts C/D.

2.4 Organisation of the thesis

As described above under 'Structure', the conceptual framework of the research inquiry is consistent with an approach that characterises systems thinking, that is, it looks at the broader picture through distinguishing different but interrelated *levels of context* in order to provide and enrich meaning. During the writing process, it took some time for this to emerge clearly. The content and organisation of the Thesis were a major challenge, and both underwent a number of radical changes.

The Parts

With the exception of the Conclusion (Part E), the structure of the Thesis largely follows the main nesting hierarchy (described in subsection 1.1. above, and in the Reearch questions):

Part A: Introduction
Part B: Worldviews in Change (including the emergence of whole systems thinking)
Part C: Whole Systems Thinking in Education and Learning
Part D: Revisioning Environmental Education through Whole Systems Thinking
Part E: Conclusion

A substantial Appendix I 'Elaboration of Whole Systems Thinking' provides more detailed discussion of the bases of whole systems thinking, and the implications of the triadic model developed in the main Thesis.

Diagram A.3: Nesting structure of the Thesis (Parts A-D)

Part A

Part B

Part C

Part D
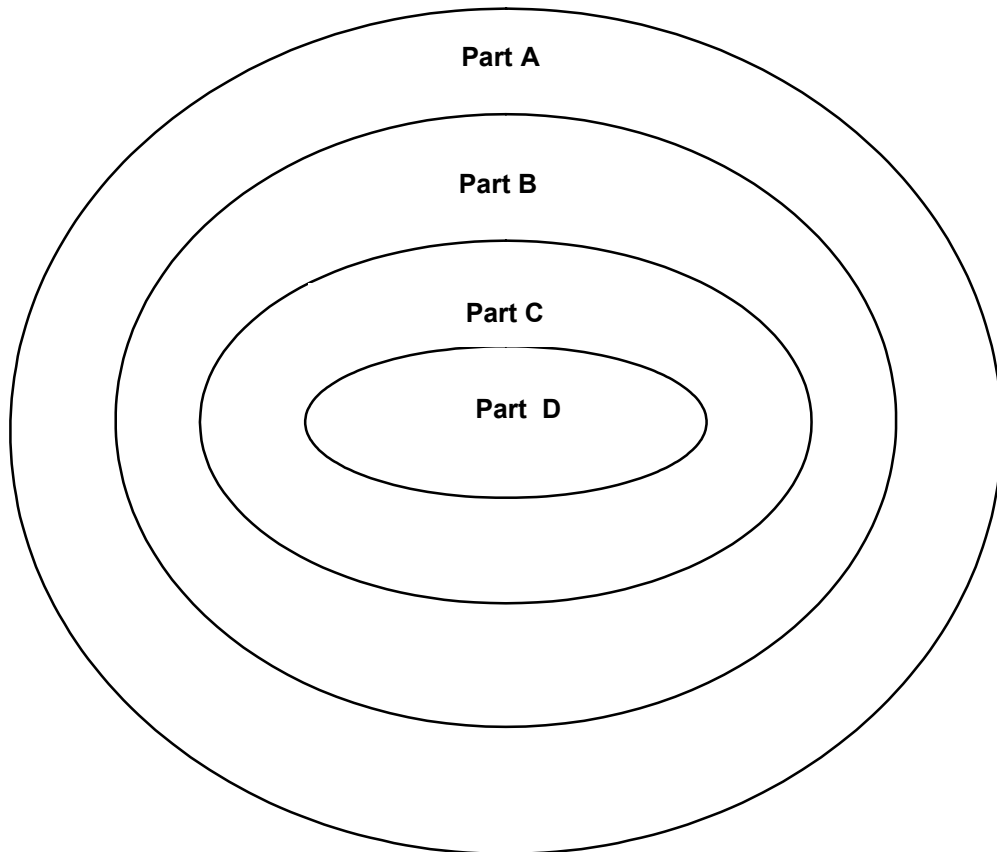
➢ Keypoint: At a more detailed level, this main hierarchy can be seen as incorporating two further nesting hierarchies. While they are less explicit in the structure of the Thesis, they informed and helped organise my thinking. They are:

• Whole systems thinking as *emergent change* - 'systems in society' bias.

• Whole systems thinking as *potential change* - 'systems in education' bias

'Systems thinking as emergent change' hierarchy

This bias is essentially *descriptive* and concerns evidence of systems thinking within the four foci reflected in the research question (as introduced in A.1.1):

Level 1 is the nature of the postmodern ecological worldview and, by implication, of paradigm change

Level 2 is the emerging nature of whole systems thinking

Level 3 is evidence of systems thinking in the educational paradigm

Level 4 is evidence of systems thinking in environmental and sustainability education

This hierarchy funnels down from the broad landscape of social paradigm, to the detail of environmental education discourse. To some extent, these themes are also treated *iteratively* throughout to clarify the relationship between them and to provide as far as possible a holistic perspective within an otherwise sequential text.

'Systems thinking as potential change' hierarchy

This second hierarchy is more *speculative* and concerns how conscious adoption of a more systemic way of thinking and organising particularly in educational endeavour might move us towards holistic education - which I term 'sustainable education' - and a more sustainable society.

Here, five levels of context are envisaged:

Level 1 is whole systems thinking as *cultural worldview*. The potential role of whole systems thinking in clarifying and progressing an emergent postmodern ecological worldview through social learning and education.

Level 2 is whole systems thinking as *educational paradigm.* The implications of whole systems thinking as a basis for an overall educational paradigm, and its possible challenge to dominant educational paradigms which influence discourse, policy and practice in education.

Level 3 is whole systems thinking as *design and management.* How it might be reflected in systemic change and systems management in the areas of curriculum theory and design, organisational ethos and management, and community/social links.

Level 4 is whole systems thinking as *pedagogy and practice.* How it might be reflected in classroom practice, in teaching and learning method.

Level 5 is systems thinking as a *subject and competencel.* The teaching and learning of systems thinking as a discipline in educational practice.

In sum, these may be restated as whole systems thinking:
1. as cultural worldview
2. as educational paradigm
3. as educational design
4. as educational practice
5. as a competence

Again, these levels can be viewed as a nesting hierarchy of subsystems, which support and reflect each other, with Level 1 as the suprasystem and the others as nesting subsystems. Thus, 1 implies and 'contains' 2; 2 implies contains 3; 3 contains 4 and so on. Banathy (1991) argues that such levels are operational in current educational discourse and practice, and therefore any effective redesign of education must take account of all levels, changes within them, and their relationship to each other.

To address each of these levels and the relationship in depth between them would be a very large task. The perhaps most obvious focus would be to concentrate solely on Level 5, which is the most immediate and practical area of enquiry. While there has been relatively little research in this area to date, there is some work (Keiny and Zoller 1991, Sheehy 1997, Wylie 1998). Whilst systems practice and competence is important, a sole research focus at this level would be unlikely to take full cognizance of the influence of the larger contexts on this level.

While the contextual Levels 3 and 4 are considered towards the end of the Thesis, the main part of this inquiry is devoted to Levels 1 and 2, in the belief that progress here will clarify and inform the tasks that I or others might undertake in the future with respect to the more practical levels. The reason for this emphasis is first, that there is a good deal of material emerging that relates to systems perspectives at the paradigm level which has hardly been explored in relation to environmental education as far as I am aware, and second, I believe clarification of theory in the area of paradigm both energises and indicates directions for practical research and there is evidence from my own work and others' that 'thinking differently' does indeed open new doors. In addition, and not least, having worked for years in levels 3-5, I have become increasingly convinced that deeper change is required.

Navigation, summaries and iteration

Given the length, I have provided summaries at the head of each Part. Cross-referencing indicates where important points are dealt with in other parts of the whole. Keypoints which might otherwise get buried in the general argument are indicated as such. Further, iteration is used to remind and help the reader, and carry the argument forward. Thus, a key idea such as 'learning levels' is revisited several times, but each time the argument is in more depth. This device also allows a reader to read Parts and sections in isolation and get some sense of the whole, without reading the whole Thesis.

In sum, navigation in the Thesis is facilitated by the following devices:

- 'Purpose' of Part set out concisely at the head of the Part
- Introductions and Summaries provided in each Part
- Summaries at the end of sections within the Parts
- Keypoints used in the text to highlight key or summary arguments
- Cross-referencing
- Taking stock and iteration where necessary to remind reader

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Heading

Note: there are four main weightings of heading:

- the Part (e.g. Part A);
- the Section (e.g. Section A.1);
- the Subsection (e.g. A.1.1),
- and the 'sub-subsection' indicated by unnumbered italic and bold heading.

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3 INTRODUCING THE FIELD

In this section 3, I outline more of the territory that is to be explored in greater depth in subsequent Parts of the Thesis. A 'Key concepts' subsection reiterates, defines and develops some of the main ideas and further indicates my interpretation and starting points. This is followed by subsections on calls for a new worldview, on the potential and limits of systems thinking, on paradigm and paradigm change, on learning levels, and on the educational context.

3.1 Key concepts

To assist the reader, some of the key concepts employed and elaborated in the Thesis are introduced. Following on from the 'Methodology' section above, this further 'sets out my stall' or starting points.

Epistemological error

Gregory Bateson suggested that Western thought was characterised by what he termed an 'epistemological error' which he saw as the root of the ecological crisis.

Thus he states:

> When you separate mind from the structure in which it is immanent, such as human relationship, the human society, or the ecosystem, you thereby embark, I believe, on fundamental error, which in the end will surely hurt you.
> (Bateson 1972, 461) (*and*)
> When you narrow down your epistemology and act on the premise 'what interests me is me, or my organisation, or my species', you chop off consideration of other loops of the loop structure.
> (Bateson 1972, 460)

➤ Key point: Bateson's notion of the 'epistemological error' is a critically important argument and problem which underpins the Thesis as a whole.

Hence he pointed to both a *perception of* and *belief in* separateness which, while it works to a degree, is ultimately destructive. Hence, he suggests:

> Epistemological error is all right…upto the point at which you create around yourself a universe in which that error becomes immanent in monstrous changes of the universe that you have created and now try to live in.
> (Bateson 1972, 461)

Global warming, to consider just one major critical issue, comes to my mind, on reading this passage. I consider Bateson's insight, which stands as a radical challenge to the individualism, anthropocentrism and dualism of most Western philosophic traditions, to be profoundly important. However, I prefer the term 'epistemological inadequacy', which recognises our dominant epistemology as representing 'part-truth'.

Epistemology

It is important to explain further my view of what I mean by 'epistemology' and how I use this term in the Thesis. Conventionally and in philosophy, it is seen as the study of the nature of knowledge, its origins, structure and validity. Harries-Jones, a Bateson scholar, contrasts the conventional philosophic sense with Bateson's own interpretation. Thus he suggests Bateson means by epistemology "the examination of knowledge in an operational sense: the 'how' of knowing and deciding, rather than the 'what' of the origins and validity of knowledge" (Harries-Jones 1995, 8). This *operational* sense is reflected in Bateson and Bateson's (1988, 208) definition of epistemology being about "the necessary limits and other characteristics of the processes of knowing, thinking and deciding". Similarly, Keeney (1983, 13), a colleague of Bateson, suggests epistemology refers to "how people...know things and how they think they know things; how people come to construct and maintain their habits of cognition". Harries-Jones (1995, 83) suggests that both Wittgenstein and Bateson thought that epistemology should no longer simply talk about metaphysical propositions, but "aim at improving thinking in everyday life" and that both writers "consistently try to demonstrate thinking as an 'operation' of everyday living".

I use 'epistemology' here then, to mean or describe the operative way of knowing and thinking that frames people's perception of and interaction with the world. Hence, Milbrath (1994,117) describes worldviews as "epistemological structures for interpreting reality that ground their picture of 'reality' in their own construction". Thus, in brief, and to illustrate the point, the operational epistemology or 'knowledge system' of the dominant techno-scientific worldview which influences us all, is essentially positivist, objectivist and reductionist, and based upon the root metaphor of mechanism.

Therefore, I suggest (following Bateson) there is a close association between epistemology and perception - between how we know and how we see. I believe that our perception is not 'neutral' but coloured by our spiritual grounding and awareness, our belief system, our creative imagination, and our experiential histories. Thus perception is informed by the *inspirational*, the *affective*, the *imaginal*, and the *experiential* domains. I argue that purpose is associated with or informed by epistemology because, if we take a view of perception that includes *a priori* knowing, or revelation - what Bawden (2002) calls inspirational knowing as opposed to 'just' experiential knowing, or 'just' a sensationist view - then it is hard to divorce this from values and beliefs. If this is the case, then it is important to see worldview, perception

and epistemology, ethos and ethics as (consciously or unconsciously) all *operationally associated* rather than as separate, and I would argue that this is an holistic and extended interpretation of epistemology. Bateson similarly saw epistemology in inclusive terms. It is:

> ...the great bridge between all branches of the world of experience –
> intellectual, emotional, observational, theoretical, verbal and wordless.
> Knowledge, wisdom, art, religion, sport and science are bridged from the stance
> of epistemology.
> (quoted in Harries-Jones 1995, 9)

Therefore, a change in epistemology implies a change in worldview. This is suggested by Keeney (1983, 7):

> The deepest order of change that humans are capable of demonstrating is
> epistemological change. A change in epistemology means transforming one's
> way of experiencing the world.

I argue in the Thesis that that the postmodern ecological worldview implies a changed and extended epistemology, based on *participativism*. Bateson called this a 'recursive or ecological epistemology'.

In sum, the meaning of 'epistemology' in discourse is complicated by its differing use by authors. It is either employed in a broad umbrella sense (as above) to imply paradigm - and by inference therefore also implying an associated axiology, ontology, and methodology (as above), or in the more conventional and restricted sense to mean beliefs about the nature of knowing. In this latter - more conventional - sense, epistemology, is *one part* of paradigm, the other parts being *ontology* (belief about the nature of being or reality), *axiology* (belief about values) and *methodology* (intrepretation in practice) (Bawden, 2002).

From a systemic point of view, what seems important is the *relationship* between these aspects of knowing. To dissociate epistemology, ontology and methodology seems to be characteristic of the fragmentary paradigm we need to transcend. If, as Bateson suggested, "epistemology is that science whose subject matter is itself" (quoted in Harries-Jones 1995, 9), then it would appear logical that we need to view our currently prevailing reductionist epistemology through an holistic lens if we are to transcend the former. Accordingly, a number of authors see the relationship between epistemology

and ontology as being so close that they conflate the terms, and certainly Bateson made no hard distinction.

Thus, my view and use of these terms follows Bateson's (1972, 314) which I see as a systemic view of their interrelation:

> In the natural history of the human being, ontology and epistemology cannot be separated. His (commonly unconscious) beliefs about what sort of world it is will determine how he sees it and acts within it, and his ways of perceiving and acting will determine his beliefs about its nature.

Ontology

In philosophy, ontology is the branch of metaphysics concerned with the study of existence and reality and includes "the assumptions about existence underlying any conceptual scheme or any theory or system of ideas" (Flew 1979, 256). Thus, for example, realism, materialism, and idealism are ontological positions. I argue in the Thesis that the postmodern ecological worldview transcends the realism/idealism argument by subsuming them within a wider framework of relationalism. Paralleling my Batesonian view of epistemology, I use ontology to mean our lived or operational sense of reality.

Having argued (above) that it is helpful to view a pattern of association between our (both personal and culturally shared) *epistemology,* our *ethos* and our *perception*, I similarly argue that it is helpful to recognise a pattern of association between our *ontology,* our *eidos and* our *conception,* that is our belief about reality and being is directly related to how we conceive and articulate it.

Methodology

Methodology means 'the logos of method', the principles upon which a method is based (Checkland 2002, 105), but it is also used to describe the practice dimension of paradigm, arising from and related to theory and epistemology. It can be used in this broad sense, or in relation to a particular set of procedures or practices.

In the Thesis, I largely use the former sense. Again, I argue that it is helpful to recognise a pattern of association (rather than equivalence) between *methodology, praxis* and *application*.

Participative reality

The idea of participative reality, to quote Heron (1996, 10), holds that there is "a given cosmos in which the mind creatively participates, and which it can only know in terms of its constructs, whether affective, imaginal, conceptual or practical…Reality is always subjective-objective". This is a systemic view of the dialectical relationship between the cosmos and our continuing interaction with it and in it. This view of reality appears to be confirmed by the 'biology of cognition' associated with Maturana and Varela (1987) which holds that our view of the world is not representational but biologically constructed.

The problem is that if we imagine the world inadequately, founded upon an insufficient metaphor and through a narrow epistemology, then dysfunctions arise in the world - as noted by Bateson (1972). The challenge then is both to gain a more adequate epistemology and worldview, and at the same time, achieve a participative consciousness (Berman 1981) and critical subjectivity (Reason 1993) more able to recognise the nature of - and responsibility of living in - a participative reality.

Realism, idealism, relationalism

The idea of a participative reality takes us beyond the ontological positions of - and beyond the schism between - realism and idealism. Realism is a view that suggests there is a reality or world that exists independently of perceptions of or beliefs about it. It is the dominant view, reflected in empiricist, positivist, analytically based philosophy that has informed Western thought in modern times. In philosophical study, this view is usually contrasted with idealism, which suggests that what appears to be the external world is created by mind. In extreme form, idealism (or strong social constructivism) suggests that there is no independent material reality, while in a more moderate form it suggests that material reality exists but cannot be known, only our constructions of it. I suggest that whole systems thinking transcends, subsumes and integrates these contesting positions. It incorporates the ecological realism fundamental to much environmentalism, but *also* fully acknowledges the role of perception and of language emphasised by idealists and constructivists. It transcends the limits of the realist-idealist divide by marrying both positions within what I call 'relationalism', essentially a panexperientialist view. It suggests new metaphors of ecology and living systems which can overcome the pervasiveness of the influence of the mechanistic metaphor, and the limitations of text as metaphor.

Connective pattern

I use abductive thinking to investigate the possibility of what I call a meta-connective pattern between ecologically sustainable development practice and an ecological view of education. Rather than an ethos of manipulation, control, and dependence arising from the modernist and mechanist paradigm, the ecological paradigm emphasises capacity building, self-renewal and self-organisation in the individual and community as a necessary basis for 'systems health' and sustainability. I look at such principles as diversity, holarchy, relative autonomy, resilience, emergence, community and integrity, and practices such as ecological design, adaptive management and participative inquiry to indicate relationships and parallels between sustainability practice and 'sustainable education'. Thus, I argue, 'learning and education' and 'sustainability' appear far more closely related than is commonly supposed. The former often emphasises autonomy, capacity building, and participation, the latter emphasises self-organisation and self-renewal, community and resilience. Both are essentially about process and emergence, rather than about product and control. It is therefore valid to distinguish 'learning as sustainability' which I equate with transformative learning, from the more common terms and practices labelled 'learning about' or 'for' sustainability.

Paradigm and paradigm change

I use the term 'worldview' and 'paradigm' interchangeably, (except that paradigm is necessarily a collective term, see B.1.1). These concepts are discussed in more detail in B.1.1 but for now, Harman's definition (1988,10) - which reflects a broad consensus of opinion amongst commentators - is useful. A paradigm is:

> the basic way of perceiving, thinking, valuing, and doing associated with a
> particular vision of reality.
> (Harman 1988,10)

I distinguish three components of paradigm the *ethos,* which refers to the affective level, values and norms, *eidos* which refers to the cognitive or intellectual paradigm, and the *praxis,* which refers to 'theory in action' and behaviour, both what is done (and not done) and how it is done.

In terms of paradigm change, I share the Kuhnian view that change occurs when there is realisation of a critical mismatch between the prevailing paradigm and conditions in the environment. However, while Kuhn suggested that science as a 'community of interest' underwent *revolutionary* change characterised by the emergence of a new and incommensurable paradigm, in terms of individual and social learning, I subscribe to an *evolutionary* view of paradigm change characterised by learning and implying a degree of overlap and commensurability (Wilber 1996). This is touched on at several points in the Thesis (see for example, A.3.4 below) and applies to the historic 'three moments of paradigm change' outlined next.

The three 'moments' of paradigm change

This table suggests and summarises the historic movement from the still dominant modernist paradigm, to the idealist/constructivist position or moment, and pointing towards the emergent postmodern ecological worldview. By grouping key words under these three positions, I am not suggesting their equivalence, but under each moment, a broad coalescence or pattern of more or less compatible ideas. The evolutionary relationship between these positions is indicated by Diagram A.1 earlier.

Table A.1: Mapping fundamental paradigmatic positions: moments, movements and metaphors

Moments and movements		
First order change	**Second order change**	**Third order change**
Modernism	Postmodernism (decon.)	Revisionary postmodernism
Foundationalism	Pragmatism/critical theory	Participativism
Realism	Idealism	Co-evolutionism
Materialism/dualism	Dualism	Panexperientialism
Universalism	Relativism	Relationalism
Objectivism	Subjectivism	Critical subjectivity
Positivism	Constructivism	Participatory knowing
Environmentalism	Ecologism	Whole systems thinking
Hard systems	Soft systems	Whole systems thinking
Root metaphors		
Mechanism	**Text**	**Living systems/organicism**
(Organicism)	Mechanism	(Text)
	(Organicism)	(Mechanism)

The relative influence of root metaphors is roughly illustrated by whether they are shown in bold, ordinary type or in brackets. Hence, under the postmodern ecological worldview, 'mechanism' and 'text' are subsumed rather than dominant. Note that I have not shown 'critical realism' on this table. I would place critical realism as somewhere between the second order and third order positions - as indicating a pathway towards the third order position because it seeks to reconcile realist and idealist positions.

Domains, aspects and dimensions of experience (triadic model)

In writing this Thesis, I have developed what I call a whole systems triadic model which attempts to map three interrelated *domains* of human experience (referred to as Seeing, Knowing, and Doing). Each of these domains reflects *aspects* of, or

perspectives on, human experience (being *cognition*, *knowing*, and *paradigm* or belief). In turn, each of these aspects could be said to have three components or *dimensions*. This model is summarised in Table A.2 below (and further explicated in **Appendix I,** section 2.) I suggest it is both valid and helpful to recognise a pattern of correlation between *three dimensions of cognition*, *three dimensions of knowing,* and *three dimensions of paradigm* or belief, and that such a model helps simplify and clarify important relationships and use of terms. The first set of terms (re cognition) is favoured by those interested in learning, the second set (re knowing) by those interested in philosophy and research and the third set (re paradigm) by those interested in belief systems. By bringing them together, I am not suggesting equivalence, but relationship, pattern and influence.

The triads are brought under the headings of the Seeing, Knowing, and Doing domains as follows:

Table A.2: Aspects and dimensions of Seeing, Knowing, Doing

ASPECTS ⇩	*Seeing domain*	*Knowing domain*	*Doing domain*
Dimensions of cognition:	Perception	Conception	Practice
Dimensions of knowing:	Epistemology	Ontology	Methodology
Dimensions of paradigm:	Ethos	Eidos	Praxis

This affords a simple systemic model through which all these broad facets of knowing - however described - may be seen in interrelation. The Venn Diagram A.4 below suggests the dimensions exist in interrelationship within the three domains of Seeing, of Knowing, and of Doing. Further, I think this 'whole systems model' allows us to represent the ecological critique of Western culture, of Western ways of seeing/knowing/doing, as well as indicating an integrative ecological alternative. It is a bold claim, but I am suggesting that much of the body of discourse on this subject can be represented through this model. Thus, virtually all writers from an ecological perspective, in some way point to *dissociation* between or within these three dimensions of knowing, and/or to the *narrowness* of each of them in the mainstream culture. By the same token, virtually all ecological writing seeks to both broaden/deepen and re-integrate these areas of knowing: I return to this theme in Part B.1.6 'The postmodern ecological worldview – looking at essential ideas'.

Learning

Following thinking in the systems field about learning, I understand learning to have two essential characteristics, correction and meaning-making. 'Correction' is not meant in any moral sense, but in the stochastic sense of accommodating the change in the environment that leads to learning, for example through a change in factual knowing, belief or behaviour. Meaning-making refers to the cognitive attempt to interpret and understand the learning stimulus.

Learning levels

The notion of staged learning levels is central to the Thesis. Whilst paradigm change is essentially about learning - if there is no learning, there can be no paradigm change - it is clear that most learning that goes on within and outside learning institutions normally makes no difference to individuals' or to society's overall paradigm. Yet, education and learning are consistently advocated as 'the answer' to addressing the issue of sustainability. To address this paradox, I use and adapt Bateson's theory of nested learning levels. The significance of this is that it helps us to distinguish different qualities of learning and associated levels of change, and thereby helps clarify the nature and challenge of deep change that, I maintain, the transition to a more sustainable society requires. Bateson distinguished four main orders of learning and change (from 'zero-learning' to Learning III), corresponding with increases in learning capacity. These levels may be seen as nested systems whereby the learner recognises the wider context of his/her previous learning level. This theory has been adopted and adapted by learning and change theorists, particularly in the field of systemic learning and organisational change.

Specifically, I employ the theory of learning levels to help illuminate paradigm change. Whilst Bateson was interested in fundamental change in epistemology, he did not specifically elaborate on worldview change in relation to his learning level theory. While the theory can be used to understand situated learning such as in organisational change, it is also applicable to the issue of cultural worldview change. Moreover, his view of 'Learning III' as a state of awareness whereby "every detail of the universe is seen as proposing a view of the whole" (Bateson 1972, 277) implies a consciousness of interrelation which, I argue, would give rise to an operative ecological worldview and epistemology.

Bateson's writing often appears opaque and he was frequently misunderstood in his lifetime (Harries-Jones 1995). He intentionally used non-linear forms of argument to

suggest the nature of the knowledge he was trying to convey. Whilst this was intended to change the context of his readers' thinking, it also lead to difficulties of comprehension (Harries-Jones 1995, 81). As regards learning levels, various authors have interpreted and adapted Bateson's fundamental idea of learning levels differently, whilst following his logic of nesting systemic levels. My own use might differ from what Bateson strictly meant, but it is consistent with other interpretations, for example Hawkins (1991) and particularly Bawden (1997a, and 1997b), and I would defend its elaboration on grounds as to whether it is meaningful, helpful and practicable. Following Richard Bawden's work, and his experience at Hawkesbury College, Australia (which is outlined in more detail in Part C) I explore the notion of third-level 'epistemic' or transformative learning which I argue is fundamental to paradigm change. I argue that sustainability ultimately requires such a deep learning response, and that this corresponds with the necessary 'change of consciousness' outlined above and implied by the need to resolve Bateson's 'epistemological error'. This clearly may have far-reaching implications, not only for educators, but for educational organisations, institutions and policy-makers, and this is explored in Part C.

Transformative learning (epistemic learning)

I interpret 'transformative learning' to mean a quality of learning that is deeply engaging and touches and changes deep levels of values and belief through a process of realisation and re-cognition. It is equivalent in meaning to other terms such as deep learning, triple-loop learning, and epistemic learning. I argue that it inevitably gives rise to a heightened relational sensibility and sense of ethical responsibility.

Levels of educational response, and sustainable education

I employ the idea of learning levels to analyse the 'response-ability' of educational institutions, actors and the 'educational system' as a whole to the challenge of sustainability. I parallel and compare learning levels in wider society as regards the 'sustainability transition' (O' Riordan and Voisey 1998) with the response of education to sustainability using a model of three staged changes, being 'accommodation', 'reformation' and 'transformation'. I argue that, rather than 'education *for* change' or 'learning *through* education' - the common approach to education for sustainability - prior attention needs to be given to 'education *in* change' or 'learning *within* education', that is to the paradigm that underpins and informs the ethos, purpose, policies and provision in education. I suggest and outline the nature of an ecological educational

paradigm, and introduce the term 'sustainable education' to imply the change of educational culture that would arise from such a paradigm.
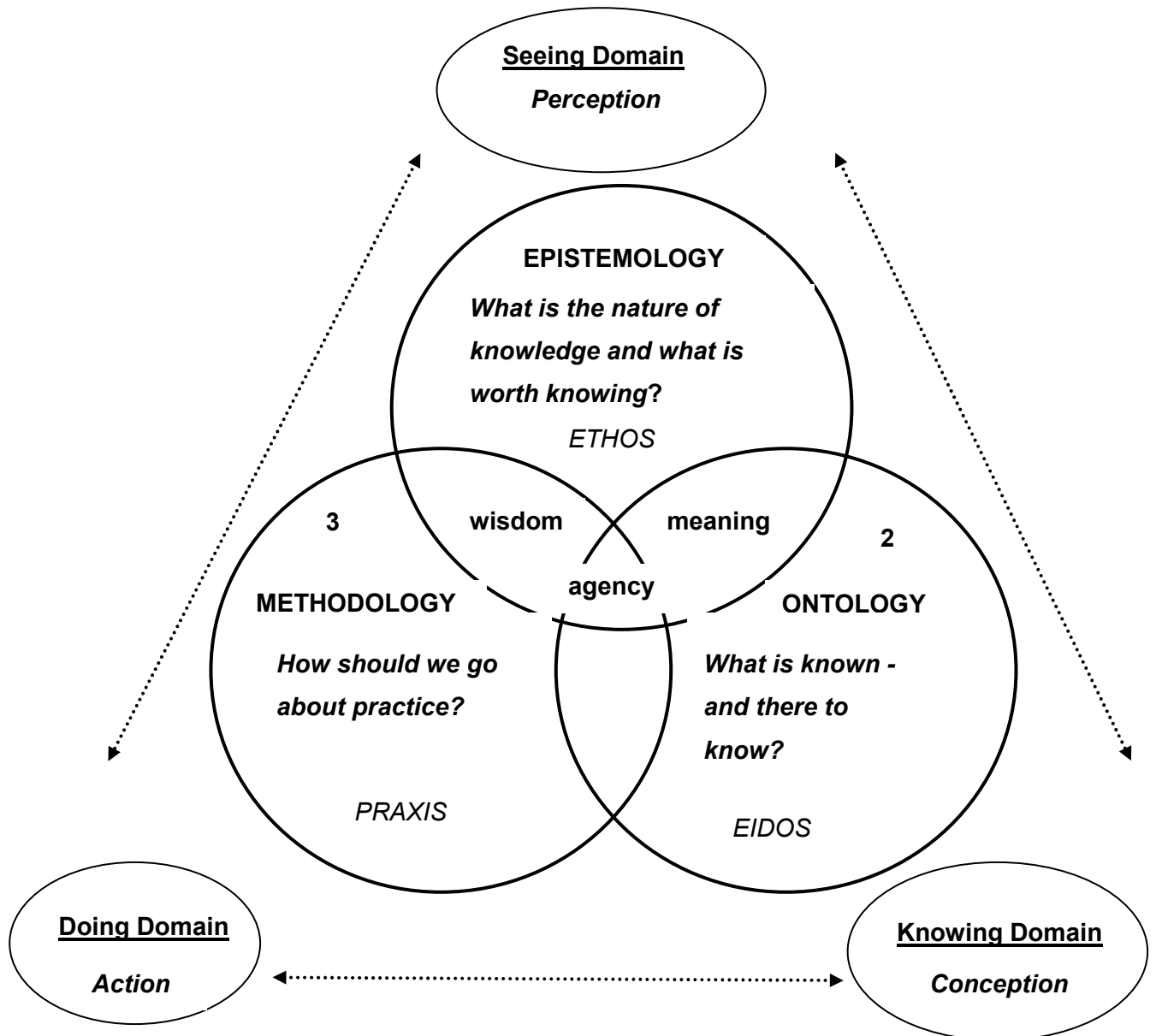
Use of the word 'system'

An epistemological use of the word 'system', as in second order systems thinking, involves the use of the concept to help make sense of the perceived world, whereby the observer treats some phenomenon '*as if it were* a system', that is, he or she is knowingly involved in defining the system. This is distinguished in the systems movement from an ontological use of the word system whereby a complex whole is regarded as an actual system (as in the common parlance such as 'education system' or 'legal system'). Second order systems thinkers argue that an ontological use of the word 'system' tends to remove the observer from conscious responsibility for defining the boundaries of any system so defined.

In the Thesis, I use the word 'system' in both ways (as do many systems writers) depending on context. As second order systems thinkers see first order use as a special case *within* the broader stance of systemic inquiry (Checkland 2002), I maintain that using the word in both ways is acceptable, as long as I am aware of my use at any one time.

Representing paradigm, knowing and cognition – a key model

This is one of the most key diagrams in the Thesis. The model suggests relationships *within* sets (e.g. paradigm: ethos, eidos and praxis), and *between* sets (paradigm, knowing, and cognition), as described in Table A.2 above.

Diagram A.4: Domains, aspects and dimensions of experience (triadic model)

Seeing Domain
Perception

EPISTEMOLOGY

What is the nature of knowledge and what is worth knowing?

ETHOS

3   **wisdom**   **meaning**   2

agency

METHODOLOGY   **ONTOLOGY**

How should we go about practice?   *What is known - and there to know?*

PRAXIS   *EIDOS*

Doing Domain
Action

Knowing Domain
Conception

Key:

Epistemology, Ontology, Methodology: dimensions of **Knowing** aspect

Ethos, Eidos, Praxis: dimensions of **Paradigm** aspect

Perception, Conception, Action: dimensions of **Cognition** aspect

This model is a recurring heuristic in the Thesis and is explicated further in **Appendix I.**

3.2 The calls for new thinking

The Thesis attempts to explore territory that commentators tend to penetrate briefly, if at all, in their calls for a change in human thinking. The critical questions concern 'from what?' - and 'towards what?', and 'how'? This issue is explored in more depth in Part B, and introduced here.

In recent years, there have been an increasing number of high level warnings which state that humanity as a whole has little choice but to move towards sustainable living patterns or face a scenario of increasing systemic breakdown and possible catastrophe, whether ecological, social or economic or some combination (WCED 1987, King and Schneider 1992, IUCN, UNEP, WWF 1991, Meadows *et al.* 1992, World Resources Institute 2000, Loh 2002).

Whereas early calls emphasised resource limits as the critical issue (Meadows, Meadows and Randers, 1972), a number of more recent studies echo Clayton and Radcliffe (quoted at the head of the Thesis) in calling for a fundamental change in *human thinking* as the key to sustainability. Thus Meadows' 1992 updated study of the limits to growth, twenty years on from the first seminal book on the same subject states:

> We see 'easing down' from unsustainability not as a sacrifice, but as an opportunity to stop battering against the earth's limits and to start transcending self-imposed and *unnecessary limits in human institutions*, *mindsets, beliefs, and ethics.*
> (Meadows, Meadows and Randers 1992, xvii) (my italics)

According to this view - and it is one that is shared by many commentators - the root of the 'world problematique' (Peccei 1982, Ekins 1992) (the nexus of seemingly intractable and tightly bound ecological, social and economic issues that characterise our times) lies in a crisis of perception; of the *way we see the world* (Bateson 1972, Skolimowski 1981, Laszlo 1989, Capra 1982, 1996, Spretnak 1997, Orr 1994). Accordingly, there are calls for 'a new way of thinking' (Clark 1989, Bohm 1992, Laszlo 1997, Capra 1996, Korten 1999, Elgin 1994, Milbrath 1989) or 'reperception' (Harman 1988) which allows us to transcend the limits of thinking that appear to have led to the current global predicament. From this perspective, the challenge of sustainability

invokes much more than technical or 'rational' solutions. Laszlo (1997,13) a noted holistic scientist and systems thinker, in a report for the Club of Budapest think-tank, states:

> To live in the third millenium we shall need more than incremental improvements on our current rationality; we shall need new thinking joined with new ways of perceiving and visioning ourselves, others, nature and the world around us.

Similarly, O'Riordan and Voisey (1998, 3), writing on the need to achieve what they call 'the sustainability transition', suggest that it "is as much about *new ways of knowing, of being differently human* in a threatened but cooperating world, as it is about management and innovation of procedures and products" (my italics).

Such writers follow the logic of Einstein's statement, quoted at the head of this Thesis, which insists that problems cannot be solved using the same consciousness or mode of thinking that created them, and that instead we need to perceive the world anew. Examination of many writers' descriptions of what the desired 'new way of thinking' might be, and which might transcend this trap, reveals much use of terms like 'integrative', 'holistic', 'systemic', 'connective', and 'ecological' yet their interpretation of these terms is rarely fully developed - and this is particularly the case as regards environmental education discourse. Mary Clark, in a lengthy work subtitled 'The Search for New Modes of Thinking' argues that it is "the West that is most in need of the 'new modes of thinking' that Einstein demanded" (1989, 472) because of the rate of environmental change that the science and technology associated with this worldview has created. This worldview, she maintains, has "grown maladaptive". Similarly, Rich (1994, 288) points out the danger of the dominance of this worldview: "the consequences of maladaptation in a single, global culture may entail disaster on a scale unprecedented in human history".

Following Bateson, others including Clark, Laszlo, and Senge (1990) suggest not only the need for a change in consciousness, but that we need to 'take charge' of the evolution of our own consciousness, at individual and social levels. According to Clark (1989, 235) in the last 2500 years, there have been only two "major periods of *conscious* social change, when societies deliberately 'critiqued' themselves and created new worldviews". So, following the example of Athenian and Renaissance societies, it would appear that our own time needs to be third period of deep reflection and change. A recent Worldwatch Institute report advocates that we should tap our

potential "as conscious agents of cultural evolution" in order to create a sustainable civilization (Gardner, in Brown 2001, 206). Seen from such perspectives as these, 'the learning society' is one that seeks to understand, transcend and re-direct itself through *intentional learning*.

Whilst I attempt to explore in this Thesis the nature of an emergent ecological cultural paradigm - which perhaps is evidence of this deep learning beginning to occur - the habits of mind associated with fragmentary and linear thinking are still very much with us. Mary Catherine Bateson (MC Bateson 2000, xiv) suggests that they:

> can be seen in every newspaper or newscast; the search for short-term solutions that worsen the problem over time; the focus on individual persons or organisms or even species seen in isolation; the tendency to let technological possibility or economic indicators replace reflection; the effort to maximize single variables (like profit) rather than optimizing the relationship among a complex set of variables.

Thus there appears to be a fundamental mismatch between the deeply systemic world we inhabit (and in part have created), and the fragmented way we predominantly perceive and think. In brief:

➢ Keypoint: we inhabit a relational world but we of the Western mind are informed by a fundamentally non-relational philosophy.

We might reasonably ask therefore, whether and how systems thinking might help us achieve a more integrative, more systemic 'change of mind' both at the level of individual and of shared culture. Yet to date, systems thinking has not achieved its early promise - and this is a view that is reflected in the systems community (Checkland 2002). As Flood states (1999, 27):

> Pockets of committed people across the globe…have kept alive aspirations of systemic thinking since its entrance in the 1930s and 1940s into Western thought. Apart from a number of forays that gave hope, but did little more than raise dust, systemic thinking has remained pretty much in the outback...as a vision of marginalised groups struggling to penetrate the educational and social mainstream.

Part of the problem is that for most people, systems thinking either appears obtuse and inaccessible, or it is simply unknown - quite apart from what Meadows (1982b) calls people's 'innate sense' of systems, a sensibility which does not rely on systems language as such. Thus part of the challenge to the systems community is to connect

with and engage people far more frequently and effectively than has been the case to date, and this includes of course, the education community. Clearly, there is much to do if systems thinking is to help us achieve the 'change of mind' that appears to be required.

3.3 Systems thinking and changes in worldview

According to Senge (1990, 68), the "essence of the discipline of systems thinking lies in a shift of mind". Senge's own work and its considerable influence in the field of 'the learning organisation' goes some way to exemplify the change in worldview he advocates, (although I would agree with Flood 1999 in his book *Rethinking the Fifth Discipline* that Senge's work is a limited representation of systems thinking).

The 'fifth discipline' identified by Senge in his book of the same name is systems thinking, which together with complexity theory, is increasingly seen as an essential to understanding and guiding organisational change, particularly in businesses (Ray and Rinzler, 1993). This interest in systems thinking in business seems to be evidence of a deeper change in the way some organisations think about themselves, which appears to accord with an incipient cultural change in worldview, at least to some degree. Incidentally, this interest in the business sector far outstrips interest in systems thinking in the education sector.

Senge's description of systems thinking is a useful starting point for elaborating its meaning and import. Senge (1990, 68-69) states:

> Systems thinking is a context for seeing wholes. It is a framework for seeing interrelationships rather than things, for seeing patterns of change rather than static "snapshots". It is a set of *general principles* distilled over the course of the twentieth century...It is also a set of *specific tools and techniques...*And systems thinking is a *sensibility* - for the subtle interconnectedness that gives living systems their unique character.
>
> Today, systems thinking is needed more than ever because we are becoming overwhelmed by complexity...All around us are examples of "systemic breakdowns" ..by seeing wholes we learn how to foster health.
> (My italics)

This quote appears in a chapter entitled 'A Shift of Mind', and subtitled, 'Seeing the world anew'. All this begs critical examination. For example:

- if systems thinking is as important as Senge and others say it is, why is it? On what grounds? And why now, at this stage of our cultural evolution?

- what does it mean? Is there one form of systems thinking, or is this a catch-all term for a number of different, perhaps very different, approaches?

- what is the cultural significance of systems thinking? What does it imply about other forms and more dominant forms of thinking - are these still valid from a systems thinking point of view?

- if non-systemic and linear forms of thinking are defining characteristics of our culture, how deep do these go? How possible is a shift of mind, assuming that it is necessary or desirable?

- what evidence is there for a shift of mind in Western culture? How would we know when we saw it?

- how does a systems approach to thinking help lead us towards a systems approach to thinking?

None of these questions can be simply answered, but they are explored in some depth in the Thesis. At this point, it will be helpful to introduce a conceptual framework which represents three critical aspects of systems thinking which I have identified, and which are represented by the phrases I have italicized in the Senge quote above.

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, methods, tools and skills. (This corresponds to Senge's 'tools and techniques'.)

These dimensions apply both to a personal or a shared social context and may be viewed from either perspective.

Diagram A.5: Three dimensions of systems thinking

Personal knowledge

Practical knowledge   Propositional knowledge
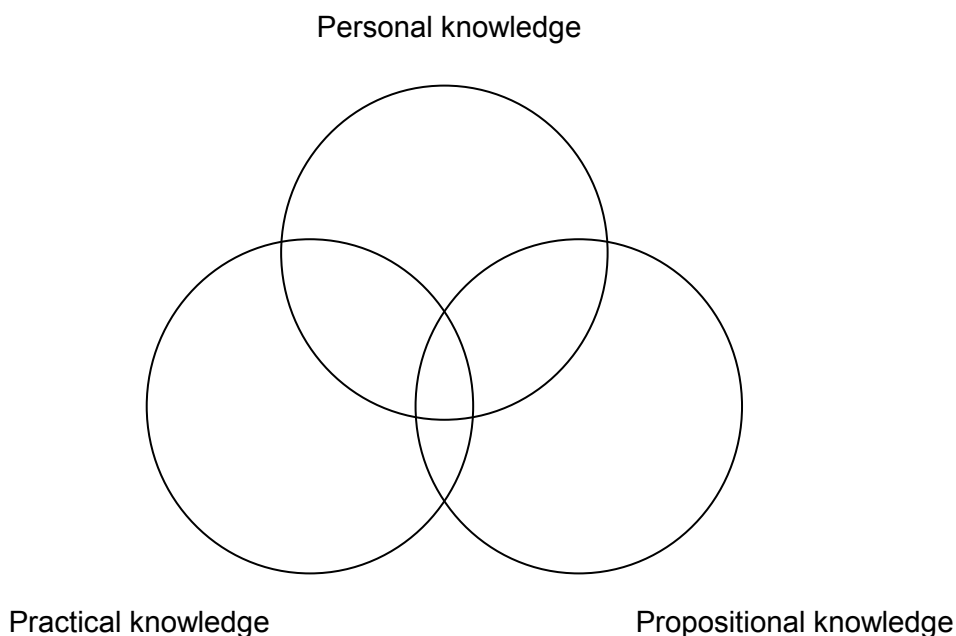
The Venn representation indicates that a whole systems approach to systems thinking recognises the importance of all three dimensions. This schema is consistent with the triadic model of paradigm, knowing and cognition introduced above.

In brief, systems thinking is: relational rather than non-relational; systemic and connective rather than linear and fragmentary; concerned more with process rather than substance, with complex dynamics rather than limited cause-effect, with pattern rather than detail, with wholes rather than parts. Common descriptors are integrative, holistic, contextual, relational, qualitative, dynamic, and, in its emergent form which is discussed here (whole systems thinking), ethical and epistemic. Its essential quality is that of *relation*: it seeks to understand in Bateson's seminal phrase, "the pattern that connects" (1980, 7), and in doing so, the thinker sees him/herself as a participant in the perception of that pattern. All this, as Senge (1990,78) and others suggest similarly, represents "a profound shift of awareness". However, there a difference between an ontological and an epistemological view of systems, and the former is less challenging to the dominant paradigm.

The *ontological bias* is based on the idea that systems literally 'exist out there'. This is characteristic of 'hard systems' methodologies, and for contained problem-solving applications this can be a useful approach. In the systems movement however, there is significiant tension between the ontological bias on the one hand, and the view that

primarily systemicity lies in the perception of the observer. This latter *epistemological bias* is essentially metaphorical. It holds that we cannot know whether 'systems' as such exist, that a 'system' is essentially a human construct which can be used to help understand a complex world. Yet it also holds that a systemic epistemology or lens appears more adequate than a non-systemic epistemology as it *appears* that we inhabit a systemic reality. An endemic problem is the systems movement is the frequent lack of conscious distinction between these two views of 'system' (Checkland, 2002).

System is defined (Capra 1993) as "an integrated whole whose properties cannot be reduced to smaller parts, because they arise from the interaction of the parts. These properties are destroyed when the system is taken apart analytically or physically". Donella Meadows defines a system (1989,16) as "an interconnected set of elements that is coherently organised around some purpose. That is, a system consists of three kinds of things: elements, interconnections, and a purpose". Capra's definition usefully and importantly adds the idea of *emergent properties* to these three characteristics. 'Purpose' in systems terminology means it exhibits behaviour like adaptation, or self-organisation. While in living systems these behaviours are a product of cognition (Capra 1996), 'purpose' does not necessarily imply teleology or consciousness.

As noted earlier, becoming a systems thinker implies for most people a change of consciousness, at least to some degree. Systems thinkers argue that a 'shift of mind' (Senge 1990, 68) is needed to enable humanity to live more harmoniously in what might be termed a 'systemic world' i.e. one characterised by a high degree of connection, or what Mulgan (1997) calls 'connexity' in ecological and human systems. But systems thinking goes beyond just awareness of this state of interconnection, or its rational description. As living is a participative act for all living systems (Goodwin 1999, Heron 1996) such thinkers argue, then humanity needs to recognise and develop a 'participative consciousness' which is aware of and works creatively as part of this dialogic reality (Berman 1981). The gradual emergence of a more systemic, ecological worldview in some parts of society in the last few decades may be interpreted as evidence of a systemic learning process, that is, a difference in outlook arising from awareness of the anomalies within and inadequacies of the dominant worldview.

To clarify a complex argument, I will use a crude analogy. Let us say the world is represented by a disk, with a circular hole in it its middle. Let's say the dominant way of seeing the world in Western culture is represented by a square peg. The anomalies

and problems caused by forcing a 'square peg in to a round hole' gives rise to difficulty, to some squaring of the hole, but also to learning. Some 'square peg people', a minority at first, move through such learning towards a 'round peg consciousness', a view which harmonises rather better with the way the world is, or appears to be. What also follows from this analogy, is the argument put by systems thinkers that the human predicament largely stems from the consequences of imposing a 'square peg worldview' onto a much more complex 'round' reality. For example, Bohm (1980, 16) states:

> …it is not an accident that our fragmentary form of thought is leading to such a wide range of crises, social, political, economic, psychological, etc. in the individual and in society as a whole. Such a mode of thought implies unending development of chaotic and meaningless conflict.

Similarly, Korten (1995, 11) in his critique of the dysfunctional effects of economic globalisation states:

> When we limit ourselves to fragmented approaches to dealing with systemic problems, it is not surprising that our solutions prove inadequate. If our species is to survive the predicaments we have created for ourselves, we must develop a capacity for whole-systems thought and action.

Thus a systems view emphasises a more holistic epistemology, ontology, and form of action, and coherent relation between them. The need for this is reflected in the Bateson quote at the head of this Thesis, which encapsulates the dialectic between worldview and reality. Thus, Bateson warns of the 'self-validating power of ideas: that the world "partly becomes - comes to be - how it is imagined" (1980, 223). In other words, what you 'see' becomes - over time - what you get because of the recursive relationship between our inner and outer worlds. Commentators argue therefore (see Ho 1998, Korten 1999, for example) that a mechanistic view of the world, that is, interpreting the world from the basis of a world-as-machine metaphor, together with a fragmentary epistemology, leads to the manifestation of mechanistic patterns of thought in the environment, for example in landscape, architecture, or biotechnology. (Ho's work in this respect concerns the issue of genetic engineering.)

'Square peg' thinking then, sees, projects, and reifies squareness. Or put more strongly, a dis-integrated worldview brings forth a dis-integrated world, and arguably, dis-integrated people in a mutual systemic cycle of affect. This mutuality is argued by Bohm: "If science is carried out with an amoral attitude, the world will ultimately respond to science in a destructive way" (1994, 350). As noted above, Bateson goes

further by arguing that our belief in the separateness of our individual and collective mind from that "in which it is immanent" such as human relationship, society or the ecosystem, is the fundamental "epistemological error" (1972, 461).

Elsewhere, Bateson states that:
> (This) is the sort of world we live in – a world of circuit structures – and love can survive only if wisdom (i.e. a sense of recognition of the fact of circuitry) has an effective voice.
> (Bateson, 1967 - in Berman 1981)

This I believe is a plea for whole systems thinking, which embraces non-verbal, affective aspects - what Bateson termed 'analogue knowledge' - as well as 'digital knowledge' which is rational and abstract. In the same passage, Bateson criticises a limited rationality "unaided by such phenomena as art, religion, dream and the like", one which is "necessarily pathogenic and destructive of life". There is a key argument here to do with rigour *and* imagination *and* wisdom, to which I shall return. What is implied here is more than systems as discipline, as it has evolved over the last half century or so. Systems thinking as a *discipline* is not, nor can it be, the sole basis of an ecological worldview, yet the ecological worldview is essentially systemic.

➢ Key point: Systems thinking is necessary but not sufficient to realising an ecological worldview.

This needs further explanation. The broad range of thought that gives expression to the emerging ecological worldview is termed 'ecological', whether it concerns philosophy or practice. It is reflected, for example, in the pages of *Resurgence* and in the themes of the courses at Schumacher College at Dartington. This worldview is systemic, that is, it is fundamentally based on the perceived primacy of relation. However, ecological thinking *does not* necessarily recognise the potential of 'systems as discipline' to clarify and advance ecological thought and practice. Indeed, people subscribing to this view are not necessarily aware of systems as discipline. On the other hand, systems thinking within 'systems as discipline', is not *necessarily* ecological.

➢ Key point: Ecological thinking is a form of systemic thinking that often largely ignores systems as discipline; while systems as discipline often ignores ecology in the broad sense.

What I term in this Thesis 'whole systems thinking' is an attempt to look beyond 'systems as discipline' and locate it into a broader ecological framework. This might rejuvenate systems thinking and help it achieve its long promised but little realised potential (see Flood 1999 quote above). At the same time, such a marriage would help render the ecological worldview more intelligible, dynamic and operational.

I suggest below that the conceptual framework of whole systems thinking derives from historical antecedents and current movements, all of which may be said to exhibit in some way manifestations of a systems view of life and the world. The four areas are not exhaustive - undoubtedly there are other areas which would be fruitful to explore, but I consider these areas key. They are listed in chronological order of emergence below, and are discussed in greater detail in **Appendix I,** Section 1.

1. perennial wisdom and indigenous worldviews
2. the organicist tradition in Western science and philosophy
3. the development of systems thinking and systems science, from the early 20th century onwards
4. holistic science, and particularly complexity theory

Whole systems thinking is discussed in more detail in Part B. In addition, in **Appendix I**, I further elaborate the nature of whole systems thinking and its implications in relation to sustainability from the basis of the historical development of systems thinking, and using the three-part model outlined above (Diagram A.4). The reader interested in more detail is referred there.

To summarise, in simple terms, a key part of the argument is that (what appears to be) a fundamentally systemic reality requires an ecological epistemology and ontology which resonates with rather than conflicts with real world systemicity. This is the 'round peg consciousness' metaphor, which implies a 'paradigm shift' at individual and cultural levels.

3.4 Paradigm change

The power of the idea of 'paradigm' is that it indicates that a worldview is indeed a model, a system of knowing, rather than reality itself: a 'map rather than the territory' (a well-known metaphor which Bateson 1980, 30, ascribes to Korzybski, a Whiteheadian philosopher who influenced Bateson's thinking). I shall use the idea of paradigm as a model to enable me to describe cultural change.

While Thomas Kuhn (1962) is credited with popularising the idea of paradigm, the idea preceded him as this quote from Whitehead (an early systemic thinker and eminent science philosopher) shows:

> Each profession makes progress, but it is progress in its own groove. Now to be mentally in a groove is to live in contemplating a given set of abstractions. The groove prevents straying across country, and the abstraction abstracts from something to which no further attention is paid, but there is no groove of abstractions which is adequate for the comprehension of human life. (Whitehead 1927, 245)

Whitehead's first point shows that it is perfectly possible to have different 'subparadigms' (or grooves) within an overarching cultural worldview, and indeed at personal level an individual frame of reference is unavoidable. From a systems point of view, this can be seen as a subsystem.

This brings me to an important point, and source of confusion.

➢ Keypoint: It is vital to recognise that both 'worldview' and 'paradigm' are commonly used to denote *different systemic levels* of ideas (which might be better expressed as metaparadigm / paradigm / subparadigm).

Users of these terms often do not make clear to which systemic level they are referring. So the use of 'worldview' in one context may not be equivalent with its use in another context. This is a confusing and critical problem which, to some degree, is clarified by interpretation of Bateson's learning levels theory. It should be noted that, when I use the term 'paradigm' or 'worldview', in most cases I am referring to the overarching cultural Western worldview, rather than a subset of it.

Another source of confusion is this debate is the nature of the fundamental shift involved. A number of writers focus on and suggest there are fundamentally *two* archetypal and fundamental Western cultural worldviews in tension (Pirsig 1974, Berman 1981, Cotgrove 1982, Milbrath 1989, Capra 1996, Elgin 1997, Woodhouse 1999), being essentially the mechanistic and ecological, (or reductionist and holistic). For example, Milbrath (1989) distinguishes what he calls the Dominant Social Paradigm (DSP), and the New Environmental Paradigm (NEP). The DSP can be

equated with what I've termed 'square peg' thinking, above, or in real world terms, mechanism and modernism.

While the two-part DSP/NEP model is useful, Milbrath's presentation of them as oppositional is an oversimplification. Indeed, this is a problem with 'new paradigm' thinking and writing: that it presents oppositional lists whilst arguing against dualism. There are two issues here: firstly, two-part models of paradigm change tend to ignore the influence and contribution of the 'second moment' of postmodern deconstructionism, Whilst in the Thesis, I mostly focus on the necessary shift from mechanism towards an ecological view, I also recognise the second moment of postmodernism and deconstructionism as a necessary but insufficient part of this learning journey. The second issue is that two-part models of paradigm change tend to present a Kuhnian view of discontinuous change. By contrast, my own view is represented by Diagram A.1 which suggests that elements of the mechanistic worldview continue into and are subsumed by the postmodern worldview; and in turn, this second moment of postmodern deconstructionism is - at least potentially - subsumed by the emergent postmodern ecological worldview.

This difference - between viewing seeing contesting paradigms as incommensurable on the one hand (a Kuhnian view), and seeing evolutionary change, transcendence and subsumation on the other (a Wilberian view) - is a very important one, and is returned to in Part B. The evolutionary change model, which I favour, has greater implications for learning and education.

This discussion raises questions about the nature of paradigm and paradigm change, which in turn also invokes the need to consider the role of individual and social learning in relation to such change.

3.5 Levels of learning

These problems are clarified by consideration of levels of learning. Bateson's views of individual and social learning are further outlined here, and returned to detail in B.1.3. Bateson made a distinction, based on Bertrand Russell's theory of logical types, between what he termed four 'levels of learning', from 'zero learning' to higher order learning.

I have re-interpreted these levels in terms of cultural paradigm, so that Learning I equates to *learning within paradigm*, and according to unexamined values and norms,

that is, choosing within the 'set of alternatives' that Bateson mentions (1972). In systems terminology, this equates to first order learning. Learning II involves a degree of reflexivity, and a realisation of the possibility of alternative sets of values and norms - "a corrective change in the set of alternatives from which choice is made…" (Bateson 1972, 293). I understand this to mean a *perception of the operation and nature of the dominant paradigm and associated questioning of paradigm*, and the consequent *possibility of the adoption of alternative values and norms*. In systems terms, this equates to second order learning. Importantly, however, Bateson (1972, 302) notes that:

> there might be replacement of premises at the level of Learning II without the achievement of any Learning III…it is therefore necessary to discriminate between mere replacement without Learning III and that facilitation of replacement which would be truly Learning III.

Learning III then, is a full realisation of the 'context of contexts'. Bateson made it clear that he felt that Learning III was "likely to be difficult and rare in human beings" (301) He adds (304):

> To the degree that a man achieves Learning III, and learns to perceive and act in terms of the context of contexts, his 'self' will take on a sort of irrelevance.

Further, he suggests "personal identity merges into all the processes of relationship in some vast ecology or aesthetics of cosmic interaction" (306). If Learning III equates in some way to a kind of transparadigmatic state of enlightenment, a state of deep reflexivity to which persons might gain temporary access, then we can at least suggest that Learning III would lead to 'the facilitation of replacement' of paradigm at lower nested learning levels. I suggest, as above, that this 'replacement' would be a more integrative, systemic, ecological worldview operative at these levels.

This touches on *three key problems* with the interpretation of learning levels (which are introduced here, and discussed further in B.1.3). The first relates to Learning III. This level can be interpreted as a state beyond the constraints of paradigm, which seems to correspond with an enlightened state of awareness as Bateson suggests - in which case little can more can be said as this is "difficult and rare" (1972, 272). Or, alternatively, we can take a more pragmatic and attainable view of Learning III, and this a view which has been reflected by Hawkins (1991), and by Bawden and Packham (1993) in their view of epistemic learning. This latter view is the one that I have followed in my arguments on learning and educational change.

A second problem is that various writers' use of learning levels does not necessarily imply change of cultural paradigm, but applies to situated and contextualised change (for example, organisational change) rather than a cultural shift of consciousness. I argue in Part B.1.3 that this confusion can be addressed by regarding the use of the learning levels model to understand a *situated context* (for example changing a medical paradigm), as a subset of the use of the learning levels model in a *cultural worldview context*. Thus, change in a situated context will not necessarily lead to a change in a cultural worldview, but change in a culltural worldview is likely to lead to change in a situated context.

This second problem in interpretation of learning levels also indicates a third. Discussion tends not to distinguish between a 'learning journey towards higher order learning' as a *continual cyde* of learning, and as a '*once only'* experience. Evidence suggests that learning levels applied in a situated context are likely to be experienced as learning cycles over time, whereas significant shifts in consciousness associated with cultural worldview change are more likely to be much fewer.

The question considered in the Thesis is whether an emerging form of systems thinking that itself reaches beyond the dominant paradigm experienced in Learning I can help people learn towards an alternative, more ecological operative paradigm.
My premise, and it will be elaborated in discussion, is that dominant modes of discourse associated with the dominant paradigm are largely 'imprisoned' within or confined to first-order learning and that we have little choice but to 'learn our way out'. If this is so, then mainstream discourse on education, operating within the dominant social paradigm, takes place within certain parameters of validity: that is, within Learning I, and is also largely 'imprisoned'. However, environmental education and some other expressions of education for social change appear to relate *in part* to a contesting holistic tradition and the emerging postmodern ecological paradigm, because they challenge - at least to some extent - dominant epistemology. In Whiteheadian terms, these educational movements may be regarded as 'partly in and partly out of the main groove'. Therefore, environmental education discourse reflects tensions resulting from its having roots both within and outside dominant thinking, although these tensions are not often voiced in these terms. Much of the discourse in the so-called 'paradigm wars' has tended to be, at least until recently, still largely about differences between what I would rather call sub-paradigms mostly occupying territory within, or heavily influenced by, the operative paradigm. Similarly, schools of systems

thinking themselves have aspects and roots both within and reaching beyond the dominant paradigm, as implied for example by first order and second order cybernetics.

In terms of encouraging paradigm change, the characteristic of systems thinking (and to a lesser extent, environmental education) being partly in/partly out of the dominant worldview might be seen as a strength, because systems approaches in education and learning should be able to act as a bridge or leader towards attaining and influencing the new ecological paradigm, through helping people move through a spectrum of change that corresponds to learning levels of change. This idea will be discussed further in theoretical terms below, but would clearly be an important line of subsequent empirical research.

Hence, this Thesis is not about specifically about introducing systems ideas and techniques into environmental education practice. I have an active, practical and strong interest in this (Sterling, Irvine, Maiteny and Salter, in press), and it is an important area for more work (and would be very much simpler as a doctoral research topic). However, I see it as only a first step on a longer, more difficult, road. Alone, I doubt that this focus would help change thinking and action sufficiently to meet the challenge posited by Einstein (above), to 'see the world anew', or translated at a more specific level, to see education anew. There is an important difference then between looking at how systems methods and concepts can be used within environmental education practice, and how a whole systems approach across education as a whole might resonate with and contribute to an emerging worldview, as reflected in the main research question.

3.6 The educational context

Discourse on education and learning, perhaps unsurprisingly, reflects the social context in which it takes place. The nesting systems model, visited earlier, whereby education is seen as a subsystem of society, clarifies this relationship. At the opening of the 21st century, this relationship is in a state of change which, in Britain and other Western countries such as the USA, Australia and New Zealand at least, can be traced back to the rise of the New Right from around the mid-eighties, when traditional models of education began to be challenged through political ideology translated into educational policy.

The neoclassical and liberal models of education that informed thinking and practice for the best part of the 20th century have been challenged by politically inspired neo-

conservative and neo-liberal views, supporting late modernist and also postmodern ideas, within a socio-economic context deeply affected by globalisation, and a technological context increasingly dominated by the nature of Net-based communications. At the same time, there is a sense behind these changing circumstances that the 19th century model of education that we are perhaps most familiar with as a kind of lingering archetype cannot suffice for the very different conditions and challenges of the 21st century (Banathy 1991). This sense is a powerful force for change, but the direction that educational thinking and practice is heading in the longer term is yet unclear.

There appears to be a tension between those forces that in effect are working to control and 'modernise' education within a globalising economic context, as part of the project of modernism, and those of postmodernity exhibiting the diversity, plurality and yet lack of coherence and equality of opportunity that might be associated with this movement. Yet these forces can be seen as two sides of the same coin, neither offering the prospect of an appropriate education for our times. In positing the postmodern ecological paradigm, I want to explore the degree to which it offers a desirable but also practicable alternative to both these models, and both these futures. If education has a shaping and transformative role in society, then articulation of this alternative would appear to be an important, perhaps vital, task - particularly as the role of education as an agent of change towards a more sustainable world (UNCED 1992) is largely still unrealised (UNESCO 2002).

Moreover, the now dominant model of instrumentalism based on market ideas has become a powerful force for change across westernised educational systems globally. Education is seen in a managerialist light, where the language and strategies of business are translated into the thinking and practice of teaching, learning and institutional management.

> One of the major tenets of the "new managerialism" is that, as there is nothing distinctive of education, it can be conceptualized and managed like any other service or institution, and the "offerings" of institutions commodified like any other item on a supermarket shelf. Part of the "success" of the globalized "new managerialism" lies precisely in its claims for these generic aspects: its applicability to all spheres of administration and its homogenization of all technical and institutional problems as management problems.
> (Marshall and Peters 1999, xxviii)

The effects of this change are not all negative, however, and some changes could be said to be partly resonant with those that are suggested by a more holistic or systemic model of education, for example the emphases on flexible learning patterns, life-long learning, and the self-management of institutions. On the one hand, this can undoubtedly be seen as part of the influence of economic rationalisation, complementary to flexible working patterns and shifting capital, and designed to ensure a supply of adaptable human capital. Yet on the other, the shift away from the 19th century model of didactic teaching and passive learning (so pervasive in the 20th) that can at least be discerned here perhaps provides an opportunity to move towards more participative and sustainable forms of education and learning. But this in turn requires that a robust 'sustainable education' paradigm emerges, which can do more than occupy the margins of educational thought, policy and practice, and both effectively critique and transcend the currently dominant model.

In other ways, the market model has been destructive and narrowing, as is examined in section B.3.2. It appears that earlier models of educational purpose and focus, such as social equality and democracy, or newer ones such as environment and development are insufficient in themselves to critique the managerial model and offer a credible and healthier alternative. What is needed it seems, is more sufficient, adequate and whole models and philosophies that can perform this role.

What I want to explore here is whether - for environmental education and all educational movements which pursue education for relevance and transformation - the ecological paradigm investigated in this Thesis provides an emergent and unifying grounding, one which transcends and transforms elements of earlier educational paradigms into a greater and qualitatively different whole, rather than simply replaces them. Such a paradigm would go beyond positivistic, hermeneutic, critical and post-structural models. It might be described as *participative, co-evolutionary, collaborative, reflexive, process-oriented, dialogic, systemic, synergetic, transformative, and epistemic,* and its meaning and grounding is a key theme of this Thesis.

3.7 Summary of research field

To recap: addressing the research question, requires the mapping out of a large conceptual area relating to personal, cultural, and educational change. This is because I intend - as far as is reasonable and manageable - to take a 'whole systems' view of the apparent need for 'whole systems thinking', and its role in paradigm change. The Thesis therefore explores, to a greater or lesser extent a broad area of concern,

including 'the crisis of modernity and post-modernity', complexity, sustainability, thinking and worldview, root metaphors, the evolution of environmental and sustainability education, as well as the development and nature of systemic thinking, its expression in 'new paradigm' movements, the potential of whole systems thinking regarding the philosophy and practice of environmental and sustainability education, and a systems view of learning and its implications for the learning organisation, paradigm change and the ecological design of education.

4 THE BASIC PROPOSITIONS

The following thirty-one propositions summarise the basic argument that is explored in this Thesis. Some of these propositions were assumptions that were made at the outset of the research and were explored during its course: others arose as the research proceeded. Whilst there are many points (and details) that could be added here, these propositions may be read as the basic research findings - that:

1. 'Environmental education' may be usefully seen as a subsystem of education as a whole, and that education (as a whole) as a subsystem of society and its culture.

2. The values and practices of *education as a whole* are influenced by the larger *socio-cultural paradigm*; and that the values and practices of environmental education are influenced and constrained by these two suprasystems.

3. The prevailing cultural paradigm is *fundamentally* mechanistic, dualist, rationalist, objectivist and reductionist.

4. In recent years, this has been overlain by a strongly instrumental and managerialist orientation in the domain of education as well as other spheres, which is largely inimical to holistic approaches.

5. Environmental and sustainability education is partly grounded in an alternative holistic paradigm, and partly in the dominant paradigm, and this accounts for some of the tensions in the field.

6. Holistic and radical approaches to 'education for sustainable development' or 'environmental education' tend to be accommodated or marginalised by the mainstream which seeks to maintain its own paradigmatic coherence.

7. There is incoherence between this dominant paradigm and our experience of increasing complexity, interdependence, and systems breakdown in our lives and the world - in terms of helping us perceive the world clearly, describe it adequately, or act wisely.

8. The prevailing worldview is founded upon a dualistic 'epistemological error' or inadequacy which remains deeply influential in our individual and collective thinking.

9. Western societies are experiencing the emergence of what can be termed a revisionary postmodern ecological paradigm, a fragile quality of 'third order change' or learning which offers a direction beyond the destructive tendencies of modernism, and the relativist tendencies of deconstructive postmodernism.

10. This ecological paradigm is an expression of holistic and systemic thinking, but systemic thinking is largely implicit rather than explicit in this paradigm.

11. There is no guarantee that the ecological paradigm will prevail.

12. 'Systems thinking', as it has evolved as a discipline in the last 50 or so years, is influenced and constrained by the dominant cultural and academic paradigms or contexts within which it has developed, although it seeks to offer an holistic alternative.

13. This 'systems as discipline' has until recently been largely isolated from the postmodern ecological paradigm, from sustainability ideas and practice, and from most educational thinking and practice.

14. Systems as discipline is 'necessary but not sufficient' to further articulate and develop the ecological worldview and realise more sustainable living.

15. The potential and emergence that might arise from the integrative interaction of *systems as discipline*, of *education and learning for change*, of *sustainability ideas and practice,* and *ecological thought,* is necessary for the future of each area, and the transition towards a more fully human and sustainable society.

16. The integrative approach that can bring these together can be termed 'whole systems thinking'.

17. Whole systems thinking *extends, connects* and *integrates* the three aspects of paradigm: *ethos, eidos*, and *praxis* to reflect wholeness in (respectively) purpose, description, and action.

18. Whole systems thinking therefore brings together an epistemology based on an ecological worldview, a co-evolutionary ontology, and a methodology based on systemic and integrative approaches.

19. The antecedents and informing bases of whole systems thinking may be seen as fourfold:

    - 'perennial wisdom' and indigenous worldviews
    - the organicist tradition in Western science and philosophy
    - the development of systems thinking and systems science, from early 20th century onwards
    - holistic science, particularly complexity theory

20. The articulation of whole systems thinking makes the postmodern ecological worldview more intelligible, more communicable and more practically operational.

21. The nature of whole systems thinking is emergent and dynamic.

22. The articulation of whole systems thinking gives the postmodern ecological worldview greater ability to challenge, transcend, incorporate, and go beyond the prevailing mechanistic paradigm in education and wider society, and the relativist tendencies of deconstructivism.

23. The challenge of unsustainability and opportunities of sustainability require a deep learning response, which may be termed transformative or epistemic learning.

24. Most learning shaped by the prevailing educational paradigm is transmissive rather than transformative, and may be seen as first order change.

25. Paradigm change is itself a learning process, and that an evolutionary rather than 'incommensurability' view of paradigm change is a more adequate and helpful model.

26. Systemic thinking offers a model of staged learning that clarifies the nature of transformative learning, based on Bateson's three learning levels.

27. Whole systems thinking indicates a philosophical basis for an ecological educational paradigm, and in turn, a basis for a more ecological environmental and sustainability education subparadigm.

28. This ecologically based educational paradigm might be termed 'sustainable education'.

29. Sustainable education recognises the partial validity of both realism and constructivism, and integrates these pole positions into a more whole participative paradigm.

30. The realisation and implementation of a sustainable education paradigm requires *vision, image, design,* and action - at all levels - from all concerned with achieving healthy societies and ecologically sustainable lifestyles.

31. Realisation of a sustainable education paradigm requires an intentional co-evolutionary alliance with manifestations of the postmodern ecological worldview in wider society as a process of intentioned social learning.

This concludes Part A. The next Part is an examination of change in Western worldviews, looking particularly at the roles and place of ecological thinking and systems thinking in this change, and the influence of shifting worldviews on how education is perceived and practised.